SPECIAL REPORT 303

Equity of Evolving Transportation Finance Mechanisms

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Evolving Transportation Finance Mechanisms

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This report has been reviewed by a group other than the authors according to the procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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Preface

Society is increasingly concerned with issues of equity, notably who pays for and who benefits from publicly delivered services such as health care, education, and transportation. Transportation in particular—how we get to work or school, to medical appointments, to the grocery store, and to a variety of social activities—is central in determining who is able to participate fully in society. Ways of raising the revenues needed to sustain and renew the nation's surface transportation system have attracted considerable attention in recent years, in large part because expenditures from the Highway Trust Fund account continue to exceed revenues. Policy makers are exploring a range of alternatives to current finance mechanisms, and in this context, questions have been raised about equity issues in financing surface transportation.

This study on assessing the equity of evolving transportation finance mechanisms was initiated by the Transportation Research Board (TRB) Executive Committee in 2008. The Executive Committee recognized that equity issues associated with surface transportation are complex and that practical experience with emerging finance mechanisms is limited. The purpose of this report is to provide guidance about equity issues to public officials responsible for deciding how to fund transportation programs and projects. The report is directed to policy makers at all levels of government who are considering new finance mechanisms, as well as to their advisors.

To conduct the study, TRB assembled a committee of 12 members under the leadership of Joseph L. Schofer, Professor of Civil Engineering and Transportation and Associate Dean, Robert R. McCormick School of Engineering and Applied Science, Northwestern University. The members of the committee have expertise in equity analysis and environ-

mental justice; public policy, planning, and finance; transportation economics; travel behavior and modeling; social science and public opinion; and human environmental sciences. The committee's task was to provide guidance to public officials about assessing the equity implications of evolving transportation finance mechanisms. The study was sponsored by TRB.

The committee held five meetings between December 2008 and February 2010 (see Appendix B). It also commissioned four expert papers (see Appendix C) to inform its discussions. Preliminary drafts of these papers were discussed by committee members and the papers' authors at the committee meeting held in Washington, D.C., in May 2009. The authors then completed their drafts, which were reviewed by committee members in advance of a 1-day public symposium, held in Washington, D.C., in September 2009 in conjunction with the committee's fourth meeting. After presenting their major messages at the symposium, the authors finalized their papers.

All four commissioned papers are available in electronic form in conjunction with this report. The reader is cautioned that the interpretations and conclusions contained in the papers are those of the authors and are not necessarily endorsed by the committee.

After its fifth and final meeting in February 2010, the committee worked by correspondence to refine its findings and recommendations and develop its report.

ACKNOWLEDGMENTS

The committee thanks the individuals and organizations who participated in the information-gathering sessions of its meetings and gratefully acknowledges the contributions of all those who attended the public symposium (see Appendix D).

Particular appreciation is expressed to the authors of the commissioned papers: Alan Altshuler, John F. Kennedy School of Government, Harvard University, Cambridge, Massachusetts; David A. King, Graduate School of Architecture, Planning and Preservation, Columbia University, New York; Lisa Schweitzer, School of Policy, Planning and Develop-

ment, University of Southern California, Los Angeles; and Sarah E. West, Department of Economics, Macalester College, St. Paul, Minnesota. Their expert papers and the authors' participation in committee discussions and e-mail correspondence contributed greatly to the overall effort.

Jill Wilson managed the study under the supervision of Stephen R. Godwin, Director of TRB's Studies and Special Programs Division. Dr. Wilson also drafted portions of the final report under the committee's guidance. Nikisha Turman was responsible for meeting logistics and assisted with communications with committee members.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise in accordance with procedures approved by the National Research Council (NRC) Report Review Committee. The purpose of this review is to provide candid and critical comments that will assist the institution in making the report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

NRC thanks the following individuals for their review of this report: Mort Downey, Mort Downey Consulting, LLC, Vienna, Virginia; Steve Heminger, Metropolitan Transportation Commission, Oakland, California; Tom Higgins, K. T. Analytics, Inc., Oakland, California; Norm King, consultant, Palm Springs, California; Therese McGuire, Northwestern University, Evanston, Illinois; James Reed, National Conference of State Legislatures, Denver, Colorado; Mindy Rhindress, Abt SRBI, New York, New York; Kumares Sinha, Purdue University, West Lafayette, Indiana; and Marty Wachs, RAND Corporation, Santa Monica, California. Although the reviewers provided many constructive comments and suggestions, they were not asked to endorse the committee's findings, conclusions, or recommendations, nor did they see the final draft before its release. The review of this report was overseen by Institute of Medicine member Charles E. Phelps, retired, and National Academy of Engineering member C. Michael Walton, University of Texas, Austin. Appointed by the NRC, they were responsible for making certain that an independent examination of this report was carried out

in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of the report rests solely with the authoring committee and the institution.

Suzanne Schneider, Associate Executive Director, TRB, managed the report review process. The report was edited and prepared for publication by Janet M. McNaughton; the background papers and the prepublication files for posting to the TRB website were formatted and prepared by Jennifer J. Weeks; and the book design and production were coordinated by Juanita Green, under the supervision of Javy Awan, Director of Publications, TRB.

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Summary

As traditional sources of funding for the nation's surface transportation system fail to keep pace with demand, proposals for new sources have proliferated. New funding strategies, such as pricing the use of new and existing roads, and new institutional arrangements, such as public–private partnerships, have emerged over the past few years. As with all transportation policies, these strategies raise questions about equity. Will certain groups bear a disproportionate share of the burden of paying for transportation services? Will members of some groups be adversely affected by a particular finance strategy? Will revenues collected in one geographic area be spent elsewhere? Road pricing in particular has often raised equity concerns because of the fear that low-income drivers may be priced off the road, but there are other equity concerns as well. To address these concerns, the Transportation Research Board convened an expert committee to provide guidance to public officials about assessing the equity of evolving transportation finance mechanisms. The committee was charged with

- Identifying the various dimensions of equity important for public policy debates about evolving finance mechanisms,
- Suggesting specific issues for policy makers to consider when evolving mechanisms are proposed, and
- Making recommendations for research.

The committee recommends actions to be taken by public policy makers and their staff and by researchers and analysts and identifies sources of funding for these recommended actions. The most important actions are discussed under the four headings that follow.

EXAMINE DETAILS OF EVOLVING AND EXISTING FINANCE POLICIES TO ASSESS THEIR EQUITY

The most important lesson from the committee's work is that broad generalizations about the fairness of high-occupancy toll (HOT) lanes, cordon tolls,[1] and other evolving mechanisms oversimplify the reality and are misleading. Equity can be assessed in many ways (e.g., in terms of income or geography and across generations). Furthermore, the specifics of policy instrument design, revenue usage, and service delivery can change equity outcomes as judged by any equity criteria. Thus, the fairness of a given type of finance mechanism depends on how it is structured, what transportation alternatives are offered to users, and which aspects of equity are deemed most important. It is impossible to draw reliable conclusions about the equity of a particular type of finance mechanism without delving into the details.

Existing finance mechanisms have not prompted equity debates to the same extent as road pricing proposals. This observation is explained in part by the general bias in favor of the status quo and in part by the lack of explicit comparisons of the equity implications of existing and evolving mechanisms. Existing mechanisms are not, however, inherently equitable. General sales taxes, for example, though often politically expedient, usually result in poorer households paying a larger share of their income than wealthier households. These taxes also disconnect those who benefit from the transportation system from those who pay for it, and therefore are less equitable than the gas tax or road pricing according to several equity criteria, including the well-established user pay principle.

ASK A BROAD RANGE OF QUESTIONS ABOUT EQUITY IMPACTS

Public policy makers should pay attention to the defining characteristics of all proposals, particularly the ways in which revenues are collected and used, because the fairness of many transportation finance mechanisms is so dependent on application-specific details. Moreover, the equity

[1] HOT lanes are tolled lanes operating alongside existing highway lanes that provide users with a faster and more predictable travel option in return for payment of a toll. Cordon toll policies require users to pay a toll to enter or drive within a congested urban area during times of heavy traffic.

implications of transportation finance mechanisms are not always as they seem initially. To move beyond superficial analysis, policy makers should insist on well-designed studies of transportation finance that yield reliable information about the likely distribution of burdens and benefits and facilitate comparison of a given finance strategy with alternatives. In conducting such studies, researchers and analysts need to consider not only who pays and who uses the transportation system, but also likely short- and long-term behavioral changes and their consequences. These effects include shifting tax or fee burdens to others and subsequent changes in mobility and land use. Analyzing these outcomes can guide refinements of finance strategies to offset adverse impacts.

Empirical evidence about the impacts of road pricing and other evolving finance mechanisms continues to accrue but is necessarily limited by the number of cases available for study. Additional studies that gather data both before and after new finance mechanisms are implemented will be particularly important for informing future analyses of equity and developing robust information to assist public officials faced with decisions about transportation finance approaches.

ENGAGE THE PUBLIC IN DECISION MAKING

Public policy makers who wish to promote equity should engage their constituents and other stakeholders early and often when considering the use of new or unfamiliar transportation finance mechanisms. As part of this process, they should develop outreach programs and educational activities to help diverse audiences understand and participate in discussion of proposed projects and programs, associated finance mechanisms, and equity implications. Scientifically rigorous public opinion research can help policy makers gauge the public's understanding of and responses to a new finance proposal as well as their reactions to a new mechanism following its implementation, when the benefits and costs are often better understood.

DEVELOP A BETTER UNDERSTANDING OF TRAVEL BEHAVIOR AND ITS CONSEQUENCES

New transportation finance policies motivate people to change their travel behavior, often to avoid paying a new tax or fee or to take advantage of new travel options. For example, commuters wishing to avoid

increased peak-hour transit fares may join carpools or modify their work schedules to travel earlier or later, and drivers in a hurry may choose to use a new HOT lane (and pay the fee) to get to work or child care faster. Determining who wins and who loses as the result of behavioral changes and their consequences is complicated, and the answers are rarely clear cut. Some research has been conducted on these questions, but more is needed to understand better the equity effects of new finance mechanisms. Researchers need to gather fine-grained data on personal travel and freight movements and to develop models that can simulate relevant travel behaviors. Researchers and analysts then need to use these tools to explore a wide range of questions about how people modify their use of the transportation system in response to changes in prices and services and the consequences of these responses—always bearing in mind the uncertainties inherent in travel forecasting models.

In making informed decisions about what constitutes an equitable transportation finance policy, policy makers need to recognize that there are multiple dimensions of equity, some of which may be contradictory. Under these circumstances, policy makers need to consider a variety of factors in making choices about what is equitable in a given situation. Good data and analytical tools, knowledge gained through research, carefully crafted situation-specific analyses, and meaningful interactions with all stakeholders can help policy makers compare the equity of alternative mechanisms and craft policies that enhance equity.

1

Equity and Transportation Finance

To raise the revenues needed to sustain and renew the nation's surface transportation system, policy makers are exploring a range of alternatives to current finance mechanisms. Among these alternatives are new toll facilities, including those developed and operated through private concessions; long-term leasing of toll roads to private concessionaires; high-occupancy toll (HOT) lanes, which have the dual objective of both raising revenue and managing congestion; sales taxes dedicated to new highway and transit infrastructure; and fees for vehicle miles traveled. Practical experience with these alternatives is limited, and, as a result, officials charged with deciding whether to adopt alternative finance mechanisms have relatively few case studies and limited empirical data to inform their decision making.

The equity implications of alternative and evolving finance mechanisms have captured the attention of politicians and the public. Most notably, concerns have been raised about the possibility of tolls pricing poor drivers off the road, leading to the popular moniker "Lexus lanes" to describe congestion pricing policies that charge drivers more to travel particular routes or use selected lanes at peak travel times (Schweitzer 2009). At the same time, questions have been raised about whether different groups, who may be neither poor nor otherwise disadvantaged, are treated equitably by various transportation funding mechanisms.

Equity in transportation financing, as in other areas, means different things to different people. The many possible definitions sometimes overlap with broader aspects of taxation and public finance, as well as with measures of transportation system performance unrelated to finance. Throughout this report, the authoring committee has followed precedent by treating equity as synonymous with fairness (see, for example, Pearce

1994), thereby recognizing that the selection and application of equity goals require value judgments. Chapter 3 is devoted to assessing commonly used definitions of equity and fairness and to showing how they can be made explicit and subject to empirical measurement.

The equity dimensions of transportation finance have long been a subject for academic research, and numerous articles on the topic have been published in the fields of social exclusion,[1] environmental justice,[2] and tax incidence[3] (Schweitzer 2009). Noting the complex and multidimensional nature of equity, many articles compile alternative definitions and explore different classification schemes in an attempt to analyze equity in a logical and consistent manner. In general, however, these articles do not provide readily accessible, practical advice for public officials and other decision makers.

This report seeks to bridge the gap between the academic research on equity and the needs of public officials for guidance in practical decision making. It draws on the technical literature, on resource papers commissioned by the committee, and on information gathered during the committee's meetings and symposium to develop guidance for public officials and their advisors about assessing the equity of evolving transportation finance mechanisms. It also makes recommendations for further research that could enhance understanding of these mechanisms, thereby providing a more robust basis for future decision making.

To set the context for the discussions in later chapters, the next section of this chapter examines the role of equity in the evolution of U.S. surface transportation finance, with emphasis on the focus areas of this report, namely, personal travel by automobile and transit. The legal protections

[1] The term "social exclusion," which is widely used in Europe, is a broader concept than poverty. It refers to the outcome of multiple deprivations that prevent individuals or groups from participating fully in the economic, social, political, and cultural life of the society in which they live.

[2] Environmental justice is defined by the U.S. Environmental Protection Agency as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. According to the agency, environmental justice will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work (www.epa.gov/environmentaljustice/).

[3] Tax incidence is an economic term for the allocation of a tax's burden among suppliers and consumers of a taxed item.

and rights afforded Americans with regard to transportation finance equity are then discussed. The committee's charge is presented, and its approach to its work described.

ROLE OF EQUITY IN THE EVOLUTION OF U.S. SURFACE TRANSPORTATION FINANCE

The extensive U.S. transportation system is administratively and fiscally complex, and collecting revenue for and spending money on transportation regularly generates political debates over fairness. Questions frequently arise about who should pay and how much, and how revenues should be spent and where. The recent interest in various forms of road pricing has prompted some observers to reflect on the fairness of charging travelers to use roadways. Such concerns over transportation finance equity are not new, however. In the United States, political debates over transportation finance have centered on questions of equity for more than a century and, as the following overview illustrates, have played a key role in shaping the ways in which the surface transportation system is currently funded.

Local Streets

Local streets make up the vast majority of the U.S. road system's lane miles. They provide essential access to residential and commercial property for private, commercial, and emergency vehicles, thereby conveying the value of connectivity to individual land parcels. They are also the most common channels for utilities such as electricity, gas, water, and sewer services, as well as for cable and fiber-optic networks. For these reasons, cities and counties have long provided and maintained such roads, financing them primarily by levying taxes on the properties that benefit directly from the access they provide.[4] As land values are directly related to local street access, it has long been seen as fair and reasonable for property owners, rather than local street users, to pay for property-serving roads.

[4] In some instances, land developers pay directly for local roads.

Highways

In contrast to the land-serving focus of local streets, each of which may be lightly traveled, expressways and highways tend to carry longer-distance trips traveling at higher speeds and in greater volumes. Roads serving long-distance travelers have a lengthy history, but the development of modern highways started in the early part of the 20th century. With strong incentives from the federal government in the form of matching grants, states augmented local roads by creating major routes designed for heavy, longer-distance traffic. Costs for construction and reconstruction of urban and rural highways were (and still are) covered by issuing bonds. Early on, some debt service was financed by tolls, but most was paid from general revenues, which quickly strained state treasuries.

Tolls on travelers have a long history as a source of highway finance, with privately financed turnpikes appearing in the United States in the late 1700s. With the exception of bridges and a few heavily traveled turnpikes, however, tolls had been largely eliminated by the beginning of the 20th century, because the costs of collection absorbed a large proportion of revenues. Further, developing interconnected road networks required the construction and maintenance of both expensive-to-build links (over waterways or through mountain passes) and some lightly used links that could not be financed entirely by locally generated toll revenues.

An alternative approach to highway funding came when states, starting with Oregon in 1918, adopted motor fuel taxes—taxes that have paid most of the costs of building and operating major roads in the United States for nearly nine decades. In contrast to tolls, motor fuel taxes do not levy charges at precisely the time and place of road use; however, they charge for road use in rough proportion to motorists' travel, and heavier vehicles pay more because they use more fuel per mile. In addition, when fuel taxes were introduced, they cost much less to collect and administer than tolls because the former were collected from a relatively small number of fuel distributors.[5]

[5] Although toll collection costs have now fallen with the introduction of electronic tolling, the fuel tax remains much cheaper to collect than tolls.

Most states reserved fuel taxes exclusively for transportation expenditures, and when the federal government decided in the 1950s to finance intercity highways on a national scale, it increased federal fuel taxes and created the federal Highway Trust Fund to secure these funds for highways, emulating the user-pays principle that had been successful in the states. Dedicating the revenues collected to road expenditures was viewed as fair because it charged the beneficiaries of roads for their use, an approach known as the user fee principle.

Over time, public policy gradually came to favor a transportation system balanced in metropolitan areas between private vehicles and public transit. From 1964 onward, federal funding for public transit was provided from general funds, and the transfer of highway funds to transit projects was first permitted by the Highway Act of 1973. The Mass Transit Account was established within the Highway Trust Fund in 1983, thereby making a portion of highway user fees available for transit systems.[6] It was argued that improving mass transportation systems would in turn improve operating conditions on highways; hence, spending some portion of highway user fees on mass transit was deemed appropriate (McDaniel and Coley 2004). Some objected that this diversion of road user fees to other purposes was unfair because it violated the user fee principle; however, funding public transit, as well as bicycle and pedestrian projects, with highway user fees has been institutionalized based on the rationale that drivers and their communities benefit from such investments, at least indirectly.

As this historical overview indicates, the U.S. notion of highway trust funds arose, at least in part, out of concern for equity. During the period from 1920 to 1945, highway finance shifted away from general instruments of taxation toward user fees in the form of motor fuel taxes. The user fee logic was codified during the period from 1945 to 1970 by putting motor fuel tax revenues into trust funds (Taylor 2006). Hence, the user pay principle is well established as an equitable policy for highway financing, even though the recent trend toward using sales taxes to fund transportation violates this principle (see Chapter 5).

[6] In large urban areas, funds from the Mass Transit Account can be used only for capital or capital-related expenditures. In small urban and rural areas, however, these funds can also be used for operating expenditures.

Public Transit

Most of today's large publicly owned and operated transit systems have private, for-profit origins. At the turn of the 20th century, most large U.S. cities were served by multiple private streetcar operators, often linked to real estate development on the fringes of urban areas; however, fiscal problems for private transit operators began to emerge shortly thereafter. Contributing factors included service extensions and public regulation of fares to address concerns about unserved areas and unfair treatment of customers, labor agreements, and increased automobile ownership. The combined problems of rising costs and relatively flat revenues continued to grow during the following decades. Despite an increase in transit ridership during World War II, transit system bankruptcies and public takeovers of private systems were commonplace. Once public-sector organizations acquired the assets of private firms, they were also required to subsidize operating costs, mainly from general revenues, including sales and property taxes.

Federal subsidy of public transit began gradually in the early 1960s and accelerated rapidly in the 1970s. One of the arguments in favor of federal subsidies was that transit was key to ensuring mobility in cities, the primary economic engines for much of the nation. Big city mayors and other urban interests also argued that an infusion of federal funding was needed to make up for years of private disinvestment in transit systems.

Today, public transit receives federal subsidies for capital expenses, while operations are funded by local and state subsidies from general revenues or dedicated taxes (often sales taxes), direct user fees (fares), and, in some cases, indirect user fees (fuel tax revenues). This diversity of funding sources raises a host of equity questions, as do the multiple social needs that transit is asked to address. These needs include, but are not limited to, providing mobility for those without cars, providing alternatives to driving, reducing the environmental footprint of travel, providing quality employment for workers with relatively little education, and making communities livable and sustainable. One of the sources of debate over finance equity is that transit ridership is not distributed equally across jurisdictions. Approximately one-third of all unlinked transit passenger trips in the United States are made in the New York metropolitan area, and the 10 largest U.S. transit systems carry almost

60 percent of such trips (APTA 2010).[7] The allocation of federal transit formula funding reflects these spatially asymmetric patterns of usage, for example, through the Urbanized Area Formula Program, instead of attempting to distribute transit resources somewhat equally across states and congressional districts according to principles of geographic equity.

Further, transit riders, especially outside of New York City, are disproportionately low-income bus riders (Giuliano et al. 2000). Thus, equity questions arise about whether fares should cover as much of costs as possible or be kept low so as not to burden excessively the disproportionately low-income transit riders. In recent years, two issues have dominated much of the debate about the equity of public transit finance. One issue concerns whether subsidies should go to capital-intensive investments in new rail lines to higher income districts, so as to draw commuters away from congested roadways, or to local bus services that serve larger shares of low-income riders.[8] The other issue concerns the ways in which bus services are designed to capture discretionary riders at the expense of those who have no alternative means of transportation (see, for example, Sanchez et al. 2007 and Sanchez 2008). As discussed in the following section, a number of such equity questions are addressed, either directly or indirectly, by Americans' legal protections and rights.

LEGAL AND POLICY FRAMEWORK FOR EQUITY

Legal Protections and Rights

An array of constitutional protections, statutory mandates, presidential executive orders, and regulations accompanying federal grants or contracts collectively ensures that disadvantaged groups are included in transportation planning efforts, receive appropriate transportation services, and are given fair access to transportation infrastructure (see Appendix A for more detail). The protections provided tend to focus on persons with disabilities, the elderly, racial and ethnic minorities, and

[7] An unlinked transit passenger trip is defined as a trip on one transit vehicle, regardless of the type of fare paid or transfer presented.

[8] Bus riders generally have lower incomes than rail riders, but there are exceptions (for example, on some transit services in the San Francisco Bay area). Thus, the specific characteristics of each individual case need to be examined when the equity of transit services is considered.

those disadvantaged by low income and, in the context of transportation finance equity, relate primarily to questions about ability to pay, benefits received, costs imposed, and process equity. (These equity concepts are discussed in Chapter 3.)

The principal U.S. law governing equity is Title VI of the Civil Rights Act of 1964, which forbids discrimination based on race, color, or national origin. The U.S. Department of Transportation's (DOT's) regulations related to Title VI prevent local and regional recipients of U.S. DOT grant funds from directly or indirectly (through contracts, for example) discriminating against people because of their race or national origin, but not necessarily because they have low incomes. The regulations specifically discuss how facilities and services are provided or located, although not specifically how they are paid for:

> [I]n determining the site or location of facilities, a recipient or applicant may not make selections with the purpose or effect of excluding persons from, denying them the benefits of, or subjecting them to discrimination under any program to which this regulation applies, on the grounds of race, color, or national origin; or with the purpose or effect of defeating or substantially impairing the accomplishment of the Act. . . . (49 C.F.R. §21.5(b)(3))

In particular, U.S. DOT regulations define the phrase "effect of excluding persons" to mean that government actions cannot create what is called a "disparate impact." Disparate impacts occur when transportation services are delivered in ways that create benefits for some users but not for others or create disproportionate benefits for some system users compared with others.

Disparate impacts are, however, a common occurrence—no transportation system is ubiquitous, service levels and quality vary substantially across an area in response to different ridership or traffic patterns, and costs and benefits are rarely distributed evenly or even in response to usage patterns. When these differences appear to have a racial component, however, even without the intent to exclude or harm specific racial or ethnic groups, Title VI and the U.S. DOT regulations issued pursuant to that legislation may apply.

In practice, Title VI by itself, as interpreted by U.S. DOT and the federal court system, has generally not offered a remedy for equity claims made by

racial and ethnic minorities who, even if not intentionally excluded from transportation system benefits, receive inferior levels of service or pay more for the services they do receive. There is a lengthy list of court cases beginning in the 1990s in which advocacy groups sued their local transit systems, contending that these transit operators favored wealthy white users of their rail services over poor African-American and other ethnic minority and low-income riders of the bus system. Even where disparate impacts were obvious, the federal courts largely held that if transportation agencies were acting in good faith, making reasonable allocation and investment decisions, and not intentionally discriminating against groups on the basis of race or ethnicity, such disparate impacts were permissible (Thomas 2008).[9]

One area where Title VI—in conjunction with major presidential executive orders and U.S. DOT regulations relating to environmental justice—has been effective is in giving disadvantaged groups more access to the process by which decisions about the transportation system are made. This increased access has, in turn, allowed disadvantaged groups to address other equity concerns. Over time, the concepts of environmental justice and environmental equity have expanded both legally and intellectually (Schweitzer and Valenzuela 2004). These concepts initially covered issues directly related to adverse environmental effects of transportation facilities (e.g., pollution and siting and transport of toxic hazards). Now, however, equity issues that can be addressed by environmental justice mandates include inequitable financing or distribution of transportation services as well as exclusion of certain groups or communities from decisions about the location, financing, and service parameters of transportation system improvements.

Policy Questions

Travelers who are neither poor nor otherwise disadvantaged (and who are not afforded protections under Title VI and related regulations) may

[9] In February 2010, the Federal Transit Administration withdrew $70 million in federal stimulus funds from the proposed Oakland Airport Connector project following a complaint filed under Title VI. The complaint alleged that Bay Area Rapid Transit (BART) had failed to conduct an equity analysis to determine how the benefits of the project would be distributed (Brenman and Marcantonio 2010). A new funding package totaling $484 million and including $25 million in federal New Starts funds has now been approved, however, and equity issues are being pursued further.

nonetheless be disproportionately affected by finance policies because they live in certain types of communities, have certain travel patterns, or drive certain types of vehicles. For example, Orszag (2008) notes that the incremental damage imposed by trucks on highways is not reflected in the current taxes on truck ownership and use; as a result, "there are wide disparities in the degree to which different types of trucks pay the cost of highway damage that is associated with their use" (p. 24). Another example is provided by Rosenbloom (2010), who notes that, on average, older drivers subsidize younger drivers because the former tend to avoid peak-period driving and major highways, but nonetheless pay the taxes needed to provide peak-period capacity on major roads. As these examples illustrate, current financing mechanisms raise questions about equity, even though such questions have attracted relatively little public scrutiny as compared with evolving mechanisms, notably road pricing.

CHARGE TO THE COMMITTEE

As the preceding discussion illustrates, equity is a fundamental issue in public decisions about transportation, both for investments in facilities and services and in financing those investments. A broad legal framework prohibits discrimination in the collection and use of resources for transportation, at least at the federal level, although lack of discrimination may not itself assure equity. Within that framework, the courts have given administrative agencies considerable latitude in allocating resources in the fulfillment of their mandates. This observation underscores the notion that equity issues are neither cut and dried nor susceptible to formulaic resolution. Moreover, equity is rarely the sole criterion used to inform decisions about transportation investments. Public officials make trade-offs among many criteria—efficiency, economic development, environmental protection, equity, and others—in arriving at a compromise solution. Addressing, and in some sense assuring, equity in transportation finance and investment will require understanding the issues, impacts, and options as well as balancing diverse interests to find resolutions broadly viewed as fair. It is important to remember, for example, that the cost burdens imposed by a finance policy may be partially or totally offset, or even exceeded, by the resulting benefits such as faster travel times, safer roads,

and cleaner air. Therefore, equity is an ongoing and evolving concern that will need to be addressed over time through many and diverse decisions that will often involve trade-offs between benefits and costs. In making such trade-offs, policy makers need to recognize that the transportation finance policies may bring net benefits to some but impose net burdens on others. Furthermore, discussions of transportation finance equity are necessarily linked to broader discussions about the equity of the entire transportation delivery system, from funding sources through project selection and operating policies.

Ways of raising the revenues needed to sustain and renew the nation's surface transportation system have attracted considerable attention in recent years. Relevant reports include *The Fuel Tax and Alternatives for Transportation Funding* (TRB 2006), *Future Financing Options to Meet Highway and Transit Needs* (Cambridge Systematics, Inc., et al. 2006), and *Transportation for Tomorrow* (NSTPRSC 2007). A fourth report, *Paying Our Way: A New Framework for Transportation Finance* (NSTIFC 2009) was released while the present study was in progress. These reports consider aspects of equity in transportation finance, although none focuses on equity per se.

Against this backdrop, the Transportation Research Board Executive Committee decided at its meeting in early 2008 that more time and effort were needed to understand the complexity of equity issues in financing the nation's surface transportation system (Rosenbloom 2009). As a result, the Committee on Equity Implications of Evolving Transportation Finance Mechanisms was tasked with providing guidance to public officials about assessing the equity of evolving transportation finance mechanisms.

To assist in its deliberations, the study committee was charged with holding a public symposium to discuss papers it would commission. Participants from a wide range of stakeholder groups were to be invited to that symposium. The committee was also charged with the following specific tasks:

- Identifying the various dimensions of equity important for public policy debates about evolving finance mechanisms,
- Suggesting specific issues for policy makers to consider when evolving mechanisms are proposed, and
- Making recommendations for research.

COMMITTEE'S APPROACH

The committee's first two meetings, held in Washington, D.C., in December 2008 and Irvine, California, in February 2009, were devoted primarily to talking with experts who have studied current and evolving transportation finance mechanisms and their equity implications (Appendix B). The committee also met with decision makers to gain a better understanding of the ways in which equity in general, and finance equity in particular, enters into decisions about which transportation projects and programs to pursue and how to fund them.[10]

Armed with the information gathered from these meetings, together with its collective knowledge of the literature on transportation finance equity and of practical experience with evolving finance mechanisms, the committee commissioned four expert papers to inform its deliberations (Appendix C). During the course of its third meeting, held in Washington, D.C., in May 2009, the committee discussed drafts of the papers with the authors and provided guidance for developing and completing these drafts in preparation for the planned symposium.

The first day of the committee's fourth meeting, which was held in Washington, D.C., in September 2009, was devoted to the symposium on equity issues in financing transportation. The primary purpose of the symposium was for the committee to explore various aspects of transportation finance equity with a wide range of experts and stakeholders. In developing the symposium agenda (Appendix D), the committee sought to maximize its opportunities to listen to and learn from participants on a range of topics, including

- The politics of transportation finance and the roles of equity,
- Public opinion on equity and transportation finance,
- International experience,
- Modeling travel and land use patterns to inform equity assessments, and
- Remedies for problems of transportation equity.

[10] Although the word "finance" is often used interchangeably with the word "funding" to mean a source of revenue, people also use "finance" in another sense: to mean how funding is managed (such as through debt). Finance can affect when funds are collected, which can have equity implications. Therefore, the committee considered the equity implications of both funding (source of revenue) and finance (management of the revenue and disbursements). The word "finance" is used throughout this report in both of its senses.

Invitations to the symposium were sent to academic and research organizations; professional associations; consultants; think tanks; congressional staff; federal, state, and local government organizations; transportation users and providers; and environmental and other stakeholder groups. Many of the 46 symposium participants were specialists in transportation policy and finance, and a number of participants represented groups that either provide or use transportation services (see Appendix D).

The remainder of the fourth meeting and the fifth and final meeting, which was held in Washington, D.C., in February 2010, were devoted to committee deliberations and the development of this report.

Taylor (2010) reports that public opinion research has consistently found most people's idea of justice, and thus of equity, to be highly variable and complex. Studies comparing how people say they would act in a given situation and their actual behavior show that people "switch among characterizations of justice according to the situation" (p. 6). In the light of such observations, the committee agreed that its task was not to make the complex value judgments needed to select and apply equity goals. Rather, its task was to describe alternative equity definitions and concepts (e.g., criteria and impacts) and to explore the likely implications of these definitions and concepts in the context of decisions about how to finance transportation projects and programs. Value judgments about what constitutes an equitable transportation system and how such a system should be financed are the prerogative of elected officials and are inherent in the broader political process.[11]

There is no clear consensus among the authors of articles and reports on transportation finance about what constitutes an alternative (or evolving) finance mechanism. Nonetheless, most authors identify user fees collected through electronic tolling (generally referred to as "road pricing") as an alternative finance strategy, the details of which continue to evolve as experience is gained with practical applications. For example, the authors of a report on the fuel tax and alternatives for transportation funding make

[11] The committee recognizes that the choice of transportation finance mechanism may affect social equity in general, as well as equity within the transportation sector. For example, changes in transportation services resulting from a new finance policy may affect inequities in other sectors by making it easier or more difficult (more time consuming, more expensive) for some people to access jobs, education, and health care services. An assessment of the impact of transportation funding on general social equity is, however, beyond the scope of the committee's charge.

a distinction between financial reforms within the present framework and alternative mechanisms based on toll road expansion and road use metering (i.e., road pricing) (TRB 2006). Examples of these latter mechanisms include cordon tolls, HOT lanes, and distance-based pricing or mileage fees. The technical feasibility of such options depends on information technologies that make it "easier and cheaper to measure and record vehicle travel by road segment and time of day across different jurisdictions" (Wachs 2009, p. 9).

Road pricing has been the subject of much discussion by professionals, policy makers, and the public, and much of the finance equity research deals with pricing (Schweitzer 2009). This focus on the income-equity implications of road pricing is similarly reflected in the committee's report, particularly in the sections examining lessons learned from research, but should not be interpreted as advocating for road pricing.

ORGANIZATION OF THE REPORT

The next chapter discusses sources of surface transportation revenues in the United States and presents a taxonomy of transportation funding approaches, with emphasis on evolving mechanisms. This discussion is directed primarily to transportation officials who are not familiar with the topic. Transportation experts already familiar with surface transportation financing are likely to skip to the second part of the chapter, which introduces the idea of tax shifting. The discussion of who ultimately pays outlines the process whereby a tax imposed on one party is actually paid by another. Such shifting has important implications for the fairness of a tax.

Chapter 3 discusses the equity concepts public officials may encounter when considering the use of evolving finance mechanisms to raise revenues for transportation projects and programs. Examples illustrate the range and complexity of equity issues that may arise and highlight the importance of looking at these issues from different perspectives. The final section of the chapter discusses tax shifting as illustrated by two examples—the gas tax and a weight-distance tax on trucks. Examining who is affected by these taxes and by how much provides useful lessons for assessing the equity implications of transportation finance mechanisms in general.

Chapter 4 summarizes the evidence about equity in road and transit finance, with emphasis on what has been learned following the practical

implementation of evolving finance mechanisms. The chapter then discusses possible strategies for remedying inequities associated with transportation finance mechanisms as well as the accompanying challenges. The final section of the chapter identifies opportunities to fill gaps in current knowledge about the equity implications of transportation finance mechanisms.

Chapter 5 addresses the ways in which equity has entered into debates over road pricing. Public opinion about equity issues can play a decisive role in determining the success or failure of road-pricing proposals, and the results of an analysis of public opinion surveys on the acceptability of road pricing are discussed. The chapter concludes by summarizing important lessons learned about the role of equity during real-life efforts to implement road pricing in the United States and overseas.

The final chapter presents the committee's findings and its recommendations for public policy makers and their staff and for researchers and analysts. The chapter concludes with a discussion of possible sources of funding for the recommended actions.

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Abbreviations

APTA	American Public Transportation Association
NSTIFC	National Surface Transportation Infrastructure Financing Commission
NSTPRSC	National Surface Transportation Policy and Revenue Study Commission
TRB	Transportation Research Board

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2

How Transportation Is Funded and Who Pays

Given the size and complexity of the U.S. surface transportation system, it should come as no surprise that collecting revenue for and spending money on transportation regularly generates political debates over fairness. Who should pay? How much should they pay? From where should revenues be collected? On what should revenues be spent? Where should revenues be expended? Such questions are at the heart of transportation policies and politics.

This chapter presents a taxonomy of transportation funding approaches for highways and transit in the United States to set the scene for later discussions of specific issues relating to transportation finance equity. For a more detailed discussion of surface transportation revenue sources, the reader is referred to the reports of the National Surface Transportation Policy and Revenue Study Commission (NSTPRSC 2007) and the National Surface Transportation Infrastructure Financing Commission (NSTIFC 2009). Chapter 3 of the latter report includes tables evaluating both existing sources of financing for surface transportation and new revenue options. The evaluation criteria include equity considerations, notably income and geographic equity, and the extent to which the financing mechanisms can be structured to reflect the user (beneficiary) pay principle. Highlights from the commission's generic and qualitative assessment of selected finance mechanisms in terms of these criteria are summarized in Appendix E.

The legislation and administrative regulations authorizing the various sources of revenue described in the taxonomy often identify who is responsible for making payments but do not address who actually pays in practice. The motor fuel tax, for example, is levied on fuel distributors, but, as motorists know, at least some portion of this tax is incorporated

into the price they pay for gas at the pump. The question of who ultimately pays is fundamental to any equity analysis. Therefore, the chapter concludes by considering briefly the question of who bears the burden (cost) of a given transportation finance policy. This topic is examined in detail in the section of Chapter 3 on distributions of burdens and benefits.

TAXONOMY OF TRANSPORTATION FUNDING APPROACHES

The revenue raised for surface transportation comes from a variety of transportation and nontransportation sources, ranging from vehicle registration fees and weight-based fees to property and sales taxes. Individuals and firms pay for private vehicles, insurance, fuel, and fares. Local governments—cities and counties—use tax money to pay for local streets and roads. State and federal governments collect fees and taxes to share the capital costs of freeways, other highways, and components of public transit systems, while operating and maintenance costs are typically the responsibility of state and local agencies. The structure of transportation finance varies from state to state, and even from county to county, thereby adding to the overall complexity.

Major sources of surface transportation revenues for highways and transit are listed in Box 2-1 and discussed below.[1] This discussion is not intended to be exhaustive, but rather to provide a brief overview highlighting features particularly pertinent to the committee's examination of the equity implications of evolving transportation finance mechanisms. To this end, several road-pricing mechanisms, including cordon tolls, high-occupancy toll (HOT) lanes, and vehicle miles traveled (VMT) fees, are described.

[1] The taxonomy presented here draws extensively on a report assessing the viability of a range of conventional and innovative options for financing investments and operations of highway and transit systems (Cambridge Systematics, Inc., et al. 2006). The reader is referred to this document for a more comprehensive treatment and additional details of the finance mechanisms. The relevance of both existing and evolving finance mechanisms for different levels of government (federal, state, and local) is discussed by Rosenbloom (2010).

BOX 2-1

Overview of Transportation Finance Sources

- Motor fuel taxes:
  - Federal and state excise taxes and
  - State sales taxes.
- Motor vehicle taxes and fees:
  - Vehicle registration and license fees,
  - Vehicle personal property taxes, and
  - Excise taxes on vehicle sales.
- Tolling, pricing, fares, and other user fees:
  - Tolling and congestion pricing,
  - Vehicle miles traveled fees, and
  - Transit fares and other fees.
- General revenue sources:
  - Income taxes,
  - Property taxes, and
  - General sales taxes.
- Special-purpose taxes: local-option sales taxes.
- Value-capture strategies.

Motor Fuel Taxes

The gas tax (or, more precisely, the motor fuel excise tax) is a levy imposed on the sale of motor fuels on a per-gallon basis at both the federal and state levels. All 50 states and the District of Columbia levy motor fuel excise taxes, which are in addition to the federal gas tax. The current federal fuel excise tax is 18.4 cents per gallon of gasoline and 24.4 cents per gallon of diesel fuel. State fuel excise taxes vary widely; in 2009, they ranged from 7.5 cents per gallon of gasoline in Georgia to 45.1 cents in Connecticut. The weighted average of the 50 states plus the District of Columbia and Puerto Rico was 21.3 cents per gallon in 2009 (FHWA 2010b). The federal gas tax is not indexed to inflation; for example, it does not change with the price of gasoline and related fuels. The federal

gas tax was last raised in 1993, whereas most states have raised their fuel taxes at least once since that date. Some states index part or all of the gas tax in response to changes in fuel prices or general rates of inflation.

In addition to the traditional motor fuel excise taxes, some states also collect sales taxes on motor fuels. These sales taxes are set as a percentage of the fuel price rather than as a unit price per gallon, and typically range from 4 to 6 percent. Some places also levy county or local taxes on motor fuel.

Motor fuel taxes account for most of the federal revenues used for highway and transit programs and for almost half of the revenues used by states to fund highway needs. In addition, state motor fuel tax revenues are commonly distributed to local governments for highway use and are used to pay debt service on bonds issued for transportation projects.

Motor fuel tax revenues are typically dedicated to transportation by statute, and about half the states currently have either constitutional or statutory restrictions that limit the use of revenues from state motor fuel taxes to highway and road purposes (Rall et al. 2011). As a consequence of these restrictions, at least in part, state and local fuel tax revenues account for only about 2 percent of state and local revenues used for transit nationwide (NSTPRSC 2007). This nationwide average is somewhat misleading, however, because the percentage may be considerably higher in jurisdictions that allow the use of fuel tax revenues for transit. At the federal level, the excise tax on motor fuels is one of the principal sources of funding for capital investments in public transit. About 16 percent of federal highway user excise taxes are deposited into the Mass Transit Account of the Highway Trust Fund and are used to support the programs of the Federal Transit Administration (GAO 2006).

Sales taxes on motor fuels are a source of funding for transportation in some, but by no means all, states. In California, for example, sales taxes on motor fuels provide funding for state and local highways and public transportation, but a portion of these taxes goes to the general fund. In New York, none of the receipts of sales taxes on motor fuels are dedicated for transportation (Cambridge Systematics, Inc., et al. 2006).

As noted in Chapter 1, the motor fuels tax is based on the user fee principle, whereby the beneficiaries of a transportation asset (highways) are charged for its use. Therefore, motor fuel taxes are referred to as "user

fees" and are widely perceived as such. In contrast to the tolls and transit fares discussed below, however, the motor fuel tax is not levied directly at the point of use. It is, therefore, an indirect user fee and so may not always be perceived by users as a fee for service.

Motor Vehicle Taxes and Fees

Motor vehicle taxes and fees levied by states include vehicle registration, license, and title fees; personal property taxes on vehicles; and excise taxes on vehicle sales. Vehicle registration fees are normally the largest source within this category, and they vary by vehicle class. Many states have a flat fee for light-duty vehicles, but others base the registration fee on weight or a combination of weight, age, horsepower, and value. Most registration fees for heavy duty vehicles are based on vehicle type and weight and are graduated based on each state's unique, legislatively defined schedule for vehicles of different weights. The fee categories for heavy vehicles are specific to each state.

Most states dedicate the revenue from motor vehicle taxes and related fees to transportation. In 2004, motor vehicle taxes and fees accounted for almost 27 percent of total state revenues dedicated to highway expenditures and represented the second largest source of revenue for most states after the gas tax (Cambridge Systematics, Inc., et al. 2006). Motor fuel taxes and vehicle registration and related fees together are the mainstay of state highway programs, accounting for more than half of highway revenues in the vast majority of states (NSTPRSC 2007).

Tolling, Pricing, Fares, and Other User Fees

Direct highway user fees levied at the point of use, such as tolling and pricing, have contributed a relatively small share of highway revenues in recent history, although in colonial times tolls were the main source of funds for building highways and bridges. Currently, tolls represent about 5 percent of highway revenues at all levels of government (FHWA 2010a). These fees have, however, received a great deal of attention in recent years as options for supplementing or replacing current highway financing mechanisms, notably the gas tax (see, for example, TRB 2006 and NSTIFC 2009). Options of particular interest include tolling and

congestion pricing as well as VMT fees. In the case of transit, fares are the primary form of user fee.

Tolling and Congestion Pricing

Currently, there are approximately 5,100 miles of tolled roads, bridges, and tunnels in the United States, with 101 tolled facilities operated by 85 different regional, state, and local agencies or entities (NGA Center for Best Practices 2008). Toll rates on most of these facilities do not vary by time of day or day of the week, though the number of variable-toll-rate facilities is slowly growing. A few states—notably California, Florida, Illinois, New York, and Texas—account for the bulk of toll revenues.

Many states are using, or considering using, tolls as a way of generating new revenue. It is generally easier to ask users to pay tolls for use of new roads, bridges, and special lanes than to apply tolls to currently unpriced facilities, which is a challenging undertaking politically and is prohibited on the Interstate System with a few exceptions. Therefore, the most promising candidates for future toll facilities are new roads or new lanes added to existing roads. These newly constructed facilities tend to be in fast-growing states, and Florida and Texas are among the leading states in building new tollways (NGA Center for Best Practices 2008).

Congestion pricing policies aim to manage congestion by levying tolls that encourage people to change their travel patterns, thereby avoiding the toll. Such policies are not usually designed primarily to be a funding source, and, in practice, the toll collected to manage congestion may be less than that needed to build or operate the facility. Nonetheless, the revenue generated may help pay for other travel options, such as transit services, or for implementation of the congestion pricing policy.

Cordon Tolls In recent years, toll charges to enter or drive within a congested urban area during times of heavy traffic have been implemented in cities around the world, including Singapore, London, and Stockholm, Sweden. In 2007, New York City's Mayor Bloomberg proposed a congestion pricing approach to discourage driving into the core of Manhattan, but this proposal generated considerable controversy and was not implemented (see Chapter 5). These cordon, or area, pricing concepts are primarily intended to reduce congestion by discouraging

some people from driving in central business districts and encouraging them to use alternative modes of transportation or to travel at less-congested times. To this end, any surplus revenue from cordon tolls, over and above that needed to operate the facility, is often dedicated to improving transit services.

Corridor Pricing Pricing is also used on specific facilities—expressways or other arterial roads—to manage congestion by charging higher fees during peak periods to encourage some travelers to alter their choice of mode, route, or time of travel. In the United States, congestion pricing applications tend to be facility-specific rather than system- or areawide applications. Examples include two bridges connecting Fort Meyers and Cape Coral in Lee County, Florida; the Tappan Zee Bridge in New York State; the Bay Bridge in the San Francisco, California area; and the bridges and tunnels of the Port Authority of New York and New Jersey. In addition, the Washington State Transportation Commission has proposed imposing time-based charges on the State Route 520 floating bridge across Lake Washington (now free) to begin paying for a replacement bridge.[2]

HOT and Express Toll Lanes HOT lanes are tolled lanes operating alongside existing highway lanes that provide users with a faster and more predictable travel option in return for payment of a toll.[3] Some vehicles, such as carpools, buses, and emergency vehicles, typically have free access to HOT lanes; other vehicles pay for access. Nearly all U.S. HOT lane projects have been converted from existing high-occupancy vehicle (HOV) lanes, usually because there is unused capacity in the HOV lanes. The first such conversion opened on Interstate 15 north of San Diego in the mid-1990s, and since then a number of other HOV-to-HOT lane conversions have opened (Altshuler 2010).

There are also projects that charge tolls for premium service in dedicated lanes but provide little or no additional incentive for HOV. The

[2] See http://www.wsdot.wa.gov/Partners/Build520/.

[3] See http://www.virginiahotlanes.com/.

first example of this was the 91 Express Lanes project in Orange County, California, where two new lanes in each direction were built in the median of an existing freeway (California State Route 91). Tolls are based on time of day and day of week, and vehicles with three or more occupants sometimes (but not always) get a discounted price.

The toll for access to an HOT lane varies, either by time of day or by real-time congestion level, such that the level of service is sufficiently attractive to offer travelers an incentive to share rides and to provide premium value to toll customers. Altshuler (2010) characterizes existing HOT lanes in the United States as a weak variant of congestion pricing: although they do charge for travel during congested periods and thus are intended to manage congestion through pricing, there is always an unpriced route available in the corridor, giving travelers the option of paying more for faster service or tolerating congestion at no incremental cost.

Truck-Only Toll Lanes There has been discussion in the United States of roadways or lanes for exclusive truck or commercial-vehicle use, financed by direct user fees (tolls). A study undertaken by the Transportation Research Board's Cooperative Research Programs found growing interest in such lanes, with many proposals appearing in the planning and traffic engineering literature in response to the growing problem of congestion (TRB 2010). A study of the potential for such lanes near the Ports of Los Angeles and Long Beach, California, found that urban truck-only toll (TOT) lane facilities would need to overcome the operational challenges of short average truck trip lengths and little or no travel-time savings relative to the free alternatives available during off-peak periods (Fischer et al. 2003). Further, the geometric constraints of adding lanes in a built-out urban environment escalated expected facility construction costs significantly. Nevertheless, there appear to be some locations where TOT lanes are financially attractive, and truckers have endorsed the concept with certain conditions, which include allowing longer or heavier vehicles than are now permitted on other highways. A study for the Atlanta metropolitan area found that TOT lanes have the potential to relieve congestion in dense urban regions with heavy truck demands (Georgia State Road and Tollway Authority 2005).

VMT Fees

A number of organizations have explored alternative (or supplementary) fees to the gas tax based on a charge for each mile driven. Such VMT fees have gained increasing exposure as policy makers become concerned about declining motor fuel tax revenues. A study on the viability of a VMT fee system using the Global Positioning System was conducted by the University of Iowa in 2002 (Forkenbrock and Kuhl 2002), and in 2005 the National Chamber Foundation recommended a two-tier VMT fee system as a long-term option that would reduce reliance on the fuel tax (National Chamber Foundation 2005). Under this system, a state VMT fee would gradually replace motor fuel taxes and a local-option VMT fee would be used to manage congestion in metropolitan areas. More recently, the National Surface Transportation Infrastructure Financing Commission recommended commencing the transition to a comprehensive mileage-based user fee system for deployment by 2020 (NSTIFC 2009).

The state of Oregon has conducted a pilot program to explore the possible use of a road user fee as a replacement for the current system of revenue collection for the state's roads and highways (Starr 2009). An important equity issue arising from the pilot program is whether rural and urban drivers should be treated differently because the former necessarily drive more and do not have readily available mass transit alternatives (Whitty 2007). A recent modeling study found that, in Oregon, rural households would actually benefit relative to urban households if the fuel tax were replaced by a VMT tax (McMullen et al. 2010). This somewhat surprising result was attributed to rural households owning less-fuel-efficient vehicles, on average, even though they drive more miles than urban households.[4]

In contrast to VMT fees for passenger vehicles, weight–distance taxes on trucks are not a new finance mechanism. State weight–distance taxes were formerly in quite widespread use but have gradually become less common as they have been strongly opposed by the U.S. trucking industry

[4] Because the motor fuel tax is assessed on a per gallon basis, the amount of tax paid per mile driven decreases with increasing fuel economy. A recent study of more than 350,000 vehicle registration records in Texas found that vehicles registered in lower income areas tended to have lower average fuel economies than vehicles registered in medium- and high-income areas (Baker et al. 2011). In other words, low-income drivers are more likely than higher income drivers to drive inefficient vehicles and thus to pay more in fuel tax per mile driven.

on the grounds that they are excessively complex administratively. Currently only four states—Kentucky, New Mexico, New York, and Oregon—charge trucks on the basis of distance traveled at a rate that depends on some measure of weight. These weight–distance taxes on trucks are a form of VMT tax.[5] In recent years, however, several European nations have implemented weight–distance truck charges using electronic tolling technology (Sorensen et al. 2009). In 2005, for example, Germany implemented an electronically administered weight–distance tax for all heavy trucks using the highway network (the Toll Collect System). Despite questions about equity (Taylor 2010), the European Union has ruled that the tax satisfies the criteria for open international commerce within the Union (Bonsall 2009).

Transit Fares and Other Fees

Research has consistently shown that transit system costs vary significantly by distance traveled, time of day, and mode, but most transit fares today are flat, that is, they are the same regardless of when or how far one travels (Taylor et al. 2000). Distance-based pricing, mostly in the form of zone fares, was more common in years past. These zone fares were, however, unpopular with bus drivers and passengers alike because, in the days before electronic fare media, they required drivers to recheck passengers' fare tickets when crossing zone boundaries, sometimes resulting in driver-passenger conflicts. The spread of transit fare smart cards allows for the relatively easy assessment of fares that vary by distance or time, or both, but most transit agencies adopting smart cards have chosen to retain their flat fare structures (Iseki et al. 2007).

Other sources of transit operating revenue in addition to fares include parking fees, investment income, advertising revenues, leases, charters, and concessions. Although these sources represent opportunities for agencies to generate some additional resources, their revenue-generating potential is limited; public transit is subsidized precisely because systems cannot function on operating income alone. Significantly increasing transit fares would both drive away customers and raise equity concerns because tran-

[5] The weight–distance tax is also called a ton-mile tax, and occasionally a highway use tax. This latter name is also used for weight-based registration fees, which are currently levied by the federal government and several states.

sit users are, on average, considerably poorer than those who travel by private vehicle. These concerns are not, however, clear cut because some transit riders, particularly those using rail services, are relatively wealthy.

Transit fares and other operating revenues account for approximately 30 percent of the total revenues used for transit expenditures at all levels of government (Cambridge Systematics, Inc., et al. 2006; NSTPRSC 2007; National Transit Database 2008). Most transit agencies dedicate fare revenues to operating and maintenance costs.

General Revenue Sources

Some states and local governments use general fund appropriations from sources such as income taxes (states) and property taxes (local governments) to support highway and public transit needs. These general revenue sources are not linked to transportation use. In 2004, about 15 percent of state and local transit revenue and 22 percent of state and local highway revenue came from general fund allocations. Local governments in particular rely on general fund appropriations to support highway expenditures. For example, in 2004, about 46 percent of the revenues used for highway expenditures at the local level came from the general fund; at the state level, however, general fund appropriations were reported at less than 8 percent of the total revenues for highways (Cambridge Systematics, Inc., et al. 2006).

Special-Purpose Taxes

This category includes special, usually incremental, tax revenue dedicated to transportation purposes with voter approval. The important distinction from general tax revenues is that voters or property owners, who typically must approve these dedicated taxes, are assured that the money will be spent only on transportation, and usually only on specific projects. Some observers attribute the success of special-purpose taxes to the fact that revenues remain within the jurisdiction where they are raised, rather than being reallocated to state or federal governments (see, for example, Wachs 2003).

Of particular interest in the present context are local-option sales taxes. These special-purpose taxes are implemented and levied at the

local or regional level, often as a means of raising funds for specific local or area projects, such as improving area streets and roads or providing transit service. For example, the dominant share of public subsidies for operating transit services in the Chicago metropolitan area comes from dedicated sales taxes of 1.25 cents in Cook County and three-quarters of a cent in the surrounding collar counties (Joseph Schofer, committee chair, personal communication, 2010). Other examples of local-option sales taxes for highway investments and transit are provided by Cambridge Systematics, Inc., et al. (2006).

In many cases, local-option sales taxes are levied for a limited period commensurate with the project(s) to be funded. For example, in 1987 the electorate in San Diego County, California, voted in favor of a 20-year, one-half-cent sales tax increase to support transit and highway expansion and local street and roadway improvements. In 2004, county voters approved a 40-year extension of the one-half-cent local-option sales tax in light of continued rapid growth in the county and the expiration of the original measure slated for 2008 (Cambridge Systematics, Inc., et al. 2006).

In 2004, special-purpose taxes provided $15.4 billion for highways and $9.5 billion for transit (12 percent of total highway revenues and 25 percent of total transit revenues at all levels of government, respectively) (Cambridge Systematics, Inc., et al. 2006).

Value-Capture Strategies

Value capture is a type of public financing that captures some of the increased value of private land or property resulting from public investment in specific transportation projects (a new freeway interchange or transit station, for example) to pay for transportation projects. Mechanisms most commonly used by state and local governments include the following:

- **Impact fees**, which are typically one-time charges to developers. Revenues from impact fees are used to pay for infrastructure improvements needed to support the growth generated by new development, including not only roads, but also water, sewers, parks, schools, and the like.
- **Special assessments** levied in specified districts (often called special assessment districts) where the cost of infrastructure is paid for by owners of properties deemed to benefit from that infrastructure.

- **Tax increment financing,** whereby bonds are issued to finance public infrastructure improvements and repaid with dedicated revenues from the increment in property taxes that can be traced to property-value increases resulting from such improvements.

Other value-capture strategies are discussed by Iacono et al. (2009).

Public–Private Partnerships

Public–private partnerships (PPPs) are contractual agreements formed between a public agency and a private-sector entity that allow for greater private-sector participation in the delivery and financing of transportation projects (FHWA Office of Innovative Program Delivery n.d.). PPPs are not a revenue source per se; rather, they are a form of project delivery that relies on one of the funding sources described above to retire project debt and cover operating and maintenance costs and profits. Tolls are often, but not always, the revenue source. In many cases, PPPs are a way of using private-sector borrowing capacity to raise revenue up front, to be paid back later by a stream of dedicated funds from gas taxes, tolls, transit fares, or parking fees. Thus, some PPPs have come in the form of a long-term lease of existing publicly financed facilities to private firms, as happened in 2005 for the Chicago Skyway and in 2006 for the Indiana Toll Road (FHWA 2008). In such cases, the upfront concession fee paid by the private partner may be substantial; for example, the fee for the 99-year lease of the Chicago Skyway was $1.8 billion. For private investors, the primary motivation for pursuing leasing opportunities is the potential to gain an attractive rate of return on their investment. Economic (and equity) issues associated with PPPs are considered by Small (2010). As discussed in Chapter 3, PPPs raise important questions about generational equity, notably, the shifting of cost burdens to future generations who may or may not benefit from the transportation facilities and services for which the funds are used.

WHO ULTIMATELY PAYS?

Who actually pays or otherwise bears the burden of the various methods used to raise revenues for transportation discussed in the preceding section? Legislation or administrative regulations may identify who is responsible

for making prescribed payments under a revenue-raising policy but cannot dictate what eventually happens to prices, incomes, investments, asset retirements, product quality, and other dimensions of economic activity through the interaction of the regulations with market forces. People and businesses faced with a tax may be able to shift the burden to others (West 2009; Besley and Rosen 1999; Holguín-Veras et al. 2006). Consumers may be less likely to pay for goods that become more expensive because of a new or increased tax, however, thereby reducing the revenues of those selling the taxed product and possibly also the amount of tax raised.

The equity implications of a transportation finance mechanism depend on who pays and how much they pay (i.e., who bears the burden), and are, therefore, strongly influenced by tax shifting. The gas tax, for example, is levied on fuel distributors, who then include some or all of it in the price they charge fuel retailers. If these retailers can shift the tax onto motorists, then the distribution of the resulting burdens among the latter is what should really matter for an equity analysis. This distribution depends on two factors: how much of the burden is shifted to which party, and how much that party can reduce its burden by curtailing its use of the priced or taxed quantity. Motorists, for example, may respond to an increase in the gas price by driving less (see West 2009 and references therein). Such reductions in driving, however, may result in other burdens (for example, difficulties in getting to work by other means) that must be taken into account in equity discussions. The subject of economic and other burdens is discussed more fully in Chapter 3.

The pattern of shifting of tax burdens can be both complicated to assess and at times counterintuitive. As a result, elected officials and the traveling public tend to focus more on immediate, proximal effects when assessing transportation tax instruments than on ultimate, shifted outcomes. Even if they rely on their staff and other advisors to delve into the details of economic incidence, however, public officials need to recognize that tax burdens may be shifted. Absent such recognition, they may fail to understand that some groups consider a finance mechanism unfair because of anticipated shifting of the burden. The subject of shifting of burdens (and benefits) is discussed at greater length in Chapter 3.

CHAPTER HIGHLIGHTS

- Revenues for highways in the United States are dominated by indirect user fees, primarily federal and state motor-fuel and vehicle taxes. User fees levied directly at the point of use (e.g., tolls, HOT lane fees, and congestion charges) account for only about 5 percent of total highway revenues at all levels of government, but this share is growing. Many states are using, or considering using, tolls as a way of generating new revenue, but currently there are only approximately 5,100 miles of tolled roads, bridges, and tunnels in the United States, that is, just over a 10th of 1 percent of the nation's 3.9 million miles of public roads.
- Revenues for public transit in the United States come from fares and federal, state, and local sources. Local sources predominate, although the federal motor fuel tax is an important source of funding for capital investments in public transit. Revenues from fares are nearly always dedicated to operating expenditures. Despite the spread of smart card technology, relatively few transit agencies have taken advantage of the opportunities this technology offers to implement fares (i.e., user fees) varying by distance or by time of day.
- Because of the limited implementation of nontraditional transportation finance mechanisms in the United States, empirical evidence on which to base equity assessments is similarly limited, although useful data are available from overseas.
  - The U.S. experience with congestion pricing of roads is almost entirely limited to HOT lanes, a relatively mild variant of road pricing that offers drivers free (but relatively congested) alternatives to tolled lanes.
  - Cordon or area pricing approaches with no free alternatives have been implemented overseas, but not in the United States.
  - The main motivation for the implementation of congestion pricing is to modify travel behavior by varying prices. Revenues, which are often modest, have usually been used to support the congestion management program, pay for highways, and improve parallel transit services.
  - VMT fees continue to attract considerable interest among policy analysts as a finance mechanism, but practical experience is limited to truck weight–distance taxes levied by a few U.S. states and recently implemented in Germany.

- Local-option sales taxes have been a popular way to get transportation projects built because they ensure local control over the use of revenues, are usually linked to one or more specific projects, and are often levied for a limited period.
- The ultimate distribution of the burden of paying taxes and fees used to fund transportation is determined by market forces and people's behavior rather than by legislation or administrative regulations. It is this ultimate distribution that determines the equity implications of transportation finance mechanisms.

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Abbreviations

FHWA	Federal Highway Administration
GAO	Government Accountability Office
NGA	National Governors Association
NSTIFC	National Surface Transportation Infrastructure Financing Commission
NSTPRSC	National Surface Transportation Policy and Revenue Study Commission
TRB	Transportation Research Board

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3

Equity Through Different Lenses

Debates about equity in transportation, including equity in transportation finance, are often bedeviled by the many different, and sometimes contradictory, notions of equity. Consider, for example, civil rights lawsuits filed against public transit operators over the allocation of services. While plaintiffs have generally argued in favor of greater income-based or social equity for those who are most dependent on transit services—low-income groups, persons with disabilities, and minority inner-city residents—transit officials have argued that achieving greater geographic equity requires them to invest in commuter-oriented suburb-to-central-business-district transit services (see, for example, Brown 1998; Garrett 2006; and Grengs 2002).

There are different equity concepts, various ways of categorizing people for the purposes of equity analysis, numerous impacts to consider, and various ways of viewing and measuring these impacts. As many observers have noted, a particular decision may seem equitable when evaluated in one way but inequitable when evaluated in another. Moreover, equity is a relative concept, and public policies are typically more or less fair rather than strictly fair or unfair. Researchers have explored different ways of defining and classifying equity in an attempt to overcome such difficulties and analyze transportation finance equity in a logical and transparent manner. Rosenbloom (2009) notes more than 25 separate definitions of equity in the literature on infrastructure finance and service delivery.

The purpose of this chapter is to consider systematically the many ways that equity is defined and used in transportation debates, thereby alerting decision makers to the diverse equity issues they may encounter during debates about evolving finance mechanisms. The focus is on the practical application of efforts to identify and categorize the equity implications of

transportation finance mechanisms. In addition, the different equity perspectives presented here provide a basis for evaluating mitigations of equity concerns and identifying possible remedies for inequities.

The chapter identifies and discusses equity concepts frequently encountered in debates over transportation finance. Useful ways of grouping people for the purposes of equity assessment are then examined, and the assessment process is discussed. The final part of the chapter discusses ways in which the impacts of a transportation finance policy—cost and other burdens, as well as benefits—may be distributed as individuals and institutions modify their behavior in response to the policy.

Examples, some hypothetical and some drawn from practical experience, are included throughout this chapter; however, no attempt is made here to capture all the empirical evidence on the equity implications of evolving transportation finance mechanisms. That task is addressed in Chapter 4.

EQUITY CONCEPTS

People use different criteria for judging equity, each based on an underlying idea of fairness. Table 3-1 lists five equity concepts often encountered in debates over transportation finance, together with simple definitions and transportation examples illustrating the principles involved.[1]

Benefits Received, Ability to Pay, and Return to Source

Rosenbloom (2009) notes that benefits received and ability to pay are the most traditional and familiar equity concepts. The benefits-received concept argues that equity increases when individuals pay in proportion to the benefits they receive from the service being financed, and this concept underlies the traditional user fee approach to highway financing embodied in the gas tax. Ability to pay is based on the principle that those with

[1] In a broader context, social problems and inequities are sometimes addressed by providing transportation access or resources, and this approach has been termed "compensatory equity." This approach is not really an equity concept, but rather a remedy for achieving equity. Putting compensatory equity into practice often focuses on matching transportation services to the particular needs of users—for example, by financing a variety of special transportation services for people with disabilities or for older people, whether poor or not, as well as providing additional services to certain neighborhoods or otherwise disadvantaged travelers (Bonsall and Kelly 2005).

TABLE 3-1 Equity Concepts

Type of Equity	Simple Definition	Transportation Example
Benefits received	I get what I pay for.	People who use a facility the most pay the most.
Ability to pay	I pay more because I have more money.	A project is financed through a progressive tax that is disproportionately paid by higher income people.
Return to source	We get back what we put in.	Transit investment in each county is matched to that county's share of metropolitan tax revenues used for transit.
Costs imposed	I pay for the burden I impose on others.	Extra expense required to provide express bus service for suburb-to-city commuters is recovered through fares on this service.
Process (or participation)	I had a voice when the decision was made.	Public outreach regarding proposed new high-occupancy toll lanes provides transparent information and seeks to involve all affected parties in public hearings and workshops.

greater income or wealth should pay more to support public services and is a basis for income and property taxes.

The return-to-source concept of equity is also widely considered in the transportation field and is based on the idea that the amount a particular group pays should reflect the expenditures on transportation for that group. Groups are often defined by where they live or pay taxes, and return to source and geographic equity are frequently synonymous in the context of surface transportation policy (Altshuler 2010). As discussed further in Chapter 5, geographic equity is often the overriding equity concern for politicians at the state and local levels when faced with decisions about which transportation projects to pursue and how to fund them. In most highway financing debates at the federal level, return to source or geographic equity focuses on whether states get back an equitable share of the fuel taxes they send to Washington.

Other Equity Concepts

In addition to the three well-known equity concepts already noted, other less familiar equity concepts—costs imposed and process or participation—have begun to attract attention, often in the context of concerns about what has become known as environmental justice. As noted in Chapter 1, debates about environmental justice now address

not only disproportionately high and adverse human health and environmental impacts of pollution and the siting and transport of toxic hazards (costs imposed), but also the exclusion of certain groups from decisions about the transportation system (process or participation equity).

Costs Imposed

According to the costs-imposed concept of equity, people should pay in proportion to the costs they impose on society (others), including other transportation system users and third parties. This concept comes close to defining efficiency as equitable because it aligns charges with costs imposed by different users.[2] Therefore, the costs-imposed concept provides a basis for both the efficiency and the equity justifications for several policies sometimes described as market based or market like—for example, congestion pricing, carbon and other pollution taxes, and taxes on heavy vehicles proportional to the pavement damage they inflict.

Process

The concept of process, or participation, equity is an increasingly important aspect of decision making for the transportation system. Process participation can take a wide variety of forms, ranging from responses to formal solicitations for public comment, to organizing neighbors to support or oppose a local transportation project, to weighing in at the ballot box on transportation measures. Federal legislation, and that of many states, requires a high level of formal citizen engagement in transportation decisions (FHWA 2000). Moreover, there is some evidence that people's perceptions of what is fair often depend on the decision-making process as much as, or even more than, on the outcomes of the decisions.[3]

Although the opportunity for people to voice their views at meetings, in writing, or on line does not necessarily indicate that those views influence decision making in a meaningful way (Arnstein 1969), there are cases

[2] For example, according to the authors of a report on estimating the marginal social costs of freight transportation, information on the extent to which shippers and carriers pay the full social costs of their freight operations would help government to "design policies . . . that promote economic efficiency and . . . establish financing practices that are accepted as equitable" (TRB 1996, p. 1). The reader is referred to the report cited for further discussion of this topic.

[3] Lessons learned about the benefits of engaging stakeholders in discussions of road-pricing proposals are discussed in Chapter 5.

where groups concerned about inequities have clearly influenced decisions about the provision of transportation facilities and services. For example, decisions about the future of bus service in parts of Baltimore, Maryland, were strongly influenced by public hearings that focused attention on the plight of lower income residents with no alternatives to the bus as a means of transportation (Douglas Duncan, committee member, personal communication, 2009). In Chicago, the transit agency's decision to close down the Green Line completely to save time and money during the reconstruction process left members of the largely minority communities served by this line without rail transit service for more than 2 years (January 1994 to May 1996). As a result, at least in part, of the ensuing public outcry, the Chicago Transit Authority subsequently decided to keep the Brown Line running with reduced service during its reconstruction, even though the project, which ran from February 2006 through December 2009, took longer and cost more than it would have if the reconstruction had been done with a complete shutdown (Joseph Schofer, committee chair, personal communication, 2010).

Practical Difficulties in Applying Concepts

Although the definitions and examples in Table 3-1 are intended to provide a helpful system for classifying equity, practical applications are rarely straightforward. Two examples illustrate the kinds of difficulties encountered with individual concepts and the overlap between them.

In the case of the benefits-received concept, it is difficult in practice to assess and extract appropriate payment for the precise amount of the benefit a given traveler obtains from a transportation facility or service. Different individuals use the transportation system in different ways. In addition, they differ in how they value aspects of travel such as travel time, reliability, and safety. Moreover, such values can vary significantly for the same individual from trip to trip. For example, a business executive may value travel time more highly when traveling to meet with an important client than when taking a leisurely Sunday drive to visit a relative.

Overlap between the benefits-received and costs-imposed concepts can also result in some confusion. As already noted, the benefits-received concept is the basis for using the federal motor fuel tax as the primary

method of financing the federal highway system; an individual driver's fuel consumption is roughly proportional to that driver's use of the highway system and presumably also to the benefits received. Fuel consumption and use of the highway system are also related to the costs imposed in terms of pavement wear and tear and emissions, however, which leads to uncertainty as to whether the gas tax is benefit based or cost based. Thus, while identifying the equity concept(s) involved in a particular case may be useful in guiding analysis, evaluation, and the search for remedies, the classification itself may well be overlapping or ambiguous.

CATEGORIES OF PEOPLE

Most of the equity concepts just discussed require identifying impacts on different people. Useful criteria for grouping individuals for the purposes of assessing equity impacts are listed in Box 3-1.

These criteria are not independent of one another. For example, there is often a strong correlation between economic status, geographic location, and use of the transportation system. In addition, one category may sometimes be used as a proxy for another—geographic location as a proxy for economic status, for example. Low-income groups are often concentrated in areas where affordable housing is available, so transportation policy issues associated with such areas may reflect economic status as well as geographic location.

BOX 3-1

Criteria for Grouping Individuals

- Geographic location,
- Economic status,
- Generation,
- Other demographic characteristics (e.g., sex, age, race or ethnicity, physical limitations), and
- Use of the transportation system (e.g., drivers, rail commuters, bicyclists).

In addition, the concepts of horizontal and vertical equity, both of which rely on grouping people according to selected characteristics, are commonly encountered in transportation debates. Horizontal equity assesses how members of the same group (e.g., drivers or bus riders) fare relative to one another, whereas vertical equity assesses how members of different groups (e.g., low-income groups versus high-income groups, drivers versus nondrivers, or inner-city versus rural residents) fare relative to one another. Both concepts are part of most people's ideas of fairness.

Geographic Location

As noted in the earlier discussion of return-to-source equity, geographic location is very often at the heart of debates about fairness in the allocation of transportation resources; where people work and live can influence how they are affected by transportation investment decisions. Moreover, public officials who make many of the decisions about transportation investments are elected to represent specific geographic jurisdictions.

At a national level, debates about the geographic equity of transportation finance often break along state lines, whereas within states, debates are often between urban and rural areas. Within metropolitan areas, debates often highlight differences between a city center and its suburbs or differences among counties, among municipalities, and among neighborhoods and council districts. Such debates have been central to many controversial highway and transit funding decisions. For example, urban highway users subsidize rural users (Levinson 2005), and urban transit riders, particularly bus riders, generally cross-subsidize suburban transit users, particularly rail users (Golob et al. 2006; Guenthner and Jea 1985; Taylor et al. 2000). Furthermore, many funding mechanisms are set up to charge nonresidents more than residents (so-called other people's money), as is the case with highways such as the Chicago Skyway and the Indiana Toll Road that carry a large proportion of traffic from other states (Swan and Belzer 2010). The Chicago Skyway, which is owned by the City of Chicago, mainly tolls commuters from Indiana; trucks using the Indiana Toll Road are generally moving freight to and from major U.S. distribution hubs, and many are from out of state rather than from Indiana itself. (See the section below on generational equity, including Box 3-2, "Generational Implications of Long-Term Concession Agreements.")

Concerns about geographic equity extend beyond where revenues are collected to include how and where those funds are spent. Road tolls, for example, can be dedicated to financing and maintaining a specific facility but can also be used to pay for other transportation facilities if allowed by specific policies. Experience has shown that people's perceptions about fairness in the use of revenues can vary on a case-by-case basis. For example, a sticking point among elected officials voting on plans put forward by the Central Texas Regional Mobility Authority was that the proposed toll (or user tax) would be used for systemwide financing. In particular, tolls collected on one corridor (US-290 East) would be used to build State Highway (SH) 45 Southwest, despite the fact that commuters who paid the toll on US-290 East were unlikely to be regular users of SH-45 Southwest (Johanna Zmud, committee member, personal communication, 2009). In other situations, however, particularly where benefits are shared by all or most who pay tolls, the tolls are perceived as fair. Thus, in the case of the broad system of toll facilities planned for Austin, Texas, tolls from each facility contribute to an overall system of finance that is seen to benefit everyone, and explicit formulas address revenue sharing (Jeffrey Buxbaum, committee member, personal communication, 2010).

Economic Status

Economic status is another common grouping used in assessing a policy's equity implications. As already noted, the possibility of poor drivers being unable to use a tolled lane or road because they cannot afford to pay tolls or other fees has motivated concerns about the potential inequities of road pricing. In addition, low-income travelers may not be able to take advantage of discounted payment of fees and charges, such as monthly transit passes or in-vehicle transponders requiring advance payments and the use of credit cards (Schweitzer 2009).

The typical measure of economic status is current income, although other measures, such as wealth (accumulated resources), are also used. Adding a layer of complexity, life-cycle average income considers not only current income but also potential income over a lifetime, which can lead to very different results. For example, West (2009) cites students and retired people as groups that may have very low annual income at given

points in time, but high lifetime income; she notes that these different measures can lead to different interpretations of equity effects.

Generation

Most transportation investments are long-lived, so that both the resulting services and their financing may affect future generations. It is a long-held tenet of public finance that borrowing for long-lived facilities is fair because it spreads the cost across generations of users, as opposed to current users paying for future generations (Mikesell 2007). Nonetheless, generational equity concerns have recently come to the fore as some states have relied on debt more heavily to avoid increases in current taxes and others have given up long-term revenue streams in exchange for large up-front payments from the private sector.

Extensive use of debt can transfer funding responsibilities to future generations beyond the benefits they will receive. States such as Massachusetts and New Jersey, for example, have commonly used debt financing to support routine operations and maintenance rather than for longer-lived construction projects. The long-term impact of such policies is to pass responsibility for today's expenses to future generations that will not derive a commensurate benefit. Members of the later generations will still have to pay their own current operations and maintenance expenses in addition to retiring the debt incurred for earlier operations and maintenance.

Evolving and relatively untested transportation financing strategies, as well as forms of project delivery such as public–private partnerships (PPPs), may raise similar questions about generational equity. For example, PPPs in the form of long-term leases of existing facilities to private firms have on occasion suddenly and drastically shifted the burden of financing from current taxpayers to future users, because lease agreements have permitted more rapid increases in toll rates than would otherwise be likely (see Box 3-2).

Generational equity is also a concern on the investment side. Ignoring major transportation problems today because of the difficulties of funding repairs and upgrades could impose an even bigger bill for repairs and upgrades on future generations. In addition, transportation raises questions about long-term environmental damage, including climate change. As noted in a recent report, addressing climate change now should help

BOX 3-2

Generational Implications of Long-Term Concession Agreements

In 2005, the City of Chicago granted a 99-year concession on the Chicago Skyway, a toll connector linking Interstate 94 to the Indiana Toll Road. For an up-front payment of $1.8 billion, the concessionaire took on responsibility for maintaining the bridge and roadway and collecting tolls, with future toll increases contractually stipulated. A year later, Indiana granted a 75-year concession for the Indiana Toll Road for a $3.8 billion up-front payment, on similar terms (FHWA 2008). In Chicago's case, some of the up-front payment was used to pay down existing city debt, and in Indiana's case, some was used to fund the 10-year highway work program. In both cases, the concession was a way to extract market value from the facilities in exchange for a future, escalating stream of toll revenues. Potential concerns about generational equity arose because some of the up-front payments were used to fund improvements with life spans of considerably less than the concession periods. As a result, future toll payers are likely to be paying to retire debt on past improvements that will have been subsequently retired, rebuilt, or replaced.

avoid costly future investments and disruptions to operations; conversely, ignoring climate change now could result in even more deleterious effects and heavy cost burdens on future generations (TRB 2008).

Other Demographic Characteristics

Characteristics such as sex, age, race or ethnicity, language isolation, and physical limitations may be used alone or in combination with income to define groups for the purposes of equity assessment. Federal and state laws often require a focus on such groups in situations in which special needs can be addressed through transportation policies or in which the

groups incur additional costs as a result of transportation policies. For example, the 1990 Americans with Disabilities Act (ADA) requires that transportation providers make certain efforts to serve travelers with disabilities, and the 1964 Civil Rights Act, in conjunction with presidential directives about environmental justice, focuses on groups likely to suffer disparate impacts from transportation (and other) policies (see Chapter 1). Thus, U.S. Department of Transportation regulations issued pursuant to ADA expressly require public entities operating fixed-route transit systems to provide complementary paratransit service for mobility-impaired groups comparable to their fixed-route service. This stipulation has been used by plaintiffs to secure improved paratransit scheduling, routing, and vehicles.

Use of the Transportation System

Travelers can be grouped according to their use of the transportation system, such as by mode used (e.g., motorists, train or bus riders), direction of travel, and time of day when travel occurs (e.g., rush hour versus off-peak times). These groupings are based largely on choices made by travelers—for example, whether to drive or take transit or whether to avoid rush hour travel by working a flexible schedule. Whether such choices are constrained by factors beyond travelers' control needs to be taken into account in any equity assessment. For example, if affordable housing and job locations are not served by public transportation, low-income motorists cannot reasonably switch to transit to avoid tolls (see the section on impacts on travelers later in this chapter).

EQUITY ASSESSMENT

This report focuses on equity as a criterion for assessing transportation finance mechanisms. In practice, however, equity is rarely the sole criterion considered by public officials making decisions on transportation investments. Efficiency, the relationship between inputs (costs) and outputs (benefits), is frequently an important consideration and is the criterion underlying traditional and fundamental benefit–cost and cost-effectiveness evaluations of projects and programs. Decision makers and their constituents often strive for efficiency in seeking to get the

most "bang for the buck" in transportation investments. There may, however, be a trade-off between efficiency and equity—or among efficiency, equity, and a range of other criteria. For example, the most efficient transportation solution from the perspective of benefits and costs could be to collect taxes and use them to direct new services to the most mobile and economically secure travelers. On the other hand, equity considerations could lead to choices that distribute services more broadly across income groups or even focus them where mobility need is greatest. The solution to such dilemmas calls for a broad perspective and is almost never formulaic.

In assessing the equity implications of a transportation finance policy, it is important to remember that the financial and other burdens imposed on individuals and groups are a consequence of investments in facilities and services benefiting individual travelers, businesses, and society as a whole. Examination of a policy's equity implications includes analyzing and evaluating these benefits, which are the reason for raising the funds in the first place. If the funds collected are directed broadly across a transportation system—for example, to provide general operating support for a transit system—isolating the benefits associated with a particular financing mechanism may be difficult. The task is easier if the revenues are directed to a specific project, such as a replacement bridge or a transit line extension. In either case, however, explicit consideration of the benefits produced by the new funds is needed to avoid losing sight of the fundamental purposes of transportation facilities and systems.

Winners and Losers

The fundamental objective in assessing the equity implications of a transportation finance mechanism or policy is to determine how the policy affects different groups (e.g., drivers, the elderly, residents of a particular county or geographic area, low-income groups) and to decide whether these impacts, taken together, are judged to be fair or can be rendered so by taking steps to remedy inequities. There may be opportunities to compensate the losers—for example, through subsidies or rebates or by providing or improving alternative transportation services (see Chapter 4). The decision about what is fair in a particular case is ultimately made by elected representatives (politicians).

Short- and Long-Term Impacts

Identifying the full range of likely impacts of a policy is complicated and subject to uncertainty. People often change their behavior in response to a new policy, and the actual impacts may differ from those anticipated by experts and estimated using analytical tools. In particular, impacts may be shifted to another party, as noted in Chapter 2 and discussed more fully later in this chapter.

Some of the behavioral changes are likely to occur in the short term and others in the longer term, so the full impact of the policy may not be known for some time. For example, in discussing consumer responses to an increased gasoline tax, West (2009) reports that a 10 percent increase in the price of gasoline may reduce consumption by as little as 1 percent in the short term, but by an estimated 3 to 9 percent in the long term. This difference between short- and long-term impacts reflects the time it takes for travelers to change some of their behaviors. Whereas people may make increased use of carpools or transit in the near term, retiring older or second cars and possibly replacing them with more fuel-efficient models usually takes longer.

In addition, transportation investments affecting land use often have both short- and long-term equity implications. For example, people living close to the stations on a new light rail line may enjoy increased mobility in the short-term as a result of the policy makers' decision to invest in the line. The impacts of the new light rail line may be mixed in the longer term, however; for example, although the new line may increase the value of homes for existing owners, it may also increase property taxes, rents, and the price of land for new buyers. Resulting gentrification may cause owners and renters to move, some willingly, others reluctantly (Freeman 2005). While owners who choose to sell in a gentrifying area may reap windfalls, tenants may simply be forced out by rising rents.

Economic and Other Burdens

Equity depends in part on the burdens imposed by a financing system. A first step in determining those burdens is to determine the direct economic burden of the payments themselves, and the next section of this

chapter discusses ways this can be done. There are, however, further economic and other burdens to be considered. For example, West (2009) observes that low-income households consume more gasoline as a fraction of income than higher income households, but that this apparent regressivity[4] is reduced because low-income households are also more sensitive to gasoline prices. As gas taxes rise, lower income families may reduce their gas consumption up to twice as much (in proportion to initial consumption) as higher income households. Technically a tax cannot be regressive if low-income people do not pay it, but using regressivity alone to assess the impact of increased gas taxes is misleading. Being forced to depend on alternatives to the car may place substantial time and other burdens on households; many studies in the United States and abroad suggest that using public transit to access many destinations may impose great costs in time and inconvenience (Blumenberg and Manville, 2006; Giuliano and Schweitzer 2010; Sanchez 2008). Moreover, other research suggests that it simply may not be possible to reach the majority of jobs or other important destinations in most metropolitan areas at all without a car (Baum 2009; Cervero et al. 2002; Dargay and Hanly 2007; Giuliano 2005; Ong 1996, 2002; Rogalsky 2009; Rosenbloom and Plessis-Fraissard 2010).

The lack of both a car and public transit access has been linked to social isolation and a lack of social capital for whole areas and classes of low-income, elderly, and disadvantaged travelers (Delbosc and Currie 2011; Priya and Uheng 2009; Sanchez et al. 2007; Stanley et al. 2010). Thus, if rising fuel taxes prevent low-income families from traveling by car, these families may suffer substantial economic burdens and perhaps social and psychological problems (Lucas et al. 2009). These broader economic, social, or other burdens are more difficult to measure than monetary payments, but they may be equally important or more important to the people affected. Therefore, a complete equity analysis needs to take such burdens into account.

[4] A regressive tax is one that takes a greater share of the income of the poor than of the rich; in contrast, a progressive tax takes a greater share of the income of the rich than of the poor (Rosenbloom 2009). A proportional tax is one that imposes the same relative burden on all income groups.

Comparison of Alternatives

Some observers have suggested that high-occupancy toll (HOT) lanes should be rejected because they are regressive. As Weinstein and Sciara (2004) note, however, HOT lanes (and other evolving transportation finance mechanisms) do not exist in a vacuum, and their equity implications need to be assessed in comparison with alternatives such as sales taxes and gas taxes, both of which are also regressive. In practice, analyzing the impacts of wholesale shifts in financing strategies is challenging and depends on how broadly policy alternatives are defined. As a result, the equity implications of different transportation finance policies are most frequently evaluated on the basis of differential or marginal impacts, that is, relative to some other policy, such as the current financing arrangement. Schweitzer (2009) notes that researchers have generally focused on examining different variants of the same type of finance policy, such as cordon tolls of different sizes, at different toll levels, or with different revenue allocation strategies. Detailed comparisons of the incidence of very different transportation finance policies, such as a sales tax and a traditional user charge, have only rarely been undertaken.

DISTRIBUTIONS OF BURDENS AND BENEFITS

The equity implications of a transportation finance policy depend on how its effects, both positive and negative, are distributed among different groups. Identifying these effects and describing their distribution involves analyzing the policy's incidence—that is, determining who bears the burden and who receives the benefits. Careful examination of all the costs and benefits, both monetary and nonmonetary, is then needed to assess the policy's equity implications.

As discussed briefly in Chapter 2, the distribution of a policy's financial burden is not always immediately apparent. If groups are able to modify their behaviors in response to a policy, they may shift some or all of the burden of a tax, fee, or price change onto others. Therefore, the eventual burden of the policy—and its equity implications—may differ dramatically from that originally envisaged by policy makers. Two examples, the gas tax and a weight–distance tax on trucks, illustrate how shifts

of transportation cost burdens may occur in practice and provide a number of lessons for equity analysis.

The Gas Tax

Figure 3-1 portrays schematically some of the primary ways a tax on motor fuel (gasoline and diesel) may be shifted and how it may affect transportation usage.

In the first instance, the tax is levied on fuel distributors, who then include some or all of it in the price they charge fuel retailers. Fuel retailers in turn will try to incorporate the tax into the price they charge private drivers and businesses who purchase fuel; if they succeed, then the tax has been shifted from distributor to retailer and from retailer to consumer. It is not certain, however, that fuel retailers can in fact raise their prices by the full amount of the tax, because they are competing with each other for customers, and the nature of that competition dictates the ultimate price that prevails. In general, the more competitive the industry, the more fully its members can shift the tax forward while

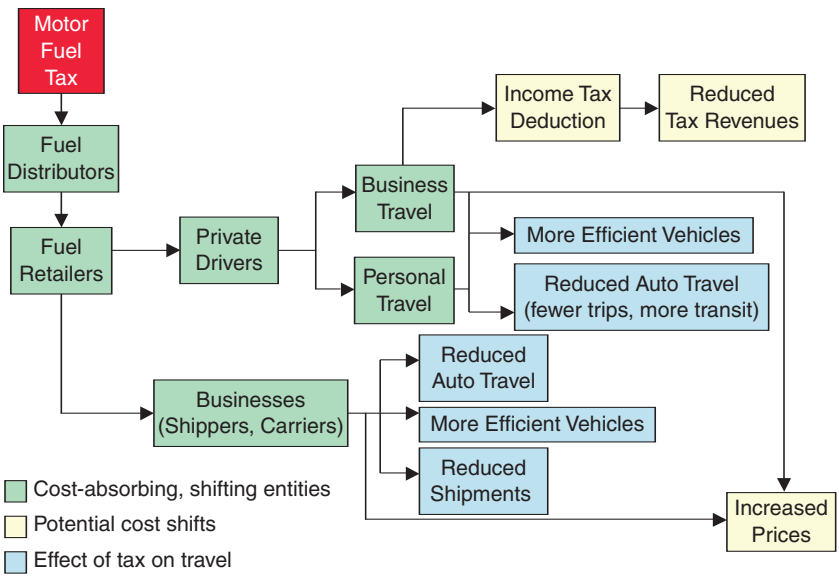

FIGURE 3-1 Motor fuel tax: an example of shifting the transportation cost burden.

at the same time suffering some loss of business and probably some business failures.

Both theory and empirical evidence suggest that the effect of the gasoline tax on prices may differ in urban and rural markets. The theoretical reasoning is as follows. In urban markets, gasoline retailers are highly competitive, with each individual retailer unable to influence the prevailing price. As a result, retailers enter or exit the market relatively smoothly in response to any changes in drivers' purchases of gasoline. This causes a near-total pass-through of a tax increase into the retail price; virtually all the tax burden is shifted to consumers, which results in a modest reduction in gasoline sales. In rural markets, by contrast, retailers have some market power but also have fewer alternative options for using their land and facilities.[5] This situation affects their ability to pass the tax through in ways that depend on the exact nature of competition among them. Empirical evidence suggests that there is indeed some difference between rural and urban markets, although this difference is not large (West 2009). Mostly the evidence shows that rural retailers absorb some portion of the tax (Alm et al. 2009), presumably because their reduced flexibility in exiting the market more than compensates for any increased flexibility resulting from market power.

The example of the gas tax highlights two of the most far-reaching implications of incidence analysis. First, the ultimate burden of a tax or other financial charge depends in part on the nature of the competition in affected markets. Second, the financial burden is usually shifted away from parties that are highly responsive to price and toward parties that are relatively unresponsive.

Those consumers that are businesses may accept lower profit margins or may further shift the burden to their customers by raising their prices, as shown in the bottom portion of Figure 3-1. At the same time, both businesses and private drivers may reduce the impact on themselves by modifying their behavior—for example, by reducing their automobile travel and freight operations through routing efficiencies and consolidation or by shifting to more fuel-efficient vehicles. Parties

[5] The longer the time between changes in a tax rate, the more responsive is supply likely to be as developers and investors find ways to add or subtract from the inventory of retail outlets.

that can reduce the impact on themselves most successfully—for example, a business with good access to a rail freight terminal or a commuter with an attractive public transit option—can reduce the ultimate burden relative to parties that have poorer options or a stronger preference for their original behavior.

Weight–Distance Tax on Trucks

As noted in Chapter 2, several states charge trucks a form of vehicle miles traveled (VMT) tax at a rate that depends on truck weight (usually registered gross loaded weight) and distance traveled. As with the gas tax, the response to a weight–distance tax (or, indeed, to any usage-based toll imposed on trucks) depends on both the level of the tax and the structure of competition within the directly affected industry—in this case, mainly the motor carrier industry, but to some extent the competing railroad industry as well.

Owner–operators tend to exist within a very competitive environment: each is too small to appreciably affect the price charged to shippers, and there is easy entry into and exit from the industry. For this reason, the new equilibrium price following implementation of, or an increase in, a weight–distance tax is likely to go up by close to the same amount as the tax; that is, the carriers shift most of the economic burden to their customers (shippers). This does not mean the owner–operators are unaffected; on the contrary, to the extent that shippers cut back on truck shipments, some owner–operators will be forced to reduce their operations or even to go out of business. That there is free entry into and exit from the industry means, however, that most such operators have other options that pay almost as well as trucking (see, for example, Global Insight, Inc. 2005); or, to put it differently, they were barely making enough to keep them in business to begin with. Therefore, their exit involves a relatively small overall economic burden, even though the burden on individuals, groups, or communities may be significant as a result of the disruption and inevitable transition difficulties such economic changes are likely to entail.

Larger companies may operate in somewhat less competitive environments, meaning that each company must account for its possible loss of market share if it raises prices. To put it differently, larger companies

have some market power enabling them to withstand some loss of profit without exiting the industry. As a result, they probably cannot fully shift the tax to their customers; they have too much invested in the business to abandon it easily, and therefore retain more of the direct economic burden.

Many entities besides motor carriers may be affected by a weight–distance tax. Examples include roadside services, markets for new and used trucks, the labor market for truck drivers, and even capital markets in which trucking firms raise money for investment or working capital. In general, it is impossible to account fully for all the simultaneous price changes that are triggered by a change in a tax affecting truck movements, especially since they all affect each other as well as being affected by outside forces such as international trade, unionization, safety regulations, and technological innovations.

Because of the complexity of analyzing multiple interconnected markets, every quantitative incidence analysis—and therefore every quantitative equity analysis—requires models that approximate the economic changes triggered by the policy being considered. To date, such models have rarely been used to inform political debates over transportation finance equity. When such models are used, different answers may be obtained using different simplifying assumptions; accounting for tax or benefit shifting can completely change the results of an equity analysis.

Again, the case of a weight–distance tax on trucking is illustrative. At first blush, the tax burden is borne by the trucking industry, and so an equity analysis would need to consider how tax payments are distributed among the various entities that are part of this industry. If the taxes are fully or partially shifted to shippers, however, the analysis also needs to consider the distributional aspects of increased costs to shippers. Indeed, if such shifting were complete, the distribution of payments among truckers would be of no relevance. Having to consider shippers unquestionably complicates the analysis, because shippers are a diverse group and most are involved in markets in which they may further shift the impacts. If the extent of shifting from truckers to shippers is believed to be minor, it might be ignored for practical reasons, but any such decision would need to be justified.

Lessons for Equity Analysis

Shifting of Burdens and Benefits

The preceding discussion and examples provide lessons for equity analysis. First and foremost, any transportation finance equity analysis that considers only the nominal payers of taxes or fees is incomplete and may well be misleading. The starting point of such an analysis must be who bears the burden (and receives the benefit) of a given policy. The policy's ultimate effects, including its equity implications, may be different either from the intended impact of legislation or regulation or from the effects perceived by elected officials and members of the public debating the policy.

The effects of any public policy take place within an economic system in which individuals and institutions are continuously responding to their environments. As a result, an important—but challenging—step in equity analysis is to explore and estimate how the burdens (or benefits) of policies are shifted through market forces. The examples of a gas tax increase and a weight–distance tax on trucks illustrate ways in which a tax may be imposed on one party but really paid by another—that is, shifted. Shifting of benefits may also occur. For example, if a new highway or transit link improves the accessibility of an apartment complex, rents may rise as a result, thereby shifting the benefits from tenants to landlords.

Price Responsiveness

One of the most far-reaching findings of economic incidence analysis is that the degree of shifting depends on how responsive parties are to prices. Specifically, the burden of a tax or other financial charge tends to be shifted away from parties that are highly responsive to price and toward parties that are relatively unresponsive. In the truck weight–distance tax example, owner–operators are highly responsive to prices but large trucking companies are less so (Dornan 2008), which causes the former to shift more of the burden to customers.

The principle by which price-sensitive groups shift burdens (or benefits) to groups that are not price-sensitive works on both the supply and demand sides of markets. Suppliers who are relatively unresponsive to price have few options to continuing in business, while consumers who are unresponsive to price have few options to continuing their purchases. In each case, the parties with fewer options are less able or willing to enter

or exit the market in response to a tax or fee, which makes them vulnerable to the greater flexibility of the other side of the market. In the case of relatively unresponsive consumers, the result can be seen as charging what the market can bear; that is, a fee tends to get passed through insofar as the higher price fails to reduce sales, as both the gas tax and weight–distance tax examples illustrate.

Price responsiveness is typically measured as an elasticity,[6] which is the (percentage) change in quantity supplied or demanded as a result of a change in price, divided by that (percentage) change in price. Much incidence analysis involves measuring the price elasticities of both suppliers and consumers (see, for example, West 2009).

Economists typically view those who alter their behavior to avoid a tax as being "successful" at avoiding the tax burden. Nonetheless, when low-income consumers stop making some desired trips because of the tax-induced burdens of higher fuel prices, for example, they may bear significant nonmonetary burdens, as noted earlier.

Impacts on Landowners

Land is thought to be one of the most inelastically supplied commodities, because there is only a finite amount of it (O'Sullivan 2008). Changes in transportation costs can have important effects on land markets by differentially affecting particular locations, with resulting implications for equity. For example, a system of toll financing for roads will affect people who live, work, or shop nearby, and their responses to tolls will in turn affect the demand for use of land at those locations. Landowners often have few options for alternative land uses, so it is likely that some or all of the burden of toll financing will be shifted to them. They may nonetheless benefit if toll roads increase the value of their land. Landowners are also likely to have very different characteristics than toll-paying travelers, and accounting for shifts in the burden of toll financing could change an equity analysis quite drastically. Therefore, the strong role taken by central city and suburban landowners in transportation projects—whether in

[6] In economics, elasticity refers to the degree to which individuals (consumers or producers) change their demand (consumers) or amount supplied (producers) in response to price or income changes. For example, elasticity is used to assess the change in consumer demand as the result of a change in the price of a good or service.

promoting government-subsidized transit that boosts the value of their land or in opposing financing proposals that are likely to decrease the value of that land—may reflect the importance of the shifting of benefits and burdens to landowners. Such shifting substantially changes the distributional impacts of policies, and therefore their equity implications.

Impacts on Travelers

Even if consumers or other economic actors who are taxed are unable to shift the burden to others, they may moderate their burden by purchasing less of the taxed good. This behavioral change does not eliminate the burden, because consumers must forego the benefits of consuming the taxed product; but it does reduce the direct economic burden compared with the case in which they had no option other than to pay the tax. Therefore, the more price-sensitive a group is, the less burden that group receives from a tax or other price increase, even if it cannot shift the burden to some other group. In the case of consumers, the burden is measured by the change in consumer surplus (net benefit), a measure of how much the product is worth to them over and above what they pay for it (West 2009). Consumers who reduce their use of a transportation service because the price goes up lose some of that consumer surplus.

As noted earlier, focusing on the success of price-sensitive travelers in adjusting their travel behavior to avoid paying transportation taxes or fees paints an incomplete equity picture. A key question for transportation finance equity centers on the ability of price-sensitive travelers and shippers to avoid paying some or all of the tax or fee while still enjoying desired access benefits. For example, in the event of an increase in the gas tax, a price-sensitive traveler wishing to avoid higher travel costs resulting from the tax increase may have several options available:

- Choosing to purchase a more fuel-efficient vehicle to reduce fuel (and fuel tax) costs without making any changes in travel behavior;
- Choosing to substitute walking, biking, public transit, or carpooling for some trips;
- Traveling to closer destinations or chaining various activities together so as to travel fewer vehicle miles to complete the same number of activities; or
- Avoiding undertaking some desired activities altogether.

Travelers who choose one or more of the first three options incur burdens in reducing their fuel consumption in the face of an increased gas tax but are still able to complete desired activities. In the fourth case, however, a price-sensitive driver with few alternative access options who simply forgoes desired activities to avoid paying an increased gas tax can be said to have paid a less visible but very real price in terms of reduced access (and consumer surplus).

Economic and Noneconomic Impacts

As the foregoing discussion illustrates, incidence shifting changes the nature of both economic and noneconomic equity considerations. Shifting of the truck weight–distance tax further illustrates this point. If the tax is mainly shifted to particular local industries, such as mining, it may have disproportionate effects on local communities dependent on that industry. Similarly, if highway truck stops play a particular social role in a region, a change that makes them less economically viable may affect that role.

The impacts of a policy or financing mechanism are often measured in terms of monetary costs and benefits, with nonmonetary effects, such as time lost or gained, converted into monetary units through studies measuring consumers' willingness to pay to acquire or avoid these effects (see, for example, Brownstone and Small 2005). The practice of converting nonmonetary effects into monetary units facilitates comparisons of like with like by reducing disparate types of impacts to a single metric, although the degree to which nonmonetary effects can be reliably monetized remains a subject for debate. It is also important for informed equity assessments to ensure that potentially significant nonmonetary impacts are not overshadowed by more readily quantifiable monetary or monetized outcomes.

CHAPTER HIGHLIGHTS

- Equity (fairness) in transportation finance policy can be viewed from a variety of overlapping, and often contradictory, perspectives. In surface transportation policy debates, geographic equity has traditionally dominated considerations of fairness. Other perspectives are increasingly relevant, however, and changes to the current system of transportation financing could result in a wider range of equity concerns gaining

traction in policy debates. For example, generational equity concerns have recently come to the fore as some states have relied on debt more heavily to avoid increases in current taxes and others have traded long-term revenue streams from tolled facilities for large up-front payments from the private sector.

- Recognizing the diverse perspectives on equity and the different groups potentially affected by a policy can help decision makers
  - Anticipate which groups may raise equity concerns when road pricing and other evolving transportation finance mechanisms are considered,
  - Anticipate what those concerns may be,
  - Clarify conflicting and overlapping equity issues, and
  - Seek ways to modify the finance plan or to find remedies to offset inequities, or both.
- The burden (or incidence) of a policy designed to raise revenues for transportation may fall dramatically differently from that stated in legislation or regulation, as illustrated by the examples of the gas tax and a weight–distance tax on trucks. In general, a complex array of market forces and changes in travel behavior determines the ultimate distribution of policy burden. The actual burdens people and businesses experience as a result of finance mechanisms are not always obvious, because there are numerous opportunities to shift costs to others. People and firms that are most cost sensitive are usually most willing, and often most able, to shift the burden away from themselves. Therefore, it is important in equity analyses to consider carefully the ways in which financial and other policy burdens may be shifted and where they may ultimately fall.
- An informed assessment of the equity implications of a transportation tax or fee involves examining both economic and noneconomic burdens. In response to a new or increased tax or fee, people may forgo trips or otherwise change their travel behavior in ways that avoid or reduce the economic burden but impose a significant social burden because of reduced access to job opportunities, services, social networks, and so on. Thus, focusing exclusively on economic burden by classifying a tax or fee as regressive, proportional, or progressive provides an incomplete picture of its equity impacts.

- Decision makers will need to pay particular attention to the possibility that people in certain locations may be adversely affected by evolving finance policies, given the importance of geographic equity to elected officials. Decision makers will also need to consider whether wealthy people benefit more than lower income groups from proposed finance policies, or whether the wealthy benefit and low-income groups lose out. As always with questions of equity, the benefits and burdens may not be obvious.
- Important questions for decision makers to ask concerning a transportation finance policy's burdens and benefits include the following:
  - Who makes direct payments?
  - Who receives direct benefits, including time and reliability savings?
  - Who is most likely to change his or her behavior to avoid a new or increased tax or toll? Are there social implications beyond the individual burden of changing travel behavior, such as loss of an industry or isolation of the elderly?
  - Are there viable alternatives that satisfy the travel needs of those who reduce their automotive travel in response to new or increased taxes or tolls?
  - What businesses are likely to be affected and how?
  - How will the revenues be spent, and who is likely to benefit from these expenditures?
  - How will the costs and benefits be distributed over time (generations)?
  - Are land prices likely to shift in response to changes in transportation costs? If so, will the burdens of the policy shift to different groups? How will location patterns (e.g., gentrification, areas of job growth, retail development) respond to shifts in land prices?

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Abbreviations

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TRB	Transportation Research Board

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4

Transportation Finance Equity

Evidence and Experience

The first two sections of this chapter summarize the evidence about the equity of road and transit finance strategies, with emphasis on different variants of road pricing. Much of the literature on the equity of road pricing discusses theoretical and modeling studies of the possible equity impacts. The literature presenting empirical evidence from practical implementation of road-pricing approaches is more limited in scope.

Both logic and experience suggest that transportation finance policies inevitably result in both winners and losers, and possible approaches for remedying the inequities suffered by losers are discussed in the third section of the chapter. The importance of involving all affected groups in identifying inequities and developing potential remedies is highlighted.

The final section of the chapter identifies and discusses opportunities to fill gaps in current knowledge about the equity implications of transportation finance mechanisms, with emphasis on the need for robust empirical evidence.

EVIDENCE ON EQUITY IN ROAD FINANCE

> A full assessment of fairness [of road pricing] must consider the incidence of toll payments, the incidence of taxes that would have been levied in the absence of tolls, the user benefits (speed and other improvements), the losses associated with some less desirable form of travel for users who avoid tolls, and the final results from the investments made with toll revenues. (Puget Sound Regional Council 2008, 28–29)

This observation, made in the context of the Puget Sound Regional Council's pilot project to evaluate travelers' response to variable road

tolling, illustrates the complexities involved in assessing the fairness (equity) of a financing mechanism. The evidence presented in the literature on equity in road finance reflects these complexities, with much of the work looking at only part of the equity equation—for example, the burden of a toll, or the equity in services offered or consumed—rather than the full range of costs and benefits associated with the toll.

Scope of the Evidence

The availability of evidence about the equity implications of road financing strategies varies considerably depending on the type of strategy. The motor fuel (gas) tax has been studied extensively, with a flurry of studies examining the incidence of the gas tax beginning in the 1990s, when this tax was last raised at the federal level. In contrast, studies of less widely implemented finance strategies—voluntary toll policies such as high-occupancy toll (HOT) lanes and comprehensive toll policies such as cordon tolls, for example—are more limited in number. As discussed in Chapter 2, HOT lanes have been implemented in various locations in the United States, and there is some empirical evidence about the equity implications of these lanes, although modeling studies predominate (Schweitzer 2009). In the case of comprehensive, or mandatory, tolls, the empirical evidence is even more limited. Cordon tolls have been implemented in several cities overseas, notably Singapore; London; and Stockholm, Sweden, but not in the United States. Empirical evidence about the equity implications of vehicle miles traveled (VMT) fees and related taxes is sparse, because such taxes have not been implemented, with the exception of truck weight–distance charges (see Chapter 2).

Study Methods

Most studies consider the distribution of burdens of taxation or other financing mechanisms and not the benefits of expenditures. Several reasons underlie this focus on burdens (costs).[1] First, examining both costs and benefits is considerably more complicated than examining costs

[1] As discussed in Chapter 3, the burdens of a finance policy may be both economic and noneconomic in nature.

alone. The data requirements are complex, in part because the benefits depend on responses to finance policies that can vary widely among groups, households, and individuals. There are many ways to use revenues raised by a given transportation finance mechanism, and treating each of them would greatly multiply the number of cases to be considered. Furthermore, Schweitzer (2009) notes that the benefits of service quality improvements to different types of travelers are seldom estimated for roadway studies, although there is evidence that the differences among groups may be startling; for example, one study finds that women value travel-time reliability more than twice as highly as men (Lam and Small 2001). Finally, the distribution of benefits of expenditures is especially likely to depend on local conditions, making it particularly difficult to draw general conclusions. For example, the distribution of benefits from a highway extension to a suburban area depends on the spatial pattern of residences and jobs by income group.

There is a natural tendency to focus on potential losses under a new financing regime. The results of such narrow studies provide one perspective on the equity implications of finance policies, but the full picture may look rather different. For example, Schweitzer (2009) suggests that the initial pricing of certain projects may be inequitable for lower income groups, but these groups may also benefit disproportionately if the same projects generate positive land use changes or decrease environmental pollution. Such disproportionate benefits accrue because lower income groups suffer more on average from dispersed land use patterns and environmental pollution than do wealthier travelers (Schweitzer and Valenzuela 2004).

A few studies have specifically identified ways that the distributions of benefits and costs are altered if one considers the ways in which revenues are actually spent and services are consumed. The term "revenue recycling" is often used to describe the use of the revenues from a financing mechanism, that is, the ways in which revenues are "recycled" or redistributed—for example, by investing in transit or highways, giving monetary credits to individual travelers, or reducing other taxes. Considering revenue uses often alters substantially the pattern of winners and losers, so it is important to know whether revenue recycling was included in a given equity analysis.

Studies of the motor fuel tax have investigated the many ways in which the burden of this tax can be shifted from retailers to final customers, motor vehicle manufacturers, and so on (see Chapter 3 and Box 4-1). Most studies of other road finance mechanisms employ rather simple, and often unstated, assumptions that place all the finance burdens on the most easily identified market participants. Thus, while the incidence of the motor fuel tax is relatively well understood, the same cannot be said for many evolving transportation finance mechanisms.

Findings

Schweitzer finds that empirical studies of transportation taxes, fees, and charges converge on a basic range of estimates for how much different groups pay, "even though the studies involve significant variations in method, data, and assumptions" (2009, 2). She finds that low-income drivers pay, on average, 0.1 to 0.5 percent of household income for most transportation taxes and fees. Higher toll levels and more comprehensive pricing strategies are expected to take a higher percentage of income—perhaps as much as 2 percent of household income for those earning less than $25,000 a year. Schweitzer emphasizes, however, that these results "depend on the geographic context and on the choices available to low-income motorists" (2009, 2). This dependence on specific details has long been recognized in discussions of the likely equity implications of congestion pricing (see, for example, Giuliano 1994).

Schweitzer's (2009) analysis suggests that a given transportation pricing or tax policy is unlikely to be always progressive or always regressive within or across regions when all the costs and benefits are taken into account. Differences in policy instrument design and revenue usage can result in a system that is regressive, proportional, or progressive, depending on specific details and local conditions. Other researchers have reached similar conclusions. For example, research by Pucher in the early 1980s showed that the incidence of public transportation policies is very sensitive to local transit service patterns and to the mix of funding sources used to finance public transit systems (Pucher 1981, 1982; Pucher and Hirschman 1982). Such findings demonstrate that simplistic policy sound bites (e.g., "if we price the freeway, the poor will suffer") are invariably misleading.

BOX 4-1

Shifting the Cost Burden of the Motor Fuel Tax

Alm et al. (2009) consider shifting of the fuel tax burden from retailers to final customers. They find such shifting to be virtually complete in urban areas (i.e., consumers pay the full cost of the tax) as a result of strong competition among retailers, and extensive, though not complete, in rural markets. The Congressional Budget Office (2003) considers the effects of increasing the federal gasoline tax, including the possibility that some of the tax may be shifted to motor vehicle manufacturers by forcing them to absorb some of the extra cost of new, more fuel-efficient vehicles. The study finds evidence of some such shifting, but still finds that 83 percent of the burden falls on vehicle owners. Bento et al. (2009), West (2004), and West and Williams (2004) focus more on how travel demand varies across income groups in response to fuel price increases; they find that wealthier households are somewhat less responsive and therefore tend to have more of the tax shifted to them than do poorer households. Taking this differential responsiveness into account reduces the regressivity of the fuel tax somewhat, but not entirely. Only when the gas-tax revenue is spent in a way that benefits everyone equally, such as by providing an equal per-household tax rebate, does the gas tax become progressive according to these analyses. In contrast, financing transportation services typically benefits different groups unequally, and so the net incidence of the tax could depend on just how those transportation services are distributed.

The study by Bento et al. (2009) is notable for its detailed depiction of markets for new and used passenger vehicles, showing how a gasoline tax is shifted to various segments of vehicle markets. The authors also consider how the burdens borne by motor vehicle manufacturers and gasoline refiners are likely to

(continued on next page)

BOX 4-1 *(continued)*
Shifting the Cost Burden of the Motor Fuel Tax

be distributed among various population groups. The result is that the burden of the tax is mildly progressive at low incomes and mildly regressive at middle and high incomes; that is, the greatest burdens (as a fraction of income) are borne by middle-income groups, although the differences are not very great. The main reason for this pattern is that most burdens are shifted to users, and fuel use rises strongly with income at low incomes but less so at higher incomes.

It should also be noted that the taxes and user fees charged for transportation vary widely across the country. As noted in Chapter 2, for example, road tolls are far more common in California, Florida, Illinois, New York, and Texas than in most other states. If the equity of current taxes and fees (the status quo) is used as a baseline against which to assess the equity consequences of a new finance policy, variations in this baseline in different regions are likely to affect the assessment. Thus, introducing new road tolls in a region in which such tolls are already relatively common may have different equity implications than introducing road tolls in a region in which fees are not currently levied on road users directly (i.e., at the time and place of use).

Motor Fuel Tax

A number of researchers have found the motor fuel (gas) tax to be regressive. Chernick and Reschovsky (1997) provide a typical finding: a simple comparison of data across income deciles, whether for a single year (1982) or averaged over 11 years (1976 to 1986), shows that family expenditures for motor fuel are regressive except for families in the lowest income brackets. (These families typically do not own cars and therefore do not spend money on fuel.) Several factors may overturn that result, however. One is that comparing tax payments to annual income—as opposed to measures of long-term income—biases the results toward

regressivity. Many low-income people (students, for example) may consume a lot of fuel and are relatively poor at the time, but are far wealthier over the course of their lifetime (Congressional Budget Office 1990; Poterba 1991). Another factor is that wealthier people buy more goods, the prices of which incorporate substantial amounts of the gas tax paid to produce and deliver them to market. Yet a third factor, discussed in Chapter 3, is that low-income households appear to be more responsive than high-income households to changes in fuel price, causing them to shed some of the burden through behavioral changes (West 2004; West and Williams 2004). These behavioral changes depend on the availability of transportation options and on various markets, including the job market. As a result, the gas tax may not be regressive but closer to proportional; that is, it takes roughly the same share of everyone's income (Rufolo and Bertini 2003).

Voluntary and Comprehensive Tolls

Schweitzer (2009) summarizes the evidence from a mix of modeling estimates and empirical data about the equity implications of voluntary and comprehensive toll policies. She finds both types of charges to be broadly regressive, with the variations in findings depending primarily on differences in policy design and distribution of revenues rather than on differences in study methods and data.

Table 4-1 summarizes major findings about equity from a selection of recent studies of road pricing. All these findings are based on models rather than on empirical data and should, therefore, be interpreted with caution; incorporating alternative assumptions into the models could modify the study findings. In addition, while individual studies may be of high quality, few look at all aspects of the equity equation and so need to be interpreted accordingly. Despite these caveats, the diversity of findings listed in Table 4-1 illustrates the difficulty of developing a clear picture of the equity impacts of pricing policies. Many of the findings depend on specific policy details and geographical context, and no clear trends emerge about the fairness (or unfairness) of pricing policies.

Voluntary Tolls HOT or express toll lanes give travelers the option of paying a toll to ensure a faster and more reliable trip time. It can be

TABLE 4-1 Equity Findings from Recent Studies of Road-Pricing Policies

Study	Study Area	Proposed Road-Pricing Policy	Finding
Anderson and Mohring 1997; Mohring 1999	Minneapolis–St. Paul, Minnesota	Congestion tolls	Most travelers (all but those with an income of greater than $80,000 per year) would be worse off with road pricing unless revenue is recycled.
Johnston and Rodier 1999	Sacramento, California	VMT tax and peak-period toll policies	Road pricing would have a detrimental effect on low-income households but would have a positive effect for middle- and high-income households.
Fridström et al. 2000	Edinburgh, Scotland; Helsinki, Finland; Oslo, Norway	Cordon tolls and distance-based charges	Prior to revenue recycling, consumers would be worse off with road pricing; after recycling, overall societal net benefits may improve. Pricing diminishes the ease of reaching destinations by car but increases the ease of reaching destinations by transit.
			While pricing makes auto (and nonauto) travel faster by pricing some cars off congested roads, this faster travel is more expensive. The combination of the two changes (time plus money) increases the composite cost for typical auto travelers.
			Revenue recycling can be used to improve transit service.
Teubel 2000	Dresden, Germany	Road user charges for commuters	The net benefits of transportation are distributed less equally after the introduction of road pricing than before.

Nakamura and Kockelman 2002	San Francisco Bay Bridge, California	A congestion alleviation strategy that is a hybrid between rationing and pricing: travelers could use the bridge on some days without tolls, but on other days only if they paid a toll.	The strategy would harm members of the lowest income group. No combination of tolls plus rationing rates was found to benefit all groups of travelers studied.
Safirova et al. 2003	Washington, D.C.	Value pricing (HOT lanes), limited congestion pricing, and comprehensive congestion pricing	HOT lanes are more equitable than congestion pricing of some or all freeway links because there is a toll-free option. Benefits from HOT lanes accrue to all income groups even before recycling. HOT lanes achieve between 77 and 83 percent of the efficiency benefits (reduction in travel time) associated with comprehensive road pricing.
Bonsall and Kelly 2005	Leeds, England	Cordon crossing charges at each of three cordons; distance-related charges within two charge areas; and time-related charges within an inner area	Road user charging will increase social exclusion for some drivers, especially for low-income, car-captive travelers.
Mitchell 2005	Leeds, England	Road user cordon and distance-based charging	Pollution reduction associated with pricing benefits the lowest income quartile more than the highest income quartile.
Whitty and Imholt 2005	Oregon	Distance-based VMT charge	According to the benefit principle, a distance-based VMT charge is more equitable than existing gas taxes because payments are more clearly related to benefits received.

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TABLE 4-1 (*continued*) **Equity Findings from Recent Studies of Road-Pricing Policies**

Study	Study Area	Proposed Road-Pricing Policy	Finding
Glaister and Graham 2005, 2006	England	Nationwide road user charging, including revenue-raising and revenue-neutral charging options	If revenues from a national road-pricing policy are recycled through a reduction in the fuel tax, benefits accrue more to rural than to urban residents.
Franklin 2006	Seattle, Washington, State Route 520	Roadway tolls	Tolling is regressive.
Maruyama and Sumalee 2007	Utsunomiya, Japan	Cordon road pricing that charges travelers per crossing and area road pricing that charges travelers for an entry permit (e.g., per day)	Area-based tolls produce greater societal net benefits than cordon tolls, but also greater regressivity.
Steininger et al. 2007	Austria	Nationwide road pricing	In terms of money spent (not as a proportion of income), road pricing is progressive: poorer households would bear a smaller burden than wealthier households because poorer households spend less money on transportation in general and use public transport more. In terms of money spent as a proportion of income, road pricing is regressive.
Zhang et al. 2008	Sioux Falls, South Dakota	Road tolls	Users with the lowest value of time harvest the least benefit (or suffer the most loss) from road pricing and investment decisions.

argued that equity effects are quite small, because the voluntary priced lanes are coupled with parallel toll-free general-purpose lanes (Verhoef et al. 1996). Supernak et al. (2002) argue that equity was not an issue in public discourse on the San Diego, California, I-15 FasTrak lanes, and Douma at al. (2005) report that equity was rarely mentioned prior to the opening of the Minneapolis, Minnesota, I-394 MnPass lane. Other authors disagree, noting that criticism of the initial HOT lane demonstration project in the Minneapolis region was based largely on people's concerns about "Lexus lanes" (see Chapter 5) and that equity has been raised as an issue in many HOT lane projects at some point in project development (Weinstein and Sciara 2006).

Objective analyses of HOT lanes reveal several potential equity issues. One is the ability to access the facility, which, for early HOT lane projects, often required signing up and paying for an electronic transponder. The acquisition cost of a transponder and minimum advanced payment for access presents a burden for low-income households that may have neither bank accounts nor credit cards. On the 91 Express Lanes in Orange County, California, and on the Pennsylvania Turnpike, transponder ownership rises disproportionately with income (Parkany 2005). Similarly, enrollment in the Katy Freeway QuickRide HOT lane in Houston, Texas, which originally did not require a transponder but still required preregistration and sign-up, increased with income (Burris and Hannay 2003). The tolling industry is, however, transitioning away from transponders to alternative toll collection technologies that do not require initial investments by travelers, such as toll tags or license plate recognition with optical character readers.

Beyond the question of access to the system, HOT lane use generally rises with income, with some exceptions. On the I-394 MnPass lanes in Minnesota and the I-15 HOT lanes and the 91 Express Lanes in California, travelers from higher income households disproportionately use the lanes and pay tolls (Patterson 2007; Supernak et al. 2002; Sullivan 2000). Thus, both the transportation benefits and financial burdens flow disproportionately to those with higher incomes. Data on use of the QuickRide HOT lane system in Houston are less clear. While those with household incomes of less than $50,000 a year represented only 7 percent of respondents to a survey sent to all QuickRide participants, these

relatively low-income respondents made proportionately more QuickRide trips than those with higher incomes (Burris and Appiah 2004). These authors caution, however, that the numbers of frequent and midlevel users in the low-income group may be too small to support reliable conclusions. Nonetheless, there is evidence that when low-income drivers place a high value on travel time savings (for example, to avoid a late penalty when collecting a child from day care), they choose to avoid the congested toll-free lanes and pay the tolls to get the benefit of a faster trip (Weinstein and Sciara 2004).

Comprehensive Tolls In the absence of a parallel free option, the equity calculus of tolling changes. Empirical evidence about the equity implications of VMT taxes and comprehensive urban tolls is limited, although there are some data from cordon toll policies overseas.

Schweitzer (2009) examined the results of a modeling study of the Stockholm cordon toll (Eliasson and Mattsson 2006). She reports that the direct incidence of the toll was projected to be approximately proportional to income or slightly progressive, mainly because public transit use in Stockholm is high and increases sharply with decreasing income, so that most low-income residents would be little affected by the toll. Furthermore, if the use of toll revenues to improve transit is taken into account, then the net benefits (toll payments and travel costs less revenues) would be progressive; in fact, the lower and middle-income groups would receive a net advantage, whereas the highest income group would incur a small net cost.

Most of the studies of comprehensive tolling systems find that road pricing introduces inequalities in payment burdens compared with nonpriced roads, at least if use of the road-pricing revenues is not taken into account. In general, tolls hit lower income groups harder than higher income groups as a share of income, although all income groups are likely to benefit from reduced congestion. If low-income groups are infrequent auto users but depend on other modes that share the roads with cars, notably buses, then road tolls may be beneficial to such groups because of the benefit they receive from reduced congestion and faster trips. This effect was projected for the cordon toll in Stockholm (Eliasson and Mattsson 2006). In the case of the London congestion charging zone,

buses did move faster and more reliably for a time after the congestion charge was introduced; however, increased congestion in central and inner London, due largely to a proliferation of road works and the reallocation of road network capacity for various initiatives, has prevented further improvement in bus speeds and reliability (Transport for London 2008). Pricing may also have a more beneficial effect on low-income households by reducing congestion and resulting vehicle emissions in areas abutting roads where low-income groups often live (Schweitzer 2009).

EVIDENCE ON EQUITY IN TRANSIT FINANCE

Research on the equity of public transportation finance has generally taken two forms:

- Demand-side studies have focused on the sociodemographics of transit passengers, often in comparison with users of other travel modes; and
- Supply-side studies have examined who pays and who benefits from transit fares, subsidies, and service.

Both of these topics received substantial scholarly attention in the 1970s and 1980s but have been given less attention since then.

Sociology and Demography of Transit Riders

Research on public transit sociology and demography has examined both the fate of disenfranchised groups and the unequal patterns of transit usage by income, race–ethnicity, sex, and other categories. For the most part, researchers have found that public transit in the United States is disproportionately patronized by low-income, carless, and nonwhite riders, whereas services are often not configured to meet such riders' needs (see, for example, Giuliano 2005; Grengs 2001; Pucher et al. 1998). In an analysis of the 2001 National Household Transportation Survey, for example, Pucher and Renne (2003) found that 38 percent of all transit riders nationally came from households with incomes below $20,000, compared with just 12 percent of automobile travelers. They also found significant differences in incomes and race–ethnicity by transit mode: for

example, 47 percent of bus and light rail transit passengers came from households with incomes below $20,000, compared with 20 percent of heavy rail passengers, and just 6 percent of commuter rail passengers. Likewise, they found that racial–ethnic minorities were far more likely to ride public transit than whites, who used transit for only 0.9 percent of their total daily trips by all means of transportation (e.g., auto, transit, walking, cycling). Comparable percentages for other racial–ethnic groups were 5.3 percent for blacks, 3.2 percent for Asians, and 2.4 percent for Hispanics.

Transit Fares, Subsidies, and Service

Complementing research on the sociodemographics of transit riders are studies of the incidence of transit fares, the allocation of transit subsidies, and the distribution of transit service. A starting point for most of this work has been an examination of how transit fares, subsidies, and services affect choice riders vis-à-vis those who are transit dependent. (Choice riders are defined as those who have the option of traveling by private vehicle for a given trip.) The absence of a private vehicle option is usually due to age, disability, or income limitations that preclude travel by car, rather than to choice.

Research in the 1970s and early 1980s found that, because low-income and nonwhite passengers tend to make shorter transit trips, transit fares that do not vary by distance traveled result in higher fares per mile for these travelers (Bates and Anderson 1982; Cervero 1981; Cervero and Wachs 1982; Rock and Zavattero 1979; Ugolik and Leutze 1979; Wachs 1981). Some of this research extended the analysis to distributional impacts of the variance in costs of transit service delivery by time of day and direction (Cervero 1990; Hodge 1988). In recent years, however, transit fares have attracted relatively little attention as a topic for empirical research on the social equity of transportation finance mechanisms, even though smart card technology has opened up an array of pricing possibilities. Schweitzer (2009) observes that researchers have been more occupied with comparing the relative merits of different modes for low-income travelers than with measuring whether any mode is affordable at all. She suggests that higher transit fares (i.e., higher mobility costs) can contribute to social exclusion for low-income transit patrons unable to afford a car.

Research on the distributional consequences of transit service allocations has centered primarily on three issues: variation in subsidies by income and race–ethnicity, the distribution of central city services vis-à-vis suburban and commuter-oriented services, and the allocation of expenditures and subsidies between bus and rail modes (Rogers 2003). The first set of these studies has generally found that higher income households tend to pay more in absolute terms in taxes (usually sales and property taxes) to fund transit subsidies than lower income households. Higher income transit riders tend to enjoy higher per trip subsidies than lower income riders, however, because they are more likely to patronize expensive-to-provide peak-period, peak-direction, express bus and rail trips (Caliper Corporation 1985; Frankena 1973; Pucher 1981; Taylor et al. 1995).

Like the fare research discussed above, the second and third sets of studies have tended to find that capital-intensive, commuter-oriented, and suburban transit services, such as commuter rail, tend to require larger per passenger subsidies and convey more higher income riders than less-capital-intensive, central-city transit services, such as urban buses (Luhrsen and Taylor 1996; Moore 1993a, 1993b; Rubin et al. 1999). Some investments in new transit services, however, aim to reduce congestion and pollutant emissions by attracting automobile users, who tend to come from higher income groups. Scholars have generally posited a tension between the needs of disproportionately low-income and minority riders, on one hand, and efforts to draw higher income drivers out of their cars on the other (see, for example, Garrett and Taylor 1999; Grengs 2002, 2005; Sanchez et al. 2003). While investments aimed at attracting discretionary riders have raised equity questions and sometimes litigation, courts have held that it is within the mission of such agencies to pursue broader community goals at the expense of income equity (see Chapter 1).

REMEDYING INEQUITIES

The evidence presented in the preceding sections demonstrates that road and transit finance policies result in both winners and losers, with the latter suffering a variety of inequities because of the ways transportation

services are funded. The possibility of remediating (or offsetting) transportation pricing or finance inequities has attracted attention in the literature, but there is little information on actually implementing remedies.

Scope of the Literature

Several scholarly studies propose and evaluate a variety of remediation strategies, often aimed at finding ways to garner political support for road pricing in the face of opposition to new tolls and fees (King 2009; Weinstein and Sciara 2006). Much of the literature focuses on possible ways of assisting those with low incomes who may have difficulty paying for new road tolls or fees—that is, on ways of offsetting income-based inequities associated with these highway finance policies.

In principle, strategies to compensate for inequitable transportation finance effects could involve either transportation or nontransportation remedies. Examples of transportation remedies include offering affected parties toll rebates or subsidies and providing alternative or improved transportation services for those who have difficulty affording tolls or taxes (King 2009). Examples of nontransportation remedies could include using toll revenues to support affordable housing options near employment sites and building a playground to compensate a community for the adverse impacts of a nearby highway expansion. In practice, however, the literature focuses almost exclusively on transportation remedies, with other solutions rarely considered explicitly as remedies for transportation finance inequities.

Proposed Remediation Strategies

Proposed transportation strategies for remediating inequities resulting from transportation finance policies fall into three main categories:

- Altering the design of the finance policy;
- Giving exemptions, discounts, subsidies, or rebates to parties adversely affected by the policy; and
- Offering or improving alternative transportation services.

Altering the Design of Finance Policy

Bonsall and Kelly (2005, 408) suggest that it may be possible to modify the design of a road user charging strategy so as to "reduce the likelihood of at-risk groups becoming socially excluded." They suggest a number of approaches, including the following: moving the boundary of a cordon toll; redefining the basis for the charge, for example, by applying distance-related charges to all traffic within a designated area and not just to traffic entering the area; and allowing different methods of paying the charge.

Allowing different methods of payment of road user charges or transit fares could avoid or reduce some of the adverse impacts on low-income travelers. As noted above, if road user charges have to be paid as a lump sum in advance or require access to a bank account or credit facilities, low-income groups are likely to be at a disadvantage. Similarly, requiring that drivers pay to have their vehicles equipped with transponders or other technologies for toll collection may be difficult for some low-income drivers (Bonsall and Kelly 2005). Schweitzer (2009) makes a similar point and also notes that low-income travelers may be disadvantaged by methods of paying transit fares. She observes that the high up-front costs of purchasing a transit pass favor higher income travelers, who can then enjoy discounts and conveniences for transfers and trip chaining. For example, travelers on the Los Angeles countywide transit system pay $744 per year if they purchase a regular monthly pass but $884 per year if they cannot pay out in lump sums for monthly passes and so purchase a weekly pass. For regular riders who pay for each ride separately, the prices are even higher; just two rides (with one transfer) each work day cost $944 per year.

Exemptions, Discounts, Subsidies, or Rebates

Almost all cordon toll systems implemented in Europe feature some type of subsidy, discount, or exemption (King 2009). For example, members of groups receiving discounts or exemptions under London's congestion charging policy include disabled drivers, residents living within the priced zone, and certain health service staff and patients. Two proposed pricing strategies in the United States, neither of which was implemented,

included subsidies aimed at offsetting inequities associated with user charges. A 1993 proposal to implement congestion pricing on the San Francisco Bay Bridge included "lifeline" credits for low-income motorists, and the 2008 New York City congestion pricing proposal offered rebates to low-income drivers (King 2009).

Bonsall and Kelly (2005) note that the choice of groups to receive an exemption or discount is often politically motivated, and not necessarily needs-driven; however, both the San Francisco and New York City proposals used established criteria to identify those entitled to rebates or credits—namely, those qualifying for lifeline utility services from Pacific Gas and Electric and Pacific Bell in the case of the Bay Bridge, and those eligible for the federal earned income tax credit in New York City.

Alternative or Improved Transportation Services

The most direct and common government action to offset inequities in highway finance has been to improve public transportation services, using revenue either from general funds or from the proceeds of gas and other sales taxes or road user fees. This approach aims to provide a less expensive alternative for those who have trouble affording a road charge or an increase in the gas tax.

In both London and Stockholm, funds were invested in improving public transportation services in advance of implementing cordon tolling strategies. Bonsall and Kelly (2005, 407) observe, however, that "public transport can never hope to provide the standard of convenience offered by the private car." Thus, drivers of all incomes may be limited in their ability or willingness to switch to public transit in response to tolls because of their travel needs or circumstances. Trip origins and destinations may not be adequately served by transit, and the necessary timing of trips may not comport with transit service schedules. In addition, the need to link trips to chauffeur children or the elderly or to carry heavy groceries or other bulky goods may preclude an easy switch to transit, even if services are improved. Low-income drivers with no realistic alternative to making particular journeys by car may be particularly hard-hit by road use charges. Rosenbloom (2010) and Schweitzer (2009) cite research showing that simply providing more mass transit services may not benefit older, fixed-income motorists, even though it might help younger peo-

ple. As these authors note, using transit can require more physical exertion than driving alone, even under favorable circumstances.

Researchers and analysts generally agree that offering improved public transportation services to those unable to afford road tolls and taxes is not a panacea for offsetting inequities associated with highway finance policies. The equity nexus between highway taxes and tolls and transit use is relatively weak. While transit users come disproportionately from low-income households, most poor people travel in private vehicles for most trips. As such, not all poor travelers can make use of transit services, even when these services are well designed and operated (NSTPRSC 2007). Therefore, the provision of improved transit services to offset inequities in highway financing policies is an imperfectly targeted remedy at best.

Furthermore, transit improvements in and of themselves do not necessarily meet the needs of travelers most affected by higher transportation taxes or user charges. This is particularly true of improvements that emphasize rail and other commuter-oriented services geared to central business district (and higher average income) commuters. For example, rail passengers receive substantially higher subsidies, on average, than do bus passengers (Taylor et al. 2000; Ward 2005). Yet bus riders are more likely to be poor, minority, and female, while rail riders are more likely to be wealthier, white, and male (Bullard, 2004; Bullard et al. 2004; Cohen and Hobson 2003; Mann 1997; Rosenbloom and Fielding 1998; Sanchez et al. 2003).

Despite the aforementioned limitations, some research suggests that offering public transportation services can offset inequities under certain circumstances. An evaluation of congestion pricing in Stockholm concluded that spending the money generated by a central city cordon congestion pricing program to improve public transit (and related) services would substantially address the equity consequences of congestion pricing (Eliasson and Mattsson 2006). Likewise, Bonsall and Kelly (2005) suggest that inequities caused by road user charges in the United Kingdom could be largely offset if revenues were used to improve the transportation system, provide alternative modes of transport, or provide alternative means of participating in the normal activities of society. Even so, not all drivers would be able to make alternative arrangements without compromising their participation in society.

In summary, available evidence indicates that the effectiveness of alternative transportation services (and in particular public transit) in offsetting inequities associated with road finance policies depends on the details of the local setting, the services provided, market demographics, and the spatial distribution of jobs and residences. This finding is not surprising, given that the inequities themselves depend on the details of the financing strategy and local conditions.

Stakeholder Participation to Identify and Target Remedies

Effective dialogue with stakeholders can lead to a better understanding of public concerns about possible inequities and help identify equity concerns that might otherwise be overlooked (see Chapter 5). As a result, such dialogue offers opportunities to highlight areas in which remedies are needed and to gather information useful in developing these remedies.

One of the challenges in developing remedies is targeting them effectively to the needs of at-risk groups (Bonsall and Kelly 2005). As noted in Chapter 1, over the years a body of laws and regulations has evolved that collectively encourage, and in some cases guarantee, participation in decision-making processes by a wide variety of stakeholders, particularly members of historically disadvantaged groups. Such participatory decision making gives stakeholders the opportunity to request specific, and possibly substantial, changes to transportation projects, including changes intended to remedy inequities.

Case study research suggests that environmental justice laws and administrative regulations have given previously marginalized or disenfranchised groups far more power at the bargaining table than in years past. For example, Ward (2005) undertook five case studies of environmental justice debates of planned public transit improvements. She found that many of the issues raised in the discussions were not focused primarily or at all on the specific improvement or project being considered, and many were not within the power of the local transit operator to affect. Nonetheless, Ward's findings suggest that opening the transportation decision-making process under the policy of environmental justice can bring a variety of untreated inequities to the surface. The

information provided can help public officials address the concerns and needs of socially or economically disadvantaged groups, even though some of the untreated inequities may be tangential to transportation.

Obstacles to Funding Remedies

Excess revenues are often not available to fund remediation strategies, particularly when newly constructed transportation facilities have to pay for themselves from toll revenues (Weinstein and Sciara 2006). Many of the HOT lane projects opened in the past few years have not yet covered their initial costs, which has left little or no net revenue to address remediation of inequities, and the same may also be true of toll roads. For example, revenues from the E-470 toll highway in Colorado are committed to debt service for the next 20 years, with revenue after that point already assigned to the Colorado Department of Transportation (King 2009). Plotnik et al. (2009) suggest that, in practice, states are most likely to devote toll revenues in their entirety to the construction, improvement, and maintenance of tolled facilities. Therefore, these authors suggest that researchers "should generally assume that no revenues will be available to offset any undesirable equity effects [of tolls]" (Plotnik et al. 2009, 15).

Public transportation budgets are often stretched too thin to allow funding of remediation strategies, particularly in times of economic downturn. For example, the Low Income Flexible Transportation (LIFT) program operated by AC Transit in the San Francisco Bay Area was terminated after 1 year because of budget constraints (King 2009), and so was not in place long enough for an assessment with confidence of the effect of free transit passes for low-income middle and high school students. Qualification for the LIFT program was based on existing criteria linked to income, with free passes distributed to students enrolled in a free or reduced-price lunch program. In contrast, transit systems offer discount pricing for all senior citizens regardless of income, but such programs do not target explicitly people in need of financial assistance.

To avoid financial obstacles, finance strategies can sometimes be designed to include some form of remediation. For example, legislation authorizing HOT lanes on I-394 in Minnesota stipulates that 50 percent

of the revenues (net of debt service) be used to support transit service in the corridor (Weinstein and Sciara 2006). Revenues from the I-15 HOT lane in San Diego must be divided approximately equally between funding for bus service in the corridor (the Inland Breeze Express Bus Service) and highway patrol and operations in the corridor (King 2009).

OPPORTUNITIES TO FILL KNOWLEDGE GAPS

There is both ample need for new transportation finance mechanisms and much interest in finding such mechanisms. As transportation finance mechanisms are developed, tested, and applied, it will be important to capture and analyze the experience—both the actions themselves and their impacts—to inform future transportation finance decisions. Current knowledge about the equity implications of alternative transportation financing mechanisms is limited, as discussed earlier in this chapter. This section identifies opportunities to learn more about such equity impacts by documenting experience, extending the scope of analyses, and using improved data and analytical tools.

Learning from Experience

Schweitzer's (2009) review of the empirical research on equity implications of transportation user charges and taxes shows there to be very few comprehensive before-and-after studies that document the equity outcomes of road pricing. The studies that have been completed provide useful information about users, nonusers, operations, and revenues, as the analyses of the I-15 and 91 Express Lanes projects in California demonstrate (Sullivan 2000; Supernak et al. 2002). For example, data on traffic and traveler-related aspects of the I-15 project were used to explore ways of allowing the HOT lanes to carry more traffic during peak commuting periods while maintaining required levels of service (Supernak et al. 2003). Dynamic, traffic-sensitive pricing with solo drivers paying a per trip fee to use the lanes was found to result in better utilization than the original pricing strategy, whereby a limited number of solo drivers paid a flat monthly fee for unlimited use of the HOT lanes.

Weinstein and Sciara (2004, 9) emphasize the value of documentary evidence as a resource for others, noting that "what is learned from proj-

ect experiences before can point the way towards more equitable projects in the future." Further practical implementation of new finance mechanisms, perhaps through experimental programs or pilot projects, will provide an opportunity to add to the knowledge base on equity implications.

Equity Implications for the Freight Sector

Little is known about the equity impacts of evolving transportation mechanisms, such as road pricing, on workers and businesses in the freight sector. The trucking industry is far from homogeneous, comprising both owner–operators and large trucking companies, and there are many truck classes characterized by different weight and axle configurations. Road pricing is expected to have different impacts on different sectors of the trucking industry (Dornan 2008). In addition, if the costs to use priced roads are passed on to customers, the competitive balance between trucks and other modes might be shifted, with consequences for both the public and private sectors (see, for example, GAO 2011). Schweitzer (2009) observes, however, that empirical research on transportation finance equity has been almost exclusively focused on passenger travel, to the exclusion of freight. She notes that most equity concerns affecting low-income drivers also affect truck owner–operators, who depend on transportation for their livelihood, as well as small business owners who rely on shipping. Furthermore, existing research has tended to ignore improvements in service quality or differentiation resulting from finance changes and has largely failed to evaluate the distribution of external cost burdens. Both of these omissions are likely to be important in assessing equity impacts on individuals employed within the freight sector, on freight businesses, and on their customers (Schweitzer 2009).

Estimating Incidence

Understanding a policy's incidence is of central importance to equity analysis, but burden shifting has not been considered adequately in most studies of equity implications of transportation financing mechanisms, with the exception of the gas tax. Furthermore, most incidence analyses have focused on who pays taxes or fees, with relatively little

attention given to burdens resulting from a need to use less convenient transportation services (such as walking or taking public transit in place of driving) or, in a worst case scenario, from foregoing travel altogether. Future studies that consider burden shifting explicitly and do not limit their analysis to financial burdens alone should provide a more accurate picture of the equity implications of evolving transportation finance mechanisms.

More Accurate Descriptions of Travel Behavior

Changes in travel costs can affect the behavior of households and businesses in complex ways. In the case of households, for example, changes in travel behavior depend not only on income, but also on gender, age, employment status, infirmities or disabilities, and household responsibilities. Schweitzer (2009) observes that researchers have generally had to limit the strata by which they study the cost and benefit incidence of transportation finance strategies because of data limitations; identifying detailed incidence with statistical accuracy requires larger and more complex data sets than are typically available. Most of the studies discussed earlier in this chapter rely on empirical data taken from a variety of surveys and transportation databases. These data sources do not always capture the dynamics of household travel in response to changing prices and services—results that might shed light on equity issues. In the future, new data collection strategies may make this task easier. Recently, Peters and Gordon (2008) developed a more focused sampling approach when they used E-ZPass data from toll collections on the New Jersey Turnpike and the Garden State Parkway to investigate the equity burden of New Jersey road tolls.

More fine-grained data on travel behavior are needed to provide an improved basis for describing, understanding, and anticipating behavioral responses to evolving transportation finance mechanisms, including actual prices paid and services used. Furthermore, such microscopic, personal data about behaviors need to capture behavioral responses over time, as behaviors shift with circumstances and situations. Such data come primarily from surveys, and particularly from longitudinal panel surveys; however, surveys in general are becoming more difficult to conduct effectively, in part because of their high costs. It is particularly dif-

ficult to secure funding for surveys with a payoff that is primarily long term—for example, the aforementioned longitudinal panel surveys. In addition, the reluctance of a growing segment of the population to respond to surveys poses problems in obtaining satisfactory data. Personal Global Positioning System tracking systems can reduce the response burden for surveys of travel behavior, but these systems are presently more expensive than traditional surveys. In the future, applying the most effective data-gathering techniques will be necessary to build an objective basis for analyzing, forecasting, and evaluating the equity impacts of evolving transportation finance strategies.

Fine-grained freight data, analogous to the personal travel data already described, will also be needed to develop an understanding of equity impacts on the freight sector. Some useful data may be obtained from vehicle tracking information used to manage logistics operations.

Anticipating Equity Outcomes

Anticipating equity outcomes requires predicting how people will change their behavior in response to changes in prices, service levels, regulations, or other facets of transportation finance policies. Travel behavior models are used to predict such behavioral changes.

Predicting day-to-day variations in people's travel behavior in response to new taxing and pricing strategies, particularly dynamic strategies based on real-time measurement of roadway performance, requires sophisticated models. Such behavioral variations depend on how people value (travel) time, and value of time is of central importance in understanding the impacts of both variable road pricing and tolled roads. People's willingness to pay a road toll or fee to save time varies from person to person, and for the same person in different situations. For example, a low-income driver working two jobs may be willing to pay a high toll to avoid congestion and make a faster trip to get from one place of work to another on time; under less pressing circumstances, however, that same traveler may simply avoid the peak period or choose an unpriced (and more congested) roadway. All models currently implemented in the United States use a single value of time for each market segment (e.g., income group), however, which may be one reason behind the poor record of forecasting the use of toll roads and the resulting frequent

financial problems of toll-road operators (Flyvbjerg et al. 2003, 2005; Kriger et al. 2006).

Models also need to capture the possibility of drivers adjusting their departure times to optimize some combination of travel time and user fees, an adjustment that may, in turn, affect route or mode choices. Households may reallocate tasks among people within the household or among different time slots with resulting changes in time of day of travel, ridesharing, or trip chaining (i.e., combining several destinations in the form of successive one-way trips within a larger tour). Because these are primary responses to time-of-day pricing and may vary considerably across different types of households, they are important in equity analysis.

Advanced models that consider travel in terms of a tour (a journey from home to one or more activity locations and back home) are being developed and implemented in response to planners' needs for better forecasting tools in general (see, for example, Donnelly et al. 2010). These models offer the potential to forecast changes in travel behavior with enough sophistication to support equity analysis. In contrast, traditional travel behavior models often fail to account for some of the ways people modify their behavior in response to changes in transportation prices (including taxes) and services. As a result, traditional models, although widely used, are limited in their ability to predict the behavioral changes central to equity analyses.

To predict long-term impacts of policies, it is also necessary to anticipate location shifts and land use changes as travelers, shippers, and others adapt to changes in transportation facilities, services, and the way these are financed (priced). Because travel is an inherently spatial phenomenon and because geographic and return-to-source equity are so important in the policy process, anticipating the land use impacts of transportation decisions is a priority—and also a challenge. Realistic land use models are complex, and their data needs are demanding, but modeling tools to support comparison of the long-term spatial effects of different transportation financing options are important for equity analysis. Some such land use models are deployed or under development within a few of the larger metropolitan planning organizations and at least one state.

CHAPTER HIGHLIGHTS

- There is limited empirical evidence on the equity implications of evolving transportation finance policies, and even less evidence on the effectiveness of strategies for remedying inequities resulting from such policies.
- When it comes to assessing equity, the devil is in the details. The findings from empirical and theoretical studies of the equity of different transportation finance policies typically reflect different local conditions and policy details and are independent of differences in study methods, such as data quality or analytical procedures. The impacts of policy design, local conditions, revenue usage, potential remedies for inequities, and other specific details on different groups of people are critical in determining a policy's overall equity implications.
- The results of studies examining different road-pricing variants (e.g., HOT lanes, cordon tolls, and VMT fees) do not show any clear trends about the fairness (or unfairness) of such policies, in part because policy details vary from place to place. In addition, very few studies have examined the full range of costs and benefits associated with a policy, so the findings from a single study often provide a narrow perspective rather than an overall equity assessment.
- If cost burdens alone are considered, most, if not all, forms of road financing are regressive to some extent (i.e., they put a disproportionately large financial burden on lower income people). To make informed decisions about finance policies, however, it is necessary to go beyond the cost burdens alone and to address the policy's benefits—for example, faster travel times, cleaner air, and safer roads as the result of congestion pricing. A policy's benefits, generated through the effective use of revenues to address the transportation needs of communities, can counterbalance some or all of its inequities.
- The most commonly used strategy for offsetting inequities in the financial burden of a transportation policy is improving public transportation—at least in the relatively few instances where any remedy at all has been implemented. Providing more and better public transportation may help offset some of the inequities associated with highway financing but is not a consistently effective remedy, especially for low-income motorists who have no realistic alternatives to making

particular journeys by car. Whether improved transit services are a viable alternative to driving depends on the details of the services provided, the populations served, the geographic distribution of jobs and residences, and other local conditions.

- Strategies for remediating inequities associated with a transportation finance policy can be difficult to implement and maintain because of other demands on the revenues generated. One possible approach to ensuring at least some form of remediation is to mandate that some portion of the revenues be set aside for remedies in the affected markets.
- Engaging all stakeholders in participatory decision making about transportation programs and projects can help identify inequities and target remedies to the needs of adversely affected communities or groups. Such an approach also helps ensure that affected groups are part of the problem-solving process.
- Documenting practical experience with evolving transportation finance mechanisms, including information pertaining to equity, can provide robust empirical evidence with which to inform future decisions about the use of such mechanisms. Comprehensive studies that record travel behaviors both before and after a mechanism has been implemented form a particularly valuable basis for equity analyses. Including information about the freight sector in such studies could help fill the current knowledge gaps in this area.
- The design and evaluation of evolving finance mechanisms require both data and predictive power that generally exceed typical current capabilities. To improve equity analyses in the future, special efforts will be needed to gather data at the required level of detail and to develop models capable of predicting and analyzing travelers' complex behavioral responses to evolving finance policies.

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NSTPRSC	National Surface Transportation Policy and Revenue Study Commission

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5

Equity and Decision Making

Experience with Road Pricing

In communicating with the public, decision makers often focus on whether the end results of the transportation projects they decide to fund are fair, particularly from a geographic perspective. The equity implications of the project financing mechanisms themselves, which are often complex, have attracted relatively little public scrutiny; however, the possibility of a major shift in the ways that revenues are collected for transportation has focused attention on who pays for and who benefits from transportation, particularly in the case of road pricing. Politicians, the public, and transportation experts have all raised questions about the possible equity implications of road pricing, with the impact of road tolls or fees on low-income motorists attracting particular concern.

This chapter discusses the ways in which equity has entered into debates over road pricing, noting the decisive role of public opinion about equity in determining the success or failure of road-pricing proposals. The measurement of public opinion about evolving transportation finance mechanisms is discussed, and the results of an analysis of public opinion surveys on the acceptability of road pricing are presented. The final section of the chapter discusses lessons learned about the role of equity in efforts to implement road pricing in the United States and overseas and identifies four strategies that decision makers may find useful when addressing equity concerns with their constituents and other stakeholders.

EQUITY IN DEBATES OVER ROAD PRICING

Geographic Equity Predominates

As discussed in Chapter 3, transportation equity debates are often first and foremost about geography, with elected officials keen to demonstrate

that their policies are bringing resources and other benefits to their constituents. Moreover, geographic equity has a strong statutory basis. The 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) focuses exclusively on geographic equity in specifying the percentages of federal highway aid apportionments to be received by states (Altshuler 2010), and those apportionments are a major source of the revenue used by states to fund highway needs. In the case of transit, federal resources are distributed by urbanized area, that is, on a geographic basis. Many states have adopted formulas based on geography for distribution of transportation funds. California, for example, has guaranteed county shares for highway funds for 58 counties, and there is a strong return-to-source bias in the state's Transportation Development Act program for public transit.

For politicians and other decision makers, one of the first hurdles to overcome in embarking on a new transportation program or project is to gain public support, and voters care primarily about what affects them, be it their neighborhood, their travel corridor, or their region. In addition, because states are the major funders of many transportation projects, decision makers go to considerable lengths when preparing their transportation capital programs and budgets to ensure that resources are distributed around the state in a way that is widely perceived as fair. In the case of major projects—the construction of a new road or transit line, for example—resource limitations generally mean that each region or area must wait its turn for state or federal funds. In any given year, the state's transportation budget may appear to favor one or two areas of the state over others because of investments in major projects, but over time, decision makers may have the opportunity to distribute major projects among different regions and to avoid unduly favoring one area over another. Nonetheless, the basis of geographic fairness—per capita, per voter, per jurisdiction, per mile of roadway, or per square mile—can itself be the subject of considerable debate, and states typically use a number of factors in addition to population in deciding how to distribute transportation funds (Dempsey et al. 2000).

The focus on geographic equity is closely tied to the U.S. system of government, with elected officials representing jurisdictions organized on a geographic basis. Consequently, this focus is unlikely to be supplanted by

other equity concerns when the implementation of road pricing is considered. Nonetheless, some observers have suggested that the concept of geographic equity is incompatible with asymmetric patterns of transportation use and that most of the resources should go to regions with the most people and goods requiring transportation. For example, an urban area encompassing a transportation hub would, under this approach, receive a greater share of funding than a rural area with a low population density.

The question of what constitutes fair use of road-pricing revenues from a geographic perspective is far from settled, as noted in Chapter 3. In some places, the revenues are reserved for the tolled facility, in others they contribute to highway revenues more broadly, and in still others, some portion is dedicated to financing adjacent transit service to provide an alternative to driving and paying tolls. Still others argue that earmarking revenues to the jurisdictions through which tolled facilities run would be a fair and efficient way to distribute the revenues (King et al. 2007).

As already noted, however, many of the questions about the fairness of road pricing concern income equity. For example, in a survey of newspaper articles discussing the fairness of a high-occupancy toll (HOT) lane project, Weinstein and Sciara (2004) note that fairness was defined with reference to income and the corresponding ability to pay HOT lane fees. The most commonly raised concern was that low-income groups would be unable to afford to use the facilities and that HOT lanes would, therefore, disproportionately benefit high-income drivers.

In a similar vein, the report of the National Surface Transportation Infrastructure Financing Commission discusses the impacts of comprehensive road pricing based on vehicle miles traveled (VMT) on different income groups under different implementation scenarios (NSTIFC 2009). According to the commission, a VMT pricing system implemented so as to increase total transportation revenues would likely have a greater impact on those with lower incomes (i.e., would be regressive). Given that a VMT pricing system would complement or replace revenue instruments that are also regressive, however, the shift would likely have a minimal effect on income-based equity. Notwithstanding, "the increased transparency of costs associated with road pricing could lead those who are more price-sensitive (particularly lower income individuals) to perceive a higher cost and to travel less" (NSTIFC 2009, 146).

The Importance of Perception

The example of possible reactions to a VMT pricing system highlights the importance of perception in determining people's views about the fairness of transportation finance policies. Behavioral economists have documented the status quo bias effect, whereby people often strongly favor the current situation (in this case, current transportation finance policies) over potential alternatives (such as road pricing) without considering the relative merits of current and alternative options (see, for example, Samuelson and Zeckhauser 1988). Furthermore, loss aversion motivates interest groups to fear potential losses under a new financing regime, and therefore to argue against losses (real or perceived) vis-à-vis the status quo as unfair (Kahneman et al. 1991). For example, Weinstein and Sciara (2004) cite the response of Staten Island motorists to changes in bridge and tunnel tolls introduced by the Port Authority of New York and New Jersey in 2001. These motorists protested the revised tolls, arguing that their island geography and limited transit service made them more car-dependent than peer communities in the region. As a result, the Port Authority retained the original toll structure for Staten Island motorists, who ended up paying a higher average toll than they would have done under the new toll structure. According to a Port Authority official, however, Staten Island drivers appreciated the fact that their wishes had been respected and, in the official's view, they perceived the outcome as fair.

As later sections of this chapter illustrate, popular and political views about transportation finance equity are often influenced more by perceptions than by empirical evidence about the equity of different finance policies. Nonetheless, as noted by one of the participants in the committee's September 2009 symposium, perceptions of equity constitute the reality that politicians have to address.

Road Pricing Often Perceived as Unfair

The idea of road pricing is unpopular with many decision makers and members of the public, in part because it is perceived as unfair (Taylor and Kalauskas 2010). May and Sumalee (2003, 87) make a similar observation in their overview of road-pricing applications outside the United

States: where road-pricing proposals fail, one of the major barriers to implementation is "lack of political commitment reinforced by limited public acceptance and concerns about equity." Many road-pricing proposals have fallen victim to political objections, and even proposals that have ultimately been implemented have met with considerable opposition from elected officials, the media, and the general public at one or more stages in the planning and approval process because of concerns about fairness.

HOT lanes and cordon tolls in particular have been scrutinized intently on equity grounds (Taylor and Kalauskas 2010). Despite evidence that HOT lanes are not as regressive as the moniker "Lexus lane" suggests (Schweitzer 2009), some media reports continue to foster the image of rich solo drivers roaring past traffic snarled in the congested free lanes (see, for example, Weinstein and Sciara 2004, Appendix C). Cordon tolls such as those implemented in London and Stockholm, Sweden, and proposed for New York City have been characterized as unfair because they impose a fee on something that was previously free, charge residents to travel to and from home, disproportionately tax commuters to reduce traffic in inherently congested central districts, and, unlike HOT lanes, do not offer drivers a free but more congested alternative (Taylor and Kalauskas 2010). These examples illustrate the importance of self-interest in people's assessment of what is fair. "How will it affect me?" and "How much will I have to pay?" are key questions in determining the response to any new tax or fee, particularly one that differs radically from the status quo. In this context, Schaller (2009) observes that supporters of New York City's congestion pricing proposal generally emphasized the anticipated societal benefits, with related individual-level benefits being of secondary importance, whereas opponents of the proposal focused primarily on individual-level impacts on drivers.

Differences in Popular and Expert Perspectives

In early 2009, Massachusetts Governor Deval Patrick proposed raising the state gas tax by 19 cents, to 42.5 cents per gallon, to raise approximately $500 million a year in transportation revenue that would otherwise have to come from raising highway tolls; however, this proposal was defeated by the state legislature, which instead raised the sales tax by 1.25 percentage points. According to reported estimates, this sales tax increase will

generate $900 million annually in state revenue, of which $275 million will be allocated for transportation projects (Altshuler 2010).

Massachusetts is not the only jurisdiction to have resorted to an increase in sales taxes—as opposed to an increase in user fees such as the gas tax—to fund transportation. Wachs (2003) and Schweitzer and Taylor (2008) report a growing use of local option transportation taxes since the 1990s to make up shortfalls in transportation revenues, with local sales taxes being particularly popular. Altshuler (2010) and Wachs (2003) both suggest reasons behind the popularity of sales taxes, noting that small rate increases in the sales tax can raise as much revenue as far larger, and therefore more visible, increases in fuel taxes. According to Wachs, one county in California estimated that a 1 percent countywide sales tax increase would produce as much added revenue for transportation as would a motor fuel tax increase of 16 cents per gallon. In addition, sales tax increases can be structured to support multiple services and thus attract constituencies beyond transportation, and they may help solve perceived problems of geographic equity. Sales taxes are administered at the state, regional, and sometimes local levels where, by definition, the funds stay with local projects.

When it comes to fairness, however, many analysts agree that the use of sales taxes to fund transportation is less equitable than the gas tax or other user fees on the basis of several equity criteria, including benefits received and costs imposed (see, for example, Weinstein et al. 2006). While all of these revenue instruments are income regressive, user fees impose the costs of building and maintaining the facilities directly on travelers and system users, who are the primary beneficiaries. In contrast, sales taxes are paid by users and nonusers of the transportation system alike and, furthermore, make no distinction between occasional and heavy users. To quote Wachs (2009, 7): "In contrast to the 'drive less, pay less' fuel tax user fee, sales taxes charge light or occasional users of the transportation system far more per mile traveled, while frequent heavy users of the transportation system tend to pay far less for each mile of travel." In addition, using sales taxes for transportation may divert revenues from essential services for which user fees are unavailable or undesirable, such as schools and libraries (Wachs 2003).

In one of the few detailed quantitative comparisons of different transportation finance mechanisms, Schweitzer and Taylor (2008) compare

the effects of congestion pricing and transportation sales taxes on low-income households in Southern California. For the specific HOT system examined, the authors conclude that, had the facility been financed by a local-option transportation sales tax, the cost of the sales tax to each family would have been comparatively small. The burden associated with a shift from tolls to sales taxes would, however, be regressive for all but the highest income groups; the poorest households, in particular, would see the largest proportional increase in burden with a shift from congestion tolls to sales tax finance. In addition, when sales taxes are spent on transportation projects that benefit users of an improved facility, cost burdens are redistributed from users to nonusers; that is, resources are transferred from lower income households, which tend to use the facility less, to those with higher incomes, who tend to use it more. In contrast, the costs of HOT lanes fall on users in proportion to their benefits received, and these users come predominantly from middle- and upper-middle income households.

As the preceding paragraphs illustrate, politicians and voters have been moving toward reliance on sources of transportation revenue that bear little or no relation to use. Sales taxes have proven popular, but by severing the user-pays link, they are less equitable than direct user pricing on the basis of the benefits-received and costs-imposed concepts described in Chapter 3. Thus, in contrast to politicians and voters, many transportation experts increasingly favor direct user pricing as inherently fairer (and more efficient) than the current system. For example, following a discussion of ways of financing transportation infrastructure in California, Wachs (2009) concludes that direct charges, levied at the time and place roads are used by means of electronic collection systems, are fairer than sales taxes and also offer the greatest promise in the longer term for both congestion management and revenue generation.

THE ROLE OF PUBLIC OPINION

Public support for or opposition to transportation proposals can have an important influence on policy makers' priorities and actions, as the example of the proposed Massachusetts gas tax increase illustrates. As the preceding discussion notes, fairness is subjective, so both measuring and

shaping public opinion are important parts of the transportation planning process if equity is to be addressed seriously.

Measuring Public Opinion

Public opinion measured in accordance with rigorous survey methods designed to ensure accurate results can inform decision making in ways that self-selecting channels (e.g., letters, newspaper editorials, blogs) cannot. For example, careful surveys can report accurately on people's views about proposed methods of funding transportation—what they know or want to know, whether they approve or disapprove, the reasons for their positions, and how strongly they hold their views. Such surveys can also identify the conditions under which a novel finance mechanism will find more or less public acceptance; and they can test whether opinions are changing over time and give meaningful clues about the likely level of public acceptance of a proposed plan, program, or process.

Discussion of the many factors affecting the quality and associated reliability of public opinion surveys is provided in a number of expert texts (see, for example, Babbie 2010; Converse and Presser 1993; Dillman 2000; Groves et al. 2009). Claims that survey results reflect public opinion are frequently unsupported, and it is generally difficult for those who are not experts in survey methodology to distinguish reliable measurements of public opinion from inferior (biased or unrepresentative) products. The following discussion highlights some of the pitfalls that may prevent a survey or poll from capturing accurately the opinions of the target population about evolving transportation finance mechanisms.

Public opinion surveys target a sample of citizens via a written questionnaire or through interviews conducted in person, by telephone, or by electronic media (e.g., the Web). For a survey to yield valid results, the sample of citizens needs to be representative of the larger population of interest, such as voters or users of a transportation facility or service. To this end, the sample needs to be probability based, which means that all respondents in the target group, including special populations (e.g., low- or high-income households, persons with disabilities), have an equal chance of participating. Nonprobability samples, such as "opt-in" surveys on the Web in which respondents select themselves based on their interest in the topic or a desire to earn money or prizes, do not yield valid (i.e.,

representative) results (Yeager et al. 2009). In addition, the size of the survey sample should be sufficiently large to allow for reliable estimates of key population segments, such as minorities or users of a transportation service.[1] And when the survey results are reported, the target or sampled group needs to be identified so the source of the survey results is known.

If a survey is to provide accurate insights into public opinion, the questions need to be carefully crafted and pretested to ensure that they elicit valid opinions. For example, researchers seeking to measure public acceptance of an issue may ask a variety of questions. Some ask respondents if they "support or oppose" a proposed mechanism (Dill and Weinstein 2007; Harrington et al. 2001); others ask if they think it is a "good or bad idea" (Verhoef et al. 1997), whether they have a "positive or negative" opinion about it (Odeck and Kjerkreit 2010), "accept or reject" it (Schade and Schlag 2003), or are "willing to vote for or against" it (Fujii et al. 2004). The researchers' goal is often to predict behavior—for example, whether people will protest a proposed funding approach for a transportation project or vote for or against it. Therefore, questions that ask for a decision such as support or opposition or a vote for or against are preferred to those that elicit general views such as being a good or bad idea. It is also possible to create questions that mislead respondents into giving a particular preferred answer, as in the case of "push polls." Designed to shape, rather than measure, public opinion, these polls include questions that plant information, and often disinformation, about a candidate or issue in the minds of those being surveyed. As this brief discussion illustrates, it is important to know what questions were asked and how they were stated when interpreting results of public opinion surveys.

In the case of surveys to assess public opinion about evolving transportation finance mechanisms, the proposed funding approach may well be new to the respondent, thereby placing a special burden on the researcher conducting the survey to communicate effectively how the mechanism will work, what it will accomplish, and how it will be paid for. Zmud and Arce (2008), in a synthesis of public opinion data on tolls and road pricing, found that the more specific the description of the mechanism in laying out

[1] For some population segments (e.g., low-income households and persons with disabilities) surveys may need to be supplemented by other qualitative research methods, such as focus groups, to obtain reliable information.

the benefits and costs, the greater the support. In particular, support was higher for a particular financing option when its benefits were described as part of the survey question; for example, "Would you support congestion pricing if the money were used to prevent an increase in mass transit fares and bridge and tunnel tolls?"

Higgins (1997) reached this same conclusion in his review of survey data on congestion pricing. He points out that when congestion pricing is described simply as a way to reduce congestion, with no other information provided, support is low; however, support increases when the mechanism is described as providing specific, rather than general, transportation benefits. A survey conducted in Seattle, Washington, for King County Transportation (EMC Research, Inc. 2007) provides an interesting example. A series of questions that conveyed a great deal of information about the need to replace the State Route 520 bridge and make other improvements preceded the following final question:

> Given what you have just heard, would you [support or oppose] a variable toll of one to seven dollars on the 520 and I-90 floating bridges to pay for replacement of the 520 bridge, maintenance on I-90, increased transit and bike investments, and new technology to improve traffic flow? The toll schedule would be fixed with higher tolls during peak times and lower tolls during off-peak times.

Thirty-five percent of respondents "strongly supported" and 33 percent "somewhat supported" this proposal.

Thus, the results of public opinion surveys about new or complex transportation finance mechanisms can depend on the extent to which the survey educates respondents. A survey that provides detailed and specific information about the benefits and costs of the mechanisms may well yield different results from a survey that does not provide such information.

Public Opinion About Transportation Finance Equity: Evidence and Experience

To date, scientific public opinion research has not played a prominent role in identifying public concerns about the fairness of evolving transportation finance mechanisms. Occasionally, however, survey respondents have been asked whether a certain finance mechanism is "fair," either in general

or to a particular segment of the population. Income is the equity dimension that has been addressed the most often in the peer-reviewed survey literature on the acceptability of transportation finance mechanisms.

Sometimes transportation policy makers and planners simply assume that certain disadvantaged groups will be more likely than others to oppose a proposed finance mechanism. For example, some have suggested that people with higher income are more likely than those with lower income to accept certain evolving finance mechanisms, because members of the latter group have less disposable income and would be more adversely affected than those in higher income brackets (see, for example, Giuliano 1994; Rienstra et al. 1999). To test the validity of this suggestion, Mitchell (2009; personal communication 2010) reviewed published studies with samples of at least 200 respondents that used (*a*) public opinion surveys to measure the acceptability of one or more evolving finance mechanisms, and (*b*) multivariate analysis to determine which variables—particularly the socioeconomic characteristics of respondents—predict acceptance. He identified 12 studies that met these criteria and that were conducted in eight countries and published between 1997 and 2010 (see Table 5-1). Most of these studies were conducted for government organizations interested in implementing evolving transportation finance mechanisms. The studies, which examined 21 instances of evolving finance mechanisms, were conducted by university researchers, and all used statistical models that assessed the role of different factors—including income—in acceptance while taking other variables into account.

The central finding of Mitchell's examination was that income is not a good predictor of people's views about evolving transportation finance mechanisms; only two of the 21 cases studied (Verhoef et al. 1997; Odeck and Kjerkreit 2010) showed statistically significant correlations between low income and opposition to pricing or tolling.[2] None of the four American studies found such income effects. For example Harrington et al. (2001) conducted a telephone survey of Southern California freeway users in 1997 to test their reaction to four pricing mechanisms involving congestion

[2] Jakobsson et al. (2000) reported an income effect, but the effect disappeared when they reanalyzed the same Swedish data using a more appropriate statistical test (Fujii et al. 2004).

TABLE 5-1 Multivariate Studies on Acceptability of Evolving Finance Mechanisms

Study	Location (target population)	Finance Mechanism
Verhoef et al. 1997	Randstad area, Netherlands (drivers)	Road (congestion) pricing
Odeck and Brathen 1997	Oslo, Norway (users)	Road tolls
Jakobsson et al. 2000	Goteborg, Sweden (drivers)	Road pricing at various price points
Harrington et al. 2001; Krupnik et al. 2001	Southern California (residents)	• Base plan: congestion VMT on all freeways, with specified congestion improvements • VMT with tax rebates • VMT with coupon rebates • HOT lanes
Bamberg and Rolle 2003	Reutlingen, Germany (residents)	Higher fuel price with decrease in public transportation prices
Schade and Schlag 2003	Athens, Greece; Como, Italy; Dresden, Germany; Oslo, Norway (drivers)	Cordon pricing packages with detailed mitigation strategies
Jaensirisak et al. 2005	Leeds and London, England (residents)	Fixed charge 7 a.m. to 7 p.m. with revenue allocated to public transport improvements and tax reductions
Podgorski and Kockelman 2006	Texas (residents)	• Tolling existing roads • Tolling new roads • Public–private partnerships • HOT lanes • Exclusive use of toll tags
Dill and Weinstein 2007	California (residents)	Registration fee varied by emissions and gas mileage
Schuitema et al. 2008	Netherlands (drivers)	Four variations of a VMT, all with compensation measures
Odeck and Kjerkreit 2010	Norway (users: cars, vans, trucks)	Road tolls

NOTE: The two Norwegian studies listed (Odeck and Brathen 1997; Odeck and Kjerkreit 2010) address toll policies implemented to supplement government funding for road infrastructure rather than to manage congestion. The tolls are flat-rate and are levied 24 hours a day. Such tolling has been used in Norway for more than 100 years and thus is not an evolving mechanism from a Norwegian perspective. The evidence presented on users' attitudes toward road pricing is nonetheless useful in the context of evolving finance mechanisms in the United States.

fees and HOT lane creation. Contrary to the researchers' expectations, income was not a positive predictor of support for the mechanisms in any of their analyses. In fact, lower income respondents were slightly more, rather than less, in favor of congestion fees and HOT lanes, as were Hispanics and Asians.

Additional support for Mitchell's findings comes from a study of 3,520 California residents using two related telephone surveys (Dill and Weinstein 2007). The large sample includes interviews conducted both in English and in Spanish. This comprehensive study measured acceptance levels for a total of 13 new taxes, fees, and tolls, of which seven may be considered emerging measures. Only one of these seven mechanisms—a new registration fee the amount of which would vary by a car's pollution emissions and gas mileage—was included in a multivariate statistical model and therefore qualified for Mitchell's review;[3] Dill and Weinstein (2007) found no income effect. Dill and Weinstein also provided a breakdown by income group for the other six financing options, which ranged from HOT lanes to a mileage fee. The pattern of responses did not show an income effect; respondents in lower income groups (those with a household income of $50,000 or less[4]) were typically a little more, rather than less, in favor of these financing approaches than the average respondent.

These findings are consistent with reports in the non–peer-reviewed literature. The California I-15 Congestion Pricing project near San Diego encouraged feedback from the low-income and minority segments of the affected public, yet despite announcements in the media, all the open meetings were poorly attended, which possibly suggests that the project was not perceived as egregiously unfair to any of these groups (Supernak 2005). The Federal Highway Administration's value pricing website provides an overview of experience related to low-income equity concerns associated with road-pricing initiatives in the United States.[5] In Miami, Florida, in 2005, focus groups revealed that perceptions of the benefits of managed lanes do not divide along any clear demographic boundary,

[3] Multivariate models for an increase in the registration fee and an increase in the gas tax were considered conventional rather than evolving mechanisms and were excluded from Mitchell's analysis.

[4] Research is needed to examine the effect of lower income levels on evolving finance mechanisms.

[5] http://www.ops.fhwa.dot.gov/tolling_pricing/value_pricing.

including ethnicity and income. In Minneapolis–St. Paul, Minnesota, a 2006 attitudinal survey found support for the HOT lanes to be comparable across income groups, although usage was lower for members of low-income groups than for members of other income groups. In San Francisco, California, a 2007 survey of residents indicated that support for congestion pricing was slightly higher among very-low-income and low-income residents than among other residents.

Why do these findings appear to contradict conventional economic predictions that lower income respondents will oppose the price increases associated with emerging mechanisms because they are regressive? There are several possible explanations. One is that lower income support for particular measures may stem from a different kind of rational calculus. For example, studies of congestion pricing conducted in California, Minnesota, and Texas, which showed that a wide range of income groups used the value-priced lanes at different levels of frequency, suggest that the (in)flexibility of users' schedules and route availability, rather than income, were the significant predictors of use (see Chapter 4). Another possibility, discussed elsewhere in this report, is that low-income travelers may be more likely to shift or reduce the burden of road pricing by some means—for example, by using public transit or carpooling on a regular basis. Also, the description of the emerging mechanisms in these studies may be especially informative about their context and purpose, giving them a broader appeal as compared with short descriptions of conventional mechanisms such as a flat toll or an increase in auto registration fees to raise revenue for unspecified purposes. Finally, a number of the emerging mechanisms described in these studies present compensatory measures designed to mitigate adverse effects on lower income respondents.

The findings of Mitchell (2009) and others illustrate the difficulty of anticipating how people will react to a new transportation finance policy and emphasize the need for empirical testing of expectations about resistance from presumed losers in such situations. If pilot tests are not an option, the best way to test the likely reaction of an affected group to the proposed use of an evolving finance mechanism a priori is to use a scientific survey to compare the acceptance level of the affected group with the acceptance level of other relevant groups.

LESSONS LEARNED FROM REAL-LIFE EXPERIENCE

> Almost any question about congestion pricing (Is it fair? Is it politically feasible?) can be answered with: It depends on how you spend the money. (Frick et al. 1996, 36)

This comment, made in a report on lessons learned in attempting to implement a congestion pricing strategy for the San Francisco–Oakland Bay Bridge in the early 1990s, illustrates how difficult it can be for politicians and other decision makers to assess the likely equity implications of a proposed transportation program or project and its financing. Moreover, experience has shown the local and political institutional context to be important in shaping debates about transportation projects and funding (Taylor and Kalauskas 2010). Details of the equity discussion are likely to differ from one jurisdiction to another as well as over time, with certain issues rising to the fore during election campaigns or in response to national policy debates. As a result, not all the lessons learned from individual road-pricing projects are directly relevant to other such projects. Nonetheless, many elected officials and other decision makers are interested in finding out how others addressed road pricing with their constituents and stakeholders and in applying the lessons learned in their own jurisdictions. Accordingly, lessons about how to communicate new transportation finance policies, notably road pricing, to the public can be particularly valuable, even if the details of the practical implementation differ from one jurisdiction to another. This section discusses some of those experiences and what has been learned from them.

New York City Congestion Pricing Proposal

One case that has attracted considerable attention is the New York City congestion pricing proposal (see Box 5-1). This proposal involved a cordon toll with no free alternatives for most drivers, as opposed to the more common and less comprehensive HOT lanes that offer drivers parallel, but slower, toll-free alternatives. As the key points in Box 5-1 illustrate, many of the questions about who pays, how the money is spent, and who benefits are centered on geographic equity, with groups in different locations within New York City and the surrounding areas claiming that they

BOX 5-1

New York City Congestion Pricing Proposal

In 2007, New York City Mayor Michael R. Bloomberg proposed a congestion pricing strategy for charging vehicles traveling in the core of Manhattan. Despite widespread support from groups throughout the city, a variety of concerns—including possible inequities—resulted in political gridlock, and the proposal was not implemented. Reports on the failed proposal by Schaller (2009) and Taylor (2010) indicate that key opposing arguments focused on concerns about geographic inequities, even though proponents of the proposal argued that it would be more equitable than the current system. The following highlights from the reports by Schaller and Taylor illustrate some of the ways in which equity entered into the debate over the New York City proposal.

- Support for the proposal was strongest in Manhattan, the least auto-dependent of the five boroughs and the one that would benefit from reduced traffic and expanded bus service. The most vocal opposition came from elected officials and civic groups in boroughs outside of Manhattan who currently enjoy toll-free automotive access via bridges into Manhattan.
- Opposition to the proposal was particularly strong in eastern Queens and southern Brooklyn—neighborhoods that are more auto-dependent than neighborhoods closer to Manhattan and that have the "least rapid or convenient transit access to Manhattan jobs" (Schaller 2009, 6).
- Under the proposal, commuters from New Jersey would have their tolls on the Hudson River bridges offset against the congestion fee, whereas commuters from Queens, Brooklyn, and the Bronx using the free East River bridges would pay the congestion fee in full. As a result, the latter group felt that they were being unfairly singled out. Some residents of Brooklyn

(continued on next page)

BOX 5-1 *(continued)*
New York City Congestion Pricing Proposal

claimed that they would be geographically isolated because commuters driving through Manhattan to New Jersey would be forced to pay a toll to cross Manhattan.

- Concerns about the burden of the congestion fee on low-income households were raised by poverty advocates, by elected officials representing low-income districts, and by a number of politicians representing wealthy suburban districts.
- Proponents claimed that the proposal represented a more equitable distribution of burden than the current system, because the revenue collected from drivers would be used to fund transit improvements benefiting the residents of New York City.

would be unfairly affected by the proposed strategy. Economic fairness was also an issue, with some opponents claiming that implementation of the proposal would impose an unfair burden on low-income families.

The New York City experience shows that concerns about who pays and which areas might be negatively affected can be "multifaceted and murky" (Taylor 2010, p. 43). For example, the likely air quality impacts on low-income residents living in areas outside of the priced zone were a subject of disagreement between opponents and proponents of the proposal. Opponents claimed that some of the city's poorest neighborhoods bordering the priced zone would be transformed into parking lots for those driving in from outlying areas, as a result of which the promised improvement in local air quality would not materialize. In contrast, proponents thought reduced traffic from outlying suburbs en route to the central business district would result in improved air quality and public health for lower income residents.

Observers have suggested that there may be a tactical (or political), motivation behind some claims of inequity, with critics seeking primarily to build a coalition to block a distasteful proposal rather than expressing sincere concerns about its fairness. In discussing the New York City

congestion pricing proposal, Taylor (2010) suggests that some concerns about the burden of the congestion fee on low-income groups may have been largely tactical, citing one city councilwoman who questioned the sincerity of elected officials from suburban communities who claimed to be concerned about the impact of congestion tolls on lower income residents. In the same vein, Wachs (1994) notes that concern over the plight of the poor under various pricing proposals is frequently made by self-interested parties (e.g., trucking, auto clubs) who "seem to have little concern over the well-being of the poor or of working women when considering other policy initiatives, such as sales tax increases to support the expansion of rail lines" (as cited by Taylor 2010, 12). Nonetheless, while some people may feign concern about the poor while opposing road pricing on other grounds, the concerns expressed about the poor may in fact be justified.

Guidance for Addressing Equity Concerns

A number of authors have examined the lessons learned from efforts to implement road pricing in the United States and overseas and have used these lessons to develop guidance about ways to address equity concerns in transportation projects involving road pricing (see, for example, Schaller 2009; Taylor and Kalauskas 2010; Weinstein and Sciara 2004). This guidance highlights the value of documenting equity outcomes of road pricing to provide a resource for others.

From the analyses of road-pricing proposals and projects, four tactics emerge as particularly useful for addressing equity concerns:

- Determining where and how revenues are used,
- Incorporating equity analysis into project planning,
- Demonstrating benefits through experimental programs and pilot strategies, and
- Using a variety of public outreach and educational tools.

The following discussion of these four approaches is intended to help decision makers assess and address equity issues arising in debates over road pricing. The intent is not to advocate for the adoption of road pricing, but rather to encourage informed and constructive discussion of equity issues among public officials and their constituents and stakeholders.

Use of Revenues

Taylor and Kalauskas (2010) observe that the use of toll revenues is likely to have a profound effect on both the actual and perceived equity of a road-pricing project. Weinstein and Sciara (2004, 13) echo this observation for the specific case of HOT lanes, noting that the way revenues are spent can "greatly affect whether people believe the project is fair or not."

Both of the aforementioned sets of authors emphasize the importance of returning revenues to the tolled corridor or geographic area to assuage public concerns about geographic inequities. In the context of Minnesota's I-394 MnPass system, for example, Weinstein and Sciara (2004, 13) quote a policy advisor's observation that "when you tell people that the money goes back into the corridor, people are satisfied." Greater London Mayor Ken Livingstone, advocating in favor of his congestion pricing proposal, emphasized that his plan would improve bus operations by reducing congestion and also generate substantial net revenue for other transportation improvements in central London (Altshuler 2010). King et al. (2007) make a similar point, arguing that revenues from road-pricing projects should be dedicated primarily to the communities through which priced highways run, because these communities bear the brunt of the traffic, noise, and pollution generated by congested roads. This approach does not necessarily mean returning the benefit of the tolls to those who pay them, but rather delivering a geographically specific benefit to build a constituency for the pricing strategy.

In a situation where revenues are returned to the tolled corridor or geographic area in the form of area transportation projects, the division of these revenues between highway and transit projects may well be an issue for further debate because of concerns about modal inequities. For example, Taylor (2010) cites the cases of Stockholm and New York City, where initial transit funding proposals were downsized and funds shifted to road improvements in response to complaints that funding transit alone was unfair to drivers and their passengers. On the other hand, dedicating toll revenues to transit has frequently proven a good strategy for assuaging equity concerns. Schaller (2009) notes that the support of New York City residents for the congestion pricing proposal was contingent on the revenues being used for expanded transit service and cites concerns among residents in parts of Queens, Brooklyn, and

the Bronx that revenues might not be spent effectively on transit service improvements.

The observations outlined above are consistent with the results of a synthesis of public opinion data on tolls and road pricing (Zmud and Arce 2008) that identified a number of factors—including the use of revenues—that affect public acceptance of these finance mechanisms. In particular, support was found to be higher when revenues went toward improved transit or stayed in the locality.

In discussing ways of addressing equity concerns over HOT lanes, Weinstein and Sciara (2004) mention the possibility of using revenues to provide compensation to those who cannot afford tolls, perhaps in the form of alternative benefits. In practice, however, funding issues often limit opportunities to implement remediation strategies, as noted in the discussion of remedying inequities in Chapter 4.

Equity Analysis in Project Planning

Taylor and Kalauskas (2010) emphasize the value of addressing equity explicitly at the outset of a project and of conducting analyses and forecasts that can provide information needed to answer specific questions about who will pay and who will benefit. Considering equity early in the project planning process increases transparency, encourages planners to address equity concerns, and also allows time to modify project designs in response to equity concerns raised during public debate over the proposals.

Weinstein and Sciara (2004) also note the importance of analysis for assessing the fairness of HOT lane proposals. They observe that useful information may be obtained by analyzing the demographic characteristics of both those living and working in the candidate corridor and potential users of the proposed HOT lane and then conducting attitudinal surveys and focus groups with members of these populations to ascertain people's perceptions of HOT lanes and their willingness to use them.

Experimental Programs and Pilot Strategies

In discussing the lessons learned from New York City's failed cordon pricing proposal, Schaller (2009) emphasized the importance of demonstrating the promised benefits of pricing projects through experimental programs and pilot strategies and also noted that experience counts

more heavily than analysis or plans when members of the public come to assess the fairness of a project.

Analyses of the Stockholm and London cordon pricing strategies confirm that experience can indeed help build support for these projects. The Stockholm cordon pricing system was adopted permanently only after a 6-month trial had demonstrated the benefits and allowed for a series of modifications to address equity concerns (Taylor 2010). As Taylor notes (2010, 21), the pilot test allowed the residents of Stockholm "to see first-hand the dramatic congestion reductions of the pricing program and allow[ed] planners to adjust the program to address equity concerns that arose during the test."

Similarly, in the case of the central London congestion charging strategy, both press coverage and the balance of local opinion shifted in favor of the strategy after its implementation in February 2003. Congestion was reduced and buses moved faster and more reliably, and a July 2003 poll of London residents reported 63 percent viewing the system favorably in general and 66 percent rating it fair (Altshuler 2010). Nonetheless, the success of the initial London congestion charging strategy did not translate into easy expansion or replication, and the process of removing the Western Extension to the original charging zone is ongoing.

Public Outreach and Education

Evidence from a number of road-pricing initiatives highlights the importance of dialogue with stakeholders in addressing concerns about possible inequities, regardless of whether the proposals were ultimately implemented or rejected. For example, Weinstein and Sciara (2004) recommend that agencies considering HOT lane projects foster community dialogue with the dual aim of (*a*) identifying equity concerns that might otherwise be overlooked and (*b*) educating policy makers, the media, and the public at large to forestall misleading or inaccurate claims about equity that could cause costly project delays.[6]

Community dialogue can be helpful in addressing equity concerns, as illustrated by two examples. First, modifications to Mayor Bloomberg's

[6] Mahendra et al. (2011) provide a literature review on road pricing, communication, and engagement. Higgins et al. (2010) provide further guidance on road-pricing communication practices.

original congestion charging proposal for New York City were recommended by the Traffic Congestion Mitigation Commission following a series of public hearings (Schaller 2010). The changes incorporated in the final plan responded to public comment on the plan's complexity and fairness and were observed to build greater support for the commission's recommendations, despite the plan's eventual demise. Second, in the case of the I-15 HOT lanes, Taylor (2010) observes that the San Diego Association of Governments incorporated public opinion surveys into the planning process and was thus able to modify the project design to address equity concerns as the project evolved. These examples illustrate the importance for policy makers of listening to equity concerns and adapting their proposals accordingly. They also highlight the value of an equitable decision-making process that allows meaningful participation by stakeholders (see Chapter 3). Nonetheless, the lessons learned from individual examples may be case-specific, and there is no information about what would have happened in the absence of community dialogue. Thus, caution is needed in framing general conclusions on the basis of a relatively small number of case studies.

Several authors have observed that road-pricing concepts are not well understood by the American public or by many politicians. Consequently, education initiatives targeting a variety of audiences can be a key component of efforts to address equity concerns associated with road pricing. Both Weinstein and Sciara (2004) and Taylor (2010) cite the I-394 MnPass HOT lanes implemented in the Minneapolis region in 2007 as a case where education played an important role in informing the equity debate. Criticism of the initial 1997 demonstration project proposal was based largely on equity concerns that emerged when people thought of HOT lanes as "Lexus lanes." In 2001, the Minnesota Department of Transportation and the Twin Cities Metropolitan Council partnered with the University of Minnesota's Humphrey Institute to conduct local and regional workshops on road pricing and address citizens' concerns. The partnership also established the Value Pricing Advisory Task Force, which represented key stakeholder groups and championed a new HOT lane demonstration project proposal. As a result of the ensuing public dialogue, public acceptance began to grow and eventually led to bipartisan support for the project.

CHAPTER HIGHLIGHTS

- Understanding public opinion is important if equity is to be addressed seriously in the transportation planning process; however, not all public opinion surveys are conducted according to the rigorous standards needed to capture accurately the opinions of the population(s) of interest (e.g., low-income motorists, the elderly, transit riders). Surveys that do not meet rigorous standards can give distorted results, so care is needed in interpreting survey results.
- High-quality public opinion surveys have shown that members of low-income groups do not oppose congestion fees and HOT lanes any more strongly than other groups, and may even be slightly more in favor of these finance mechanisms. This evidence contradicts the assumption that lower income people, having less disposable income, would be more likely to oppose road tolls, cordon charges, and other usage fees than those in higher income brackets.
- Four strategies may prove helpful for decision makers seeking to engage their constituents and stakeholders in informed discussions about the fairness of road-pricing proposals:
  - Explaining how road-pricing revenues will be spent is critical in determining whether people view a project as fair.
  - Addressing equity explicitly at an early stage and often in the project planning process increases transparency and allows time to modify project designs in response to equity concerns. Analyses and forecasts providing information about who will pay and who will benefit are particularly valuable.
  - Experimental programs and pilot projects can help to (*a*) test a financing mechanism and (*b*) educate both policy makers and the public about how the mechanism works in practice and give them a better appreciation of the costs and benefits to both the individual and the larger community.
  - Public education activities are particularly important in explaining how a proposed road-pricing strategy is expected to work in practice. In addition, public engagement through community dialogue is needed in the decision-making process. If decision makers are willing to listen, learn, and adapt, such dialogue can lead to an improved proposal that is less likely than the original to be criticized as unfair.

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NSTIFC	National Surface Transportation Infrastructure Financing Commission

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6

Findings and Recommendations

Transportation plays a key role in the functioning of the nation's economy and in determining people's ability to participate fully in society. Consequently, equity is an underlying issue in nearly all transportation decisions, from how transportation services are paid for to how existing and proposed transportation systems and services are provided. The equity implications of transportation systems and how we pay for them defy simple characterization, and talking about transportation finance equity without talking about a broad spectrum of other factors is guaranteed to lead to misguided conclusions. This report focuses on equity as a criterion for assessing transportation finance mechanisms, but, in practice, equity is only one of many criteria considered by public officials weighing alternative means of financing a transportation project or program. Trade-offs among different criteria are often needed to arrive at a compromise solution. Furthermore, the equity characteristics of transportation finance mechanisms are not solely matters of ethical concern; they can be important factors in determining political acceptance or rejection of a mechanism. Failing to address matters of equity, real or perceived, can contribute to implementation failures or delays or to increased social and economic costs. Against this backdrop, the committee was asked to provide guidance to public officials about assessing the equity of evolving transportation finance mechanisms.

This chapter discusses the various dimensions of equity, summarizes the current understanding of the equity of evolving finance mechanisms and of opportunities to remedy inequities, and discusses approaches to measuring equity. It then identifies equity-related issues for policy makers to consider and recommends actions to be taken by policy makers and their staff. A discussion of research needs is followed

by recommendations directed to researchers and analysts. The chapter concludes with recommendations about sources of funding for the recommended actions.

DIMENSIONS OF EQUITY

Researchers have compiled many different, and overlapping, definitions of equity and have explored different classification schemes in an attempt to analyze transportation equity in a logical and consistent manner. By way of illustration, Table 6-1 lists five of the many aspects of equity encountered in transportation debates, namely, income, geography, mode, generation, and race–ethnicity. This table lists important questions for judging the fairness of the distribution of burdens and benefits, identifies the kinds of information policy makers need to answer these questions, and gives examples of potential remedies for associated inequities. These illustrative examples are intended to outline the several and overlapping ways of thinking about equity and transportation finance and are neither exhaustive nor prescriptive. For example, income equity is ultimately founded on the concept of ability to pay; generational equity is based on the relationship between costs paid and benefits received.

This multiplicity of definitions and perceptions of equity often complicates the interpretation of results from empirical studies. As noted in Chapter 4, studies investigating the equity implications of road pricing typically consider only one aspect of equity—for example, the price sensitivity of low-income groups vis-à-vis new road tolls (ability to pay), or the ways in which low-income groups are affected by expenditures of toll revenues (benefits received). In fact, the overall equity outcome of a transportation finance policy depends on an array of factors, including, but not limited to

- The size of payments by the affected groups;
- The price sensitivity of the affected groups;
- The transportation options available to these groups;
- The shifting of the financial burden via changes in market prices;
- How the revenues are spent, including any efforts to offset inequities; and

TABLE 6-1 Types of Equity for Considering Distribution of Burdens and Benefits

Category	Important Questions	Policy Makers' Information Needs	Potential Remedies for Inequities
Income	Are different economic classes burdened disproportionately, taking into account fees paid, benefits received, and impacts experienced? In particular, are lower income people paying a disproportionate share of their income for transportation?	Ultimate distribution of fees paid, services received, and resulting travel behavior for different income groups	Compensatory service enhancements (e.g., improved transit services for low-income communities), discounted fees or fares, rebates, offsetting payments
Geography	Are different geographic districts or regions paying proportionally more or receiving proportionally less from transportation investments?	Distribution of fees paid within, and investments accumulating to, each geographic district or region	Spatially adjusted finance and investment strategy, e.g., investment in different projects or services in different jurisdictions
Mode	Are the fees paid by users of different modes proportionally returned to the users of transportation services?	Pattern of allocation of funds across modes, e.g., dollars per trip, per passenger mile, or per ton-mile	Adjusted investment (or taxing) plan, e.g., more or less money to (or from) a particular mode
Generation	Are the costs paid by current and future generations proportional to service benefits they receive from transportation investments?	Patterns of cost obligations (e.g., bond payback) and expected transportation service characteristics and needs over time	Adjusted financing schemes, particularly borrowing arrangements, to change the stream of future payment obligations, e.g., reduced (or increased) long-term borrowing
Race–ethnicity	Are different racial and ethnic groups, particularly minorities, burdened disproportionately, taking into account fees paid, benefits received, and impacts experienced?	Ultimate distribution of fees paid, services received, and resulting travel behavior for different racial and ethnic groups	Compensatory service enhancements (e.g., improved transit services for minority communities)

- The effects of the policy on the performance of the transportation system (for example, shorter travel times on some routes and improved air quality as a result of reduced congestion).

Consequently, studies examining only one aspect of equity provide useful, but incomplete, information and must be interpreted with caution and their limitations explicitly understood.

Furthermore, the equity of a finance mechanism depends not only on the aspects of equity considered, but also on how the baseline for comparison is defined, whether for a specific project or for a broader finance policy. For example, the equity implications of a high-occupancy toll (HOT) lane may differ depending on whether the lane in question is to be created by converting an existing toll-free lane or by adding a new lane. In the former case, the baseline is an unpriced general purpose lane; in the latter case, it is a highway with fewer lanes. In a broader context, the current highway financing approach is generally used as the baseline against which to compare evolving mechanisms, such as a comprehensive vehicle miles traveled (VMT) fee. There is no set rule for how to define the "correct" baseline in a particular case, however, and this can be one of the confusing characteristics of equity debates when different parties define baselines differently.

EQUITY OF EVOLVING FINANCE MECHANISMS

People tend to favor the status quo strongly, and sometimes even irrationally, over potential alternatives, as noted in Chapter 5. It comes as no surprise, therefore, that equity concerns are raised far more often in connection with evolving and relatively untested transportation finance strategies (which are the focus of this report) than in connection with established finance strategies. Nonetheless, research has shown that most current transportation finance mechanisms are generally regressive. For example, the use of sales taxes to fund transportation is less equitable than the gas tax or other user fees according to several equity criteria. Sales taxes are generally regressive with respect to income, are paid by nonusers and users of the transportation system alike, and make no distinction between occasional and heavy users of the transportation system.

Much of the analysis to date on the equity implications of evolving transportation finance mechanisms relates to road pricing. Most of the studies have addressed the equity implications of motorists' ability (or inability) to pay road tolls or other fees based on their income.[1] The extent of the empirical evidence is limited, however, by the extent of practical experience with different road-pricing options—HOT lanes, cordon tolls, VMT fees, and so on.

In the United States, practical experience with road pricing includes tolled roads, bridges, and tunnels, as well as "weak" congestion pricing variants offering toll-free alternatives to priced links, notably HOT lanes. Examination of equity implications has largely focused on HOT lanes; in a few cases, such as the 91 Express Lanes in California's Orange County, data pertaining to equity implications have been carefully and comprehensively documented. In general, however, the empirical evidence is limited in scope, and much of the research into the equity implications of HOT lanes is theoretical in nature.

In a number of countries outside of the United States, comprehensive road-pricing variants offering only a tolled route have been implemented. Studies of the cordon toll policies in London; Stockholm, Sweden; and several other cities provide some limited evidence about equity impacts. In the case of VMT fees, however, the literature on the likely equity implications is almost entirely theoretical. Theoretical analyses, including modeling studies, can be indispensable in guiding both analytic thinking and empirical studies. Nonetheless, empirical evidence constitutes a more credible basis for informing decision making—particularly given the difficulties of anticipating how people or firms will change their travel behavior in response to a new transportation finance policy—and thus how the burden of any new tax or fee will be distributed in practice.

Empirical evidence shows that road pricing, like most current forms of highway finance, is almost always regressive in terms of out-of-pocket costs. Priced facilities can benefit a variety of income groups, however, depending on circumstances. Despite the commonly held belief that road pricing is unfair to low-income drivers, both empirical data on travelers' use of priced roadways and public opinion surveys tell a more

[1] Ability to pay is generally assumed to be proportional to income.

nuanced story. It is dangerous to make broad generalizations about the equity of a road-pricing policy without delving into the details of its implementation. The actual effects of road pricing on low-income drivers depend greatly on the specifics of the pricing program, how travelers perceive and use priced facilities, and the services funded with the tolls. Likewise, public opinion research has shown that low-income respondents do not oppose congestion fees or HOT lanes any more than the average survey respondent does and, in some cases, are even more supportive of congestion pricing.

REMEDYING INEQUITIES

Empirical evidence about the effectiveness of strategies for remedying inequities resulting from transportation finance policies is very limited. In the relatively few instances in which a remedy has been implemented, the most frequent approach has been to provide alternative transportation services in the form of new or improved transit services aimed at assisting low-income groups and others who prefer not to drive. Substantial evidence indicates, however, that such services cannot always fully meet the mobility needs of affected groups or communities and thus may not remedy the inequities effectively. Public transit services, with their limited geographic scope and fixed schedules, rarely can serve all of the trips made by drivers wishing to avoid tolls, no matter how well these services are designed and delivered. In some cases, however, disparities between the needs of adversely affected communities and proposed remedies may be the result of failure to engage the communities in identifying responsive solutions, incomplete knowledge of the extent of adverse impacts, or other uncertainties—for example, unanticipated adaptations in travel behavior that change distributional outcomes.

Even when inequities are clearly identified, building remedies into a finance policy may be difficult because of financial constraints. Establishing compensatory mechanisms, such as discount schemes to benefit low-income travelers, often involves redirecting some of the revenue stream away from paying for the new or improved transportation services that motivated the finance policy in the first place. Many recent HOT lane projects have not yet covered their initial costs, leaving little or no net

revenue for remedying inequities. Public transportation budgets can be equally constrained. Nonetheless, HOT lane policies designed to include funds set aside for transit investment in the corridor have been successfully implemented in several instances, thereby providing transportation alternatives for some adversely affected travelers.

MEASURING EQUITY

A transportation finance mechanism levies money from various groups to pay (in full or in part) for transportation facilities and services. There is, however, no single way of defining what constitutes an equitable outcome—that is, an acceptable balance of costs and benefits—resulting from a finance mechanism. Whether an outcome is perceived as equitable varies across different contexts (for example, in different geographic locations) and depends on the perspectives—and experiences—of different individuals and groups. Thus, there are many different dimensions of equity, as noted earlier in this chapter and discussed in more detail in Chapter 3.

From a practical standpoint, the assessment of equity from any and all of the relevant perspectives should be informed by measuring the distribution of effects—the costs (who pays and how much they pay); the uses of funds (where, how, and how effectively funds are deployed); and the services, facilities, and prices delivered to various groups. Differing values and judgments come into play even in the apparently objective process of measuring these distributions, for choices must be made about what to count as costs and benefits and how to count (measure) them. Identifying and measuring distributions of effects is also complicated by the fact that people and institutions may change their behaviors in response to new or modified transportation options and associated taxes or fees, and may pass some or all of these costs on to others. The notion of burden shifting is discussed in Chapter 3.

The starting point for measurement is to define the financing scheme in detail, identifying who will bear the initial burden in terms of demographics, geography, behaviors, and other dimensions discussed in Chapter 3. The magnitude of this burden can then be estimated in both absolute terms (e.g., dollars per year) and relative terms (e.g., proportion

of household income per year). Contrasting these effects with those of existing financing mechanisms enables one to characterize the initial impacts of additional or replacement taxes or fees and to present a comparison with the status quo. Following this initial assessment, it is necessary to address additional effects resulting from behavioral changes, notably, the shifting of both economic and noneconomic burdens (see Chapter 3). Suitable models for predicting such shifts are not widely available, so logical reasoning may well be needed to develop a qualitative picture of the redistribution of the burden of a new policy.

The distribution of benefits resulting from the deployment of funds from a new finance mechanism also needs to be identified and measured. These tasks may be challenging if specific commitments to the uses of funds have not been made in parallel with selecting the finance mechanism. It is, nonetheless, important to address the potential benefits, since innovative transportation finance mechanisms arise because there is (presumably) a substantive need for incremental funds. In describing the benefits and their distribution, care is needed to avoid overpromising what future funds will actually bring.

Data to develop descriptions of the various effects described in preceding paragraphs depend in the first instance on descriptions of the finance mechanism itself—for example, who will pay the new or revised tax or fee, how much they will pay, how much revenue is anticipated, and how this revenue will be spent. In most cases, data from a variety of other sources will also be required—for example, demographic information from the Decennial Census and the American Community Survey, regional travel data collected as a part of regional transportation planning processes, and national travel data from the National Household Travel Survey. Finding relevant and sufficiently detailed freight data is more difficult, but the national Commodity Flow Survey and specialized regional data sources may be relevant.

ISSUES FOR POLICY MAKERS TO CONSIDER

Understanding the complex web of equity implications associated with a transportation finance policy is a challenge, as the preceding discussion illustrates. In addition, the shortage of comprehensive and carefully documented empirical evidence about the equity impacts of road pricing

and other evolving policies leaves public officials with relatively little experience-based information on which to draw when considering finance options. Despite these difficulties, there are a number of ways in which policy makers and the analysts who support them can address transportation finance equity issues more effectively. The following paragraphs address the importance of

- Adopting a comprehensive perspective when a policy's equity implications are considered,
- Considering the possibility that the actual incidence of a relatively untested finance policy may differ from that originally intended or anticipated,
- Engaging stakeholders in the planning and decision-making processes,
- Drawing on the results of carefully conducted public opinion research, and
- Avoiding red herrings raised during public debates over equity.

Comprehensive Perspective

Understanding the equity outcomes of a finance policy involves asking a broad range of questions about who will be affected by the policy and how, rather than just the commonly asked questions about who pays for and who benefits from transportation services. Both short- and long-term behavioral responses to a policy need to be considered, together with their consequences—for example, changes in mobility, changes in land use and associated home and job locations, and environmental impacts.

Intended Versus Actual Incidence

The actual incidence of a finance policy may be quite different from that intended or anticipated when the policy was developed and enacted into law. Individuals and institutions may be able to modify their behaviors to avoid paying a new tax or fee or to shift the economic burden to others. The equity implications depend ultimately on how the burden is shifted through the complex array of behavioral responses and market forces. Furthermore, shifting of the economic burden may change the nature of noneconomic equity considerations through disproportionate effects on particular communities or categories of people. For example, toll or tax increases may lead to greater reductions or changes in trip

making among low-income travelers than among higher income groups, with an associated loss of benefits. Thus, low-income travelers may forgo needed visits to health clinics or may have to use public transit to make very long trips that were formerly made by car.

Stakeholder Engagement

Evidence from road-pricing initiatives demonstrates the value of engaging stakeholders in the planning and decision-making processes in a meaningful way to address concerns about the equity of transportation finance mechanisms. Stakeholder engagement provides opportunities to

- Develop a better understanding of equity concerns, including any such concerns that may have been overlooked in an initial assessment;
- Educate policy makers, the public, and the media about a project and its financing and forestall or correct any inaccurate or misleading perceptions about the financing plan and its likely equity implications; and
- Identify potential remedies for inequities and target those remedies to the specific needs of adversely affected groups.

Public Opinion Research

Public opinion research can help policy makers understand their constituents' expectations for and responses to evolving transportation finance mechanisms and associated equity concerns, as well as any misperceptions about these topics. Public opinion can be influenced by limited understanding and unrealistic expectations about a finance mechanism, so explanation and education may be necessary prerequisites to getting a meaningful measure of public opinion. Furthermore, public opinion may change after a policy has been implemented. As discussed in Chapter 5, evidence from London and Stockholm shows that people's views about the proposed projects changed following implementation, becoming more supportive as the promised benefits (reduced congestion, for example) materialized.

Possible Red Herrings

Anecdotal evidence suggests that some higher income travelers may cynically use arguments about "pricing poor drivers off the road" to mask their own desire to avoid additional fees. At the same time, there may be

genuine equity concerns, even if some people's claims are self-serving. Thus, it is sometimes difficult to distinguish legitimate concerns about equity in road pricing (or other finance policies) from people's general resistance to paying more or paying differently.

Although public officials generally have to address all the equity concerns raised by stakeholders, specific concerns raised by an affected group or by someone representing them may carry more weight than general comments about the equity implications of a policy made by those unlikely to be affected. In a hypothetical case, interest groups concerned about the impact of a project on the environment might choose to bolster their case by also claiming that the project would be unfair to low-income groups. Although such a claim might have merit, input from low-income groups themselves would likely be more useful to public officials in assessing the need to modify a policy or develop remedies for inequities.

RECOMMENDATIONS FOR PUBLIC POLICY MAKERS AND THEIR STAFF

Recommendation: Public policy makers should engage all their constituents and stakeholders early and repeatedly in discussions of proposed transportation finance mechanisms. In addition, they and their staff should ensure that appropriate data, analytical results, and communication strategies are used to address equity explicitly from the outset of a program or project. Specific tasks include

- Assessing likely impacts of financing strategies,
- Using lessons learned elsewhere to inform discussions,
- Developing outreach programs and educational materials, and
- Exploring possible remedies for inequities.

Assessing Likely Impacts of Financing Strategies

Public policy makers and the analysts who support them should explore the ways in which people's travel behavior is likely to change as a result of implementing financing strategies and should develop reliable estimates of transportation service and facility use to the extent possible with existing and emerging analytical tools and data. In particular, they should

- Apply the most appropriate data and forecasting tools available, while acknowledging that better data, more sophisticated models, and alternative assumptions could refine, and possibly even modify, the outcomes;
- Address the likely incidence of costs and benefits, not just the intended effects;
- Draw on documented experience with similar finance mechanisms;
- Consider the implications—short- and long-term, direct and indirect—of changes in people's travel behavior on their quality of life and access to opportunities; and
- Consider valid public opinion research that assesses people's views, while recognizing that people may well be averse to change before it occurs and more accepting afterwards.

Using Lessons Learned Elsewhere to Inform Discussions

Public policy makers should take advantage of experience in the United States and overseas with evolving transportation finance mechanisms to inform their discussions with constituents and stakeholders. To the extent that this experience is well-documented, it should be treated as a knowledge base that, with thoughtful interpretation, can guide future decisions about transportation finance mechanisms.

Developing Outreach Programs and Educational Materials

Public policy makers should develop outreach programs and educational materials to help diverse audiences understand and engage in discussion about the proposed mechanisms and their likely equity implications. During the course of this activity, they should do the following:

- Tailor the design and content of outreach and educational materials to meet the information needs of specific audiences.
- Address the motivations or problems that led to a search for new funding mechanisms, the benefits expected to result from those mechanisms (for example, improvements in transportation services), and alternatives to the proposed funding policy.
- Explain to constituents and stakeholders the equity implications of the current way(s) in which the transportation system is financed to pro-

vide a contemporary baseline against which to understand differences between current and proposed mechanisms.
- Encourage and capture input from the various audiences to inform subsequent iterations of the program or project proposal—in particular, discern the underlying equity principles raised during discussions to help identify inequities requiring remediation among the various stakeholders.
- Provide special outreach as necessary throughout the project process (i.e., planning, implementation, identifying and resolving impacts, and monitoring outcomes) to ensure that traditionally underserved or vulnerable populations engage meaningfully in the discussions. Obtaining expert advice from resource agencies experienced in working with underserved populations could be valuable in these special outreach efforts.

Exploring Possible Remedies for Inequities

Public policy makers and their staff should identify and evaluate possible remedies for inequities, including both modifications to the design of the finance mechanism chosen and ways to use some of the revenues generated by the mechanism to compensate those adversely affected. Any change in transportation finance policy results in both winners and losers, but the new revenue may, when in excess of operating costs, offer opportunities to compensate the losers through monetary rebates or the provision of alternative or improved transportation services, such as new bus routes or more frequent bus services. Where remedies for finance inequities are identified and adopted, policy makers and their staff should develop strategies to help ensure that those remedies are meaningfully implemented and assessed. Engaging the affected communities in identifying and evaluating remedies is essential.

RESEARCH NEEDS

Comprehensive Before-and-After Studies

To date, comprehensive before-and-after studies documenting practical experience with emerging finance mechanisms have been limited in

number, at least in the United States. Such studies are expensive to conduct because they involve extensive data gathering. For example, evaluation of the impacts of the 91 Express Lanes in Orange County, California, involved collecting data over a period of more than 5 years, including about a year and a half prior to the facility's opening (Sullivan 2000). Such studies are, however, a particularly valuable resource for informing future policy decisions and guiding accompanying analyses because they produce results based on actual experience.

Better Understanding of Travel Behavior and Its Consequences

There is a shortage of reliable information about the real distribution of both burdens and benefits to travelers and shippers—information that is needed to assess the equity implications of transportation finance mechanisms. Relatively few studies to date have considered either the equity impacts of people changing their travel behavior to avoid paying a tax or the benefits resulting from the expenditure of tax revenues. For example, people who stop driving to avoid a user fee may experience a more time-consuming or less reliable commute than previously, and some may change or lose their jobs as a result. Implementing congestion pricing should, however, result in toll payers experiencing faster trips and, in many cases, also being offered better transit services.

Among the questions for which research could provide useful insights into the equity implications of transportation finance mechanisms are the following:

- How do members of different socioeconomic groups alter their behavior systematically to avoid or reduce payments, either in the short or long term? Short-term changes could include changing routes or time of travel, or both; using public transit rather than driving; or foregoing a trip entirely. Long-term changes (over a period of years) could include changing home, job, or business locations, or choosing to stop work or travel less.
- Do the consequences of any of these behavioral changes have direct and material equity impacts on the people involved, including the range of costs that they may incur (e.g., longer commutes, poorer job benefits, more expensive rents or mortgages)?

- Do the consequences of any these behavioral changes have indirect or independent equity impacts on other stakeholders? For example, do behavioral changes in response to new taxes or fees change the competitiveness of certain retail, housing, land, or labor markets, possibly accompanied by a spatial rearrangement of jobs? Do such behavioral changes improve health outcomes by reducing environmental pollutants, noise, or other negative externalities? And if so, what are the equity effects?
- What have been the behavioral responses to remedies intended to address inequities in transportation finance and services? How effective have the remedial actions or programs been? Have efforts to mitigate perceived inequities of a finance policy ever worsened actual equity outcomes?

Analysis of the equity implications of transportation finance mechanisms calls for anticipating and forecasting the ways in which people and businesses are likely to modify their use of the transportation system in response to changes in both prices (including taxes) and services. Developing reliable forecasts depends on the availability of fine-grained data on personal travel and freight movements as well as on models that can reliably simulate relevant behavioral changes.

Analysts today routinely assess some aspects of changes in travel behavior, but the traditional travel behavior models used by states, counties, metropolitan planning organizations, and local governments are limited in their ability to capture these changes. For example, none of the models in use in the United States today recognizes that willingness to pay to save time (as in HOT lanes, for example) varies from person to person, and for the same person in different situations. Cost-benefit analyses of transportation projects typically assume all drivers have the same value of time for all trips, and, as a result, evaluations of road-pricing strategies using forecast data are of questionable validity. Similarly, commonly used analytical models do not address so-called "second-order" impacts such as changes in the allocation of household duties or in work styles (e.g., more telecommuting) to moderate the burden of new transportation fees. In contrast, more advanced activity-based travel-demand models offer the potential to forecast travel behaviors with sufficient sophistication to support comparison of alternative finance schemes. In the coming years, such models, which are now

being developed and gradually implemented, are expected to prove useful in informing equity analyses, although their complexity and demanding data requirements may delay or limit widespread implementation.

More Attention to Freight and Transit

Much of the recent research on the equity implications of evolving transportation finance mechanisms has focused narrowly on public and political concerns that road pricing will force low-income drivers off the road. In contrast, the broader effects of road pricing, including impacts on freight transportation and the workers in that sector, have received far less attention. A better understanding of the impacts of road pricing on the freight sector is needed to provide a more complete picture of the likely equity implications of this finance policy. A new finance mechanism may influence the effectiveness and efficiency of freight transportation, affecting economic competitiveness and the spatial arrangement of jobs as well as changing patterns of mode utilization and congestion.

The equity impacts of transit pricing have also been largely ignored in the research literature, although concerns over the inability of low-income people to pay transit fare increases are common. Nonetheless, most conventional equity assessments largely ignore the impacts of actual fare levels, discounted passes, and the like. Transit pricing tends to affect those in the very lowest income categories far more than road pricing. Thus, informed assessments of the equity implications of finance policies on the mobility of the lowest income group cannot ignore transit pricing.

RECOMMENDATIONS FOR RESEARCHERS AND ANALYSTS

Recommendation: Researchers and analysts should conduct scientifically rigorous before-and-after and cross-sectional studies to measure the equity implications of evolving financing mechanisms and provide a robust basis for future decision making. These studies should

- Track short- and long-term behavioral shifts in response to the evolving mechanisms,
- Conduct verifiable analyses to ensure the validity and transferability of results, and
- Avoid preconceived notions and oversimplification.

Researchers and analysts should monitor the overall impacts of evolving transportation finance mechanisms through systematic and ongoing data collection and analysis programs. Such monitoring should include analyses of resulting transportation service changes and the effectiveness of remedies aimed at redressing inequities. In the case of before-and-after studies, it is particularly important to ensure that reliable before-implementation data are collected to provide a strong basis for comparison. A special data collection effort may be required, because routinely maintained data on travel and financial impacts may be insufficient. After implementation, data need to be collected on the direct and indirect impacts, both short- and long-term, on various groups. Collection of such data should ideally be done at regular intervals.

Important questions to be answered by these data include the following:

- How do members of various socioeconomic groups alter their behavior, in the short or long term, to avoid or reduce the payment?
- To what or whom are the burdens of taxes or fees shifted, in whole or part, and what are the equity implications of such shifts?
- What are the consequences (for example, reductions in travel benefits) of any resulting behavioral changes for the people involved? Are there indirect and independent equity impacts on other stakeholders?
- How have negative equity outcomes been compensated for or addressed?
- How are the affected communities engaged in identifying and addressing negative impacts?

As these questions illustrate, it is important to extend the scope of before-and-after studies beyond monetary effects to recognize behavioral impacts, the effects of changes in transportation services, and the effectiveness of any remedies. This effort should include not only short-term implications, but also long-term and indirect impacts that are often difficult to follow.

It will be important—and challenging—to sort out confounding effects. Discernible effects from funding changes emerge over time, during which many other events occur. For example, changes due to the economic cycle, such as recession or expansion, can confound the attribution of response to new finance mechanisms. Likewise, fuel price fluctuations and relocation

of centers of employment or other activities can also confound responses. Such confounding effects need to be documented as a part of comprehensive before-and-after studies. High-quality before-and-after studies are difficult and expensive, but they are the most reliable source of objective information to guide future decision making.

Although evolving transportation finance mechanisms are the focus of this report, research on current mechanisms is also relevant to the issues under consideration. In particular, analyses continue to reveal certain inequities of current mechanisms, thereby providing a baseline against which public policy makers can consider the relative strengths and weaknesses of evolving mechanisms.

> **Recommendation:** As practical experience is gained with newer transportation finance mechanisms, researchers and analysts in the United States should take full advantage of opportunities to capture lessons learned abroad.

Capturing lessons learned is partly a research activity, and partly a matter of direct information exchange, possibly through site visits by public officials or their staff. The value of adding to the empirical knowledge base through such efforts returns to decision makers, and thus this latter group bears responsibility for ensuring that the necessary resources are made available.

> **Recommendation:** As researchers and analysts continue to develop and implement advanced travel behavior and land use models for a variety of applications, they should ensure that such models incorporate features needed to inform equity analyses of transportation finance policies. In particular, models need to recognize that a willingness to pay to save time (value of time) varies from person to person, and for the same person in different situations.

Activity-based travel models are advancing in sophistication and are gradually moving into practice for transportation planning and policy analyses. The need to analyze the equity implications of road-pricing options provides another motivation to accelerate the implementation of such models. It will be important to include explicitly in the data collection and model development tasks those population segments and household

characteristics that are expected to be of special interest in equity analysis, for example, persons with disabilities, racial minorities, and low-income households.

Advanced models used to inform equity analyses need to include the ability to simulate variations in the use of modes, links, and paths as travelers adjust their behavior to optimize some combination of travel time and user costs. They also need to capture the long-term effects of transportation investments and fees on land use and development as individuals and organizations change their behavior in response to changes in transportation facilities, services, and the way these are financed.

Researchers and practitioners should remain cautious about the uncertainties inherent in all travel forecasting models and should consider how alternative assumptions could modify the outcomes of studies using these models.

SOURCES OF FUNDING FOR RECOMMENDED ACTIONS

Recommendation: The Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) should ensure that equity assessments integrated into overall project and program evaluation processes are both effective and meaningful. To this end, they should clarify and publicize the eligibility of such equity assessments as expenses of the federal aid program.

The equity assessments performed by public policy makers to inform and support decisions about the use of various transportation finance mechanisms are eligible expenses of the federal aid program via Title VI of the Civil Rights Act, requirements for environmental impact statements, and other legislative mandates. Such equity assessments, which identify equity impacts of both the finance mechanisms and of the transportation services they fund, are challenging and costly to conduct, as this report illustrates. Clarifying and publicizing the availability of funds from the federal aid program could help bring more resources to bear on equity assessments. These additional resources could improve the scope of assessments and provide the ability to address more long-term and diffuse issues.

Recommendation: The U.S. Department of Transportation's Office of Policy and its Research and Innovative Technology Administration

(RITA) should support and direct a collaborative effort to build a knowledge base for decision support that includes

- A program of scientifically rigorous before-and-after and cross-sectional studies to assess the equity outcomes of road pricing and other evolving transportation finance mechanisms as they are implemented in the United States and
- An ongoing effort to gather lessons learned about equity implications from the implementation of such mechanisms abroad.

Because there is widespread interest in evolving finance policies, particularly road pricing, there is a clear federal role in supporting research activities that lead to a more robust and informed basis for future decision making. High-quality empirical studies of the equity implications of new finance mechanisms are essential to build a credible U.S. knowledge base to support future transportation finance decisions. Both a mandate and support for equity analyses should be linked to programs and incentives to test new ways to finance transportation, particularly various forms of road pricing. The proposed knowledge base should encompass studies from other countries as well, to accelerate the rate of learning and broaden the perspectives on finance methods.

Organizations with relevant experience and expertise that could usefully lead in building this knowledge base include, but are not limited to, RITA's Bureau of Transportation Statistics and its Volpe Center; the Oak Ridge National Laboratory; FHWA; and university transportation centers around the United States.

Recommendation: The American Association of State Highway and Transportation Officials (AASHTO) and the FTA should support activities under the National Cooperative Highway Research Program (NCHRP) and the Transit Cooperative Research Program (TCRP), respectively, to develop information, guidance, and analysis tools for state departments of transportation and others to use in studying and understanding the equity implications of evolving transportation finance mechanisms. These activities should include the development of a handbook describing recommended procedures for conducting equity analyses of transportation finance policies.

Given the interest in road pricing, including VMT fees, as an alternative to current transportation finance mechanisms and of the important

role of the states in funding the nation's surface transportation system, NCHRP provides an appropriate framework under which to conduct research aimed at developing a better understanding of the equity implications of evolving transportation finance mechanisms. Given the importance attached to both income and racial equity and the role of transit in providing mobility for low-income and minority groups, there is a clear opportunity for the FTA and the TCRP Oversight and Project Selection Committee to contribute to this research through TCRP. There may also be opportunities for RITA to contribute to this effort through the National Cooperative Freight Research Program.

A transportation equity analysis manual, analogous to AASHTO's *Highway Safety Manual,* could provide tools and guidance targeting practitioners at the state, county, metropolitan planning organization, or local levels who need to conduct equity assessments of projects and programs for which the use of evolving finance mechanisms is being considered. As with the *Highway Safety Manual,* the transportation equity analysis manual would describe a science-based technical approach that helps practitioners make the most effective use of available tools and data while also recognizing areas of uncertainty and knowledge gaps.

Other potential sources of funding for the recommended actions by researchers and analysts include state planning and research funds for state-level projects, perhaps used in collaboration with one or more of the university transportation centers; the National Science Foundation (NSF); and private foundations that have traditionally been interested in topics related to equity. NSF addresses a wide range of program areas through its multiple divisions and could perhaps be a source of funds for research into burden shifting in transportation finance, research on tools for forecasting social impacts of transportation decisions, and research on other basic topics. Given the diverse facets of equity assessment, researchers will likely need to think beyond traditional transportation programs and funding sources in seeking support for their work.

CONCLUDING REMARKS

The equity implications of transportation finance mechanisms are complex, often controversial, and important in decision making. Policy makers addressing such equity issues need to have a broad understanding of the array of issues involved. They also need to recognize that the complexity of

the issues can be managed—though not eliminated—through systematic consideration of the ways in which burdens and benefits are distributed across society and institutions. Such an approach means

- Considering the ways in which people and organizations respond to, and sometimes shift, new transportation charges;
- Taking into account the distribution of the benefits from the use of those funds;
- Weighing the equity concerns about new ways to pay for transportation against those for existing methods;
- Exploring and assessing possible remedies to inequities; and
- Working closely with stakeholders to find solutions that are feasible, effective, and acceptable.

The knowledge and tools to accomplish these tasks are emerging, but there remains a need to invest in research and development to provide more effective support for decisions about new finance mechanisms. In the meantime, there is much that can be done to support our transportation systems and to make informed decisions about paying for them.

REFERENCE

Sullivan, E. 2000. *Continuation Study to Evaluate the Impacts of the SR 91 Value-Priced Express Lanes.* Final Report. State of California, Department of Transportation, Traffic Operations Program, HOV Systems Branch, Sacramento, December.

APPENDIX A

Legal Basis for Social Impact Assessment and Environmental Justice Considerations in Transportation Decision Making, Planning, Policy, and Projects

U.S. Constitution, Article XIV. Equal Protection and Due Process

This statute establishes rights, guaranteed privileges and immunities of citizenship, due process, and equal protection: "No State shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States; nor shall any State deprive any person of life, liberty, or property, without due process of law; nor deny to any person within its jurisdiction the equal protection of the laws." See http://memory.loc.gov/cgi-bin/ampage?collId=llsl&fileName=014/llsl014.db&recNum=389.

Americans with Disabilities Act of 1990 (P.L. 101-336)

The purpose of the Americans with Disabilities Act (ADA) is to ensure equal opportunity for persons with disabilities in employment, state and local government services, public accommodations, commercial facilities, and transportation. The ADA requires the establishment of telecommunications device for the deaf (TDD) and telephone relay services. See Americans with Disabilities Act, Questions and Answers, http://www.ada.gov/q%26aeng02.htm.

Department of Justice Regulation 28 CFR Part 42, Subpart F, Coordination of Enforcement of Nondiscrimination in Federally Assisted Programs

This part implements Title III of the ADA of 1990 (42 U.S.C. 12181), which prohibits discrimination on the basis of disability by public accommodations and requires places of public accommodation and commercial facilities to be designed, constructed, and altered in compliance with the accessibility standards established by this part. See http://www.ada.gov/reg3a.html#Anchor-36000.

Department of Transportation Order 5610.2, U.S. Department of Transportation Order on Environmental Justice to Address Environmental Justice in Minority Populations and Low-Income Populations (April 15, 1997)

The order describes the process that the Office of the Secretary of Transportation and each operating administration will use to incorporate environmental justice principles (as embodied in the executive order) into existing programs, policies, and activities. The order provides that the Office of the Secretary and each operating administration within the U.S. Department of Transportation (DOT) will develop specific procedures to incorporate the goals of the DOT order and the executive order with the programs, policies, and activities they administer or implement. This is done through a process developed within the framework of existing requirements, primarily the National Environmental Policy Act, Title VI of the Civil Rights Act of 1964 (Title VI), the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), and other DOT applicable statutes, regulations, and guidance that concern planning; social, economic, or environmental matters; public health or welfare; and public involvement. See http://www.fhwa.dot.gov/environment/ejustice/dot_ord.htm.

DOT Policy Guidance Concerning Recipients' Responsibilities to Limited English Proficient Persons (December 14, 2005)

The guidance requires recipients to take reasonable steps to ensure meaningful access to their programs and activities by persons with lim-

ited English proficiency (LEP) based on the four-factor analysis set forth in the Department of Justice's General LEP Guidance. See http://edocket.access.gpo.gov/2005/05-23972.htm.

DOT Regulation 49 CFR Part 21, Nondiscrimination in Federally Assisted Programs of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act of 1964

This part effectuates the provisions of Title VI of the Civil Rights Act of 1964 to the end that no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the Department of Transportation. See http://www.fhwa.dot.gov/hep/49cfr21.htm#sec.21.1.

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994

Each federal agency is charged to achieve environmental justice as part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories. This includes public participation and access to information. See http://www.archives.gov/federal-register/executive-orders/pdf/12898.pdf.

Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, 2000

The executive order requires federal agencies and their recipients to examine the services they provide, identify any need for services to those with LEP, and develop and implement a system to provide those services so that persons with LEP can have meaningful access to them. See http://www.justice.gov/crt/cor/13166.php.

Executive Order 13330, Human Service Transportation Coordination, 2004

The purpose of this order is to enhance access to transportation to improve mobility, employment opportunities, and access to community services for persons who are transportation disadvantaged. It also established an Interagency Transportation Coordinating Council on Access and Mobility (CCAM). Membership includes the Secretaries of Transportation, Health and Human Services, Education, Labor, Veterans Affairs, Agriculture, Housing and Urban Development, and the Interior; the Attorney General; the Commissioner of Social Security; and other federal officials as the chairperson of the council may designate. The Secretary of Transportation is the chair of CCAM. See http://nodis3.gsfc.nasa.gov/displayEO.cfm?id=EO_13330_.

Federal Highway Administration Administrative Order 6640.23, FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

This order establishes policies and procedures for the Federal Highway Administration (FHWA) to use in complying with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. The administrative order includes additional components (e.g., aesthetic values). See http://www.fhwa.dot.gov/legsregs/directives/orders/6640_23.htm.

FHWA–Federal Transit Administration Memorandum on Title VI Requirements in Metropolitan and Statewide Planning (October 7, 1999)

This memorandum provides clarification in implementing Title VI of the 1964 Civil Rights Act (42 U.S.C. 2000d-1) and related regulations, The President's Executive Order on Environmental Justice, the U.S. DOT order, and the FHWA order. Specifically, the memorandum states that the appropriate time for the Federal Transit Administration (FTA) and FHWA to ensure compliance with Title VI in the planning process is during the planning certification reviews conducted for transportation management areas and through the statewide planning finding rendered

at approval of the Statewide Transportation Improvement Program. See http://www.fhwa.dot.gov/environment/ejustice/ej-10-7.htm.

FTA Circular 4702.1, Title VI Program Guidelines for Federal Transit Administration Recipients (May 13, 2007)

This circular provides recipients and subrecipients of FTA financial assistance with guidance and instructions for carrying out DOT's Title VI regulations (49 CFR Part 21) and for integrating into programs and activities considerations expressed in the department's Order on Environmental Justice (Order 5610.2), and Policy Guidance Concerning Recipients' Responsibilities to Limited English Proficient (LEP) Persons. See http://www.fta.dot.gov/laws/circulars/leg_reg_5956.html for references related to specific recipients (e.g., states, designated recipients, metropolitan areas, subgrantees).

Intermodal Surface Transportation Efficiency Act, 1991

In 1991, ISTEA extended public involvement opportunities in the transportation planning process. See http://www.fhwa.dot.gov/environment/pubinv2.htm.

Joint FTA–FHWA Regulation 23 CFR Part 771, Environmental Impact and Related Procedures (August 28, 1987)

This regulation prescribes FHWA–FTA policies and procedures for implementing the National Environmental Policy Act of 1969 as amended. Key features include "public involvement and a systematic interdisciplinary approach [as] essential parts of the development process for proposed actions. . . . Measures necessary to mitigate adverse impacts [shall] be incorporated into the action." See http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&rgn=div5&view=text&node=23:1.0.1.8.43&idno=23#23:1.0.1.8.43.0.1.1.

Joint FTA–FHWA Regulation 23 CFR Part 450 and 49 CFR Part 613, Planning Assistance and Standards; Section 12 of FTA's Master Agreement, FTA MA 13 (October 1, 2006)

State, metropolitan, local, and designated recipients are required to establish early and continuous public involvement opportunities that

provide timely information about transportation issues and decision-making processes to citizens, affected public agencies, representatives of public transportation employees, freight shippers, private providers of transportation, representatives of users of public transportation, representatives of users of pedestrian walkways and bicycle transportation facilities, representatives of the disabled, providers of freight transportation services, and other interested parties. See http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=7f5985b5d2fe301f3fd5a6f537e6bfb8&rgn=div5&view=text&node=23:1.0.1.5.11&idno=23#23:1.0.1.5.11.1.1.1.

National Environmental Policy Act of 1969, as Amended (P.L. 91-190)

"The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between [humans] and [the] environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of [humans]; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality." See http://ceq.hss.doe.gov/nepa/regs/nepa/nepaeqia.htm.

Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, P.L. 109-59, 2005

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) continued to broaden opportunities for public participation in transportation decision making established in ISTEA and TEA-21. See http://www.fhwa.dot.gov/environment/pubinv2.htm.

Section 12 of FTA's Master Agreement, FTA MA 13 (October 1, 2006)

FTA recipients must agree to comply with all applicable civil rights laws, regulations, and directives. These include, but are not limited to, nondiscrimination in federal public transportation programs, nondiscrimi-

nation (Title VI of the Civil Rights Act), and equal employment opportunity. See http://www.fta.dot.gov/documents/13-Master.doc.

Transportation Efficiency Act for the 21st Century, P.L. 105-108, 1998

The Transportation Efficiency Act for the 21st Century (TEA-21) continued to broaden opportunities established in ISTEA for public participation in transportation decision making. See http://www.fhwa.dot.gov/environment/pubinv2.htm.

U.S. Code of Federal Regulations, Title 42: The Public Health and Welfare: Chapter 61. Uniform Relocation Assistance and Real Property Acquisition Policies for Federal and Federally Assisted Programs (42 U.S.C. 4601, et seq.)

This subchapter establishes a policy for the fair and equitable treatment of persons displaced as a direct result of programs or projects undertaken by a federal agency or with federal financial assistance. The purpose is to ensure that such persons shall not suffer disproportionate injuries as a result of programs and projects designed for the benefit of the public as a whole and to minimize the hardship of displacement on such persons. See http://uscode.house.gov/download/pls/42C61.txt.

APPENDIX B

Committee Meetings and Other Activities

FIRST COMMITTEE MEETING

December 18–19, 2008, Washington, D.C.

The following presentations were made to the committee by invited speakers and individual committee members:

Overview of Transportation Research Board (TRB)
Special Report 285: The Fuel Tax and Alternatives for Transportation Funding
Joseph Morris, TRB

Future Financing Options to Meet Highway and Transit Needs
Gary Maring, Cambridge Systematics, Inc.

Stakeholders' Issues and Strategies of Road Pricing Use
Daniel Dornan, KPMG LLP

Evaluating Transportation Equity—An Overview
Todd Litman, Victoria Transport Policy Institute

A Case Study in Transportation Equity
Thomas Sanchez, University of Utah

Thinking About Equity in Transportation Finance
Brian Taylor, committee member

Vox Populi: A Synthesis of Public Opinion on Tolling and Road Pricing
Johanna Zmud, committee member

Managed Lanes and Travel Behavior
Keith Lawton, committee member

Private Provision of Highways: Economic Issues
Kenneth Small, committee member

Long-Term Concessions: Issues Relating to Protecting the Public Interest
Jeffrey Buxbaum, committee member

SECOND COMMITTEE MEETING

February 23–24, 2009, Irvine, California

The following presentations were made to the committee by invited speakers:

Equity Implications of Current Transportation Finance Mechanisms
Martin Wachs, RAND Corporation

Equity Outcomes: Alternative Transportation Finance
David Ungemah, Texas Transportation Institute

Panel Discussion with Decision Makers

Panelists were asked to discuss the issues they face when deciding how to fund transportation projects, what they need by way of information and guidance, and how important equity is in the decision process.

Steve Heminger, *Metropolitan Transportation Commission, Oakland*
Richard Katz, *consultant*

THIRD COMMITTEE MEETING

May 7–8, 2009, Washington, D.C.

Closed meeting for committee deliberations.

FOURTH COMMITTEE MEETING

September 2–3, 2009, Washington, D.C.

The committee hosted a symposium to explore transportation finance equity with experts and stakeholders. The agenda for this symposium and a list of participants are provided in Appendix D.

FIFTH COMMITTEE MEETING

February 4, 2010, Washington, D.C.

Closed meeting for committee deliberations.

APPENDIX C

Commissioned Papers and Authors

Equity, Pricing, and Surface Transportation Politics. Alan Altshuler, John F. Kennedy School of Government, Harvard University, Cambridge, Massachusetts, 2010. http://onlinepubs.trb.org/onlinepubs/sr/sr303Altshuler.pdf.

Remediating Inequity in Transportation Finance. David A. King, Graduate School of Architecture, Planning and Preservation, Columbia University, New York, November 2009. http://onlinepubs.trb.org/onlinepubs/sr/sr303King.pdf.

The Empirical Research on the Social Equity of Gas Taxes, Emissions Fees, and Congestion Charges. Lisa Schweitzer, School of Policy, Planning and Development, University of Southern California, Los Angeles, December 2009. http://onlinepubs.trb.org/onlinepubs/sr/sr303Schweitzer.pdf.

The Incidence of Public Finance Schemes. Sarah E. West, Department of Economics, Macalester College, St. Paul, Minnesota, October 2009. http://onlinepubs.trb.org/onlinepubs/sr/sr303West.pdf.

APPENDIX D

Symposium Agenda and Participants

EQUITY ISSUES IN FINANCING TRANSPORTATION SYMPOSIUM

Keck Center of the National Academies
500 Fifth Street NW, Washington, DC 20001

Wednesday, September 2, 2009

AGENDA

8:30 a.m.–8:45 a.m.	Welcome and Introduction, *Joseph Schofer, committee chair*
8:45 a.m.–10:15 a.m.	**Equity in Public and Transportation Finance and Remedial Actions** Moderator: *Sandi Rosenbloom, committee member*
8:45 a.m.–9:15 a.m.	Passing the Buck: Who Gains and Who Loses from Taxes and Other Fund-Raising Ideas? *Sarah West, Associate Professor, Macalester College, St. Paul, Minnesota, paper author*
9:15 a.m.–9:45 a.m.	Equity Consequences of Current and Emerging Transportation Finance Schemes *Lisa Schweitzer, Assistant Professor, University of Southern California, Los Angeles, paper author*
9:45 a.m.–10:15 a.m.	Remedies for Problems of Transportation Equity *David King, Assistant Professor of Urban Planning, Columbia University, New York, paper author*

10:15 a.m.–10:45 a.m.	Break
10:45 a.m.–noon	**Spatial Implications of Transportation Finance and an International Perspective on Transportation Finance Equity** Moderator: *Johanna Zmud, committee member*
10:45 a.m.–11:15 a.m.	Some Recent Experiences in Equity Analysis Using Choice-Based Spatial Economic Models *John Douglas Hunt, Professor of Transportation Engineering and Planning, University of Calgary, Alberta, Canada*
11:15 a.m.–11:45 a.m.	International Experience with Equity Issues in Transportation Finance *Peter Bonsall, Professor of Transport Planning, University of Leeds, United Kingdom*
Noon–1:00 p.m.	Lunch
1:00 p.m.–2:15 p.m.	**Equity, Public Opinion, and Politics** Moderator: *David Levinson, committee member*
1:00 p.m.–1:30 p.m.	Equity Concerns and Public Acceptance of Alternative Financing Mechanisms *Robert Cameron Mitchell, committee member*
1:30 p.m.–2:15 p.m.	Equity in Surface Transport Finance: A Political Perspective *Alan Altshuler, Distinguished Service Professor and Ruth and Frank Stanton Professor of Urban Policy and Planning, Harvard University, Cambridge, Massachusetts, paper author*
2:15 p.m.–2:45 p.m.	Break
2:45 p.m.–4:15 p.m.	**Case Studies in Transportation Finance Equity** Moderator: *Doug Duncan, committee member* Four guest presenters will each describe and discuss a transportation project in which they were involved in the decision-making process.

To the extent that equity issues were a factor in the decision-making process, these issues will be discussed in the talk.

- Funding Highway Infrastructure in Texas
  Mike Krusee, former chair, Transportation Committee, Texas House of Representatives
- Oregon's Road User Fee Program
  Bruce Starr, Senator, District 15, Oregon State Senate
- Keeping Rail to Dulles on Track
  James Dinegar, President and CEO, Greater Washington Board of Trade
- New York City's Congestion Pricing Initiative
  Bruce Schaller, Deputy Commissioner for Planning and Sustainability, New York City Department of Transportation

Discussant:

- *Mortimer Downey, President, Mort Downey Consulting, LLC, and Senior Advisor, Parsons Brinckerhoff*

4:15 p.m.–5:15 p.m. **Open Discussion**
Moderator: *Joseph Schofer, committee chair*

SYMPOSIUM PARTICIPANTS

Teresa Adams
U.S. Department of Transportation; University of Wisconsin-Madison

Nathan Austin
Morgan State University

Scott Baker
AECOM

Susan Binder
Senate Committee on Environment and Public Works

Jay Borwankar
U.S. Department of Transportation, Office of Inspector General

Jane Breakell
The Pew Charitable Trusts

Michael Broadus
U.S. Department of Transportation, Office of Inspector General

Piercarlo Brunino
KPMG

Michael Callow
Morgan State University

Kelly Clifton
National Center for Smart Growth

John Collins
Transportation Business, Law and Strategy

Qingbin Cui
University of Maryland

Patrick DeCorla-Souza
U.S. Department of Transportation, Federal Highway Administration

Liisa Ecola
RAND Corporation

Peter Einhorn
Travis County, Texas

Andrew Farkas
Morgan State University

Stephen Fitzroy
EDR Group, Inc.

Harold Foster
Prince George's County Planning Department

John D. Giorgis
U.S. Department of Transportation, Federal Transit Administration

Neil Gray
International Bridge, Tunnel and Turnpike Association

Robert Grow
Greater Washington Board of Trade

Paul Hanley
Public Policy Center, University of Iowa

JayEtta Hecker
Bipartisan Policy Center

Mike Heiligenstein
Central Texas Regional Mobility Authority

Phil Herr
Government Accountability Office

Max Inman
Mercator Advisors

Emilia Istrate
Brookings Institution

Jorianne Jernberg
U.S. Department of Transportation, Federal Transit Administration

Deborah Johnson
U.S. Department of Transportation

Jana Lynott
AARP Public Policy Institute

Victor McMahan
U.S. Environmental Protection Agency

Martine Micozzi
Transportation Research Board

Adrian Moore
Reason Foundation

Sachio Muto
Embassy of Japan

Masahiro Nishikawa
U.S. Department of Transportation, Federal Highway Administration, Office of Operations Research and Development

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Transportation Research Board

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Joshua Schank
Bipartisan Policy Center

Darren Timothy
U.S. Department of Transportation, Federal Highway Administration

Pamela Whitted
National Stone, Sand and Gravel Association

Lei Zhang
University of Maryland

APPENDIX E

National Surface Transportation Infrastructure Financing Commission's Assessment of the Equity of Finance Mechanisms

TABLE E-1 Equity of Selected Finance Mechanisms for Surface Transportation

Revenue Option	Equity Across Income Groups	Geographic Equity	User–Beneficiary Equity
Federal motor fuel tax	Fair	Fair	Very good
National general sales tax	Fair	Fair	Poor
General fund allocations	Good	Fair	Poor
Facility-level tolling and pricing	Good	Excellent	Excellent
Cordon pricing	Good	Excellent	Very good
Mileage-based user fee (VMT fee)	Good	Good	Excellent

NOTE: Adapted from National Surface Transportation Infrastructure Financing Commission (2009). The reader is referred to the commission's report for details of the methods used to arrive at the assessments of equity and other criteria. VMT = vehicle miles traveled.
SOURCE: National Surface Transportation Infrastructure Financing Commission, *Paying Our Way: A New Framework for Transportation Finance,* 2009. http://financecommission.dot.gov/.

Study Committee Biographical Information

Joseph L. Schofer, *Chair,* is Professor of Civil and Environmental Engineering and Associate Dean of the Robert R. McCormick School of Engineering and Applied Science at Northwestern University and Director of Northwestern's Infrastructure Technology Institute. He chaired the Department of Civil and Environmental Engineering from 1997 to 2002 and was director of research and interim director of the Transportation Center for various periods until 2008. Dr. Schofer's research interests focus on planning and management of transportation systems, particularly the provision and use of data and information for effective decision making and evaluation of systems, plans, and projects. His current research includes studies of the sustainability of transportation systems, decision support for infrastructure preservation and rehabilitation, privatization of transportation facilities, and transportation policy. Working through the Transportation Research Board (TRB), Dr. Schofer is actively engaged in planning and implementation of conferences and workshops focused on data and information resources for transportation planning and management. He is a member of the Strategic Highway Research Program 2 Technical Coordinating Committee for Capacity Research, and he serves on several TRB standing committees and cooperative research program project panels. He chaired the National Research Council Committee to Review the Bureau of Transportation Statistics' Survey Programs, which produced the report *Measuring Personal Travel and Goods Movement: A Review of the Bureau of Transportation Statistics' Surveys.* Dr. Schofer is a member of the Congestion Pricing Technical Group for the Chicago Civic Consulting Alliance, the Mayor's Pedestrian Advisory Committee (Chicago), the Transportation Committee of the Chicago Metropolitan Agency for Planning, the Citizen's Advisory Board of Pace (the suburban Chicago bus service provider), and

other advisory boards. He earned a BE from Yale University and an MS and a PhD from Northwestern University, all in civil engineering.

Jeffrey N. Buxbaum is a principal with Cambridge Systematics, Inc., in Cambridge, Massachusetts, where he leads the tolling and road-pricing practice. He has 29 years of experience in transportation planning and policy analysis and specializes in policy and technical studies related to transportation finance and road pricing and in traffic and revenue studies for highways and bridges. He has led transportation projects addressing areawide and corridor-level planning, traffic engineering, and financial planning. Mr. Buxbaum was principal investigator for a National Cooperative Highway Research Program synthesis study of key elements for public-sector decision making in public–private partnerships and was the principal investigator for a similar study funded by the University of Southern California's Keston Institute entitled "Protecting the Public Interest: The Role of Long-Term Concession Agreements for Providing Transportation Infrastructure." He led the Washington State Comprehensive Tolling Study, which examined the short-, medium-, and long-term roles that tolling could play in raising revenue and managing congestion, and a similar study for Connecticut. Mr. Buxbaum has also investigated the future of tolling in Oregon and worked with Oregon on policy questions surrounding tolling. He also led a study of a potential system of express toll lanes for the Twin Cities for the Minnesota Department of Transportation. In addition, he supported the Massachusetts Transportation Finance Commission in its efforts to create a sustainable transportation finance system for the commonwealth and contributed to studies for the Federal Highway Administration, the Hudson Institute, and the U.S. Chamber Foundation. Mr. Buxbaum is a member of the Transportation Research Board Committee on Congestion Pricing. He earned a BS in civil engineering from the Massachusetts Institute of Technology.

William A. V. Clark is Professor of Geography and Statistics in the Department of Geography at the University of California, Los Angeles (UCLA). He chaired the department from 1987 to 1991, and again from 1995 to 1997, and was associate director of UCLA's Institute for Social Science Research from 1977 to 1981. His other former positions include Belle Van Zuylen Professor at the University of Utrecht and Visiting Professor

of Geography at the Free University of Amsterdam, both in the Netherlands. Dr. Clark's research over the past two decades has addressed the internal changes in U.S. cities, notably the changes that occur in response to residential mobility and migration. His large-scale studies of demographic change in the neighborhoods of large metropolitan areas have examined the nature of population flows between cities and suburbs, white flight, and the impact of legal intervention on the urban mosaic. He is currently investigating the interaction of class, race, and geography in metropolitan areas. Dr. Clark was elected to the National Academy of Sciences in 2005. His other recent honors and awards include fellowship of the American Academy of Arts and Sciences in 2003, honorary fellowship of the Royal Society of New Zealand in 1997, and the Decade of Behavior Research Award in 2005. Dr. Clark is a member of the Transportation Research Board Executive Committee and its Subcommittee for National Research Council (NRC) Oversight and of the NRC Geographical Sciences Committee. He earned a BA and an MA from the University of New Zealand and a PhD from the University of Illinois, Urbana-Champaign, all in geography.

Douglas M. Duncan is an independent consultant. He previously served as county executive for Montgomery County, Maryland for three terms, from 1994 to 2006. Montgomery County is Maryland's largest jurisdiction, with an annual budget of $3.9 billion and 9,000 employees. During his tenure as county executive, Mr. Duncan served on the Board of Directors of the Metropolitan Washington Council of Governments and was a member of the Metropolitan Washington Air Quality Committee and of the Maryland Comprehensive Transit Plan Transit Advisory Panel. He took a particular interest in transportation and was involved in many of the decisions relating to the Maryland Intercounty Connector project, which includes a congestion pricing element. Mr. Duncan was a member of the city council of Rockville, Maryland, from 1982 to 1987 and was mayor of Rockville from 1987 to 1993. He has also held positions with Montgomery County's criminal justice commission and spent 13 years in the private sector working in the telecommunications industry. Mr. Duncan has received numerous awards for his leadership and management, including the 2006 Community Builder Award from the Greater Washington, D.C., Chapter of the Organization of Chinese

Americans; the 2004 Leadership Award from CASA of Maryland, the state's largest Latino and immigrant-based service and advocacy organization; the 2001 Award for Outstanding Public Leadership in Serving the Disability Community from the Commission on People with Disabilities; and the 2001 Elizabeth and David Scull Memorial Public Service Award from the Metropolitan Washington Council of Governments. Mr. Duncan earned a BA in psychology and political science from Columbia University.

T. Keith Lawton is principal, Keith Lawton Consulting, Inc., based in Newberg, Oregon. He was formerly with Metro, the metropolitan planning organization for the Portland, Oregon, region and held a variety of positions during his 29 years with the organization. Immediately prior to his retirement, Mr. Lawton was Director of Technical Services in the Planning Department. He led Metro's development of a comprehensive set of models for use by all jurisdictions in the Portland area as well as an integrated transportation–land use model that links households, population, and employment with Metro's detailed transportation model. He was also involved in the federally supported activity-based model development known as TRANSIMS at the Los Alamos National Laboratory. As part of his recent consulting work, Mr. Lawton was principal investigator on a study of changes in travel behavior and demand associated with managed lanes, which was requested by the American Association of State Highway and Transportation Officials' Standing Committee on Planning. Mr. Lawton is an emeritus member of the Transportation Research Board Committee on Transportation Demand and Forecasting and has served on several National Research Council committees, including the Committee on Physical Activity, Health, Transportation, and Land Use and the Committee to Review the Bureau of Transportation Statistics' Survey Programs. Currently, he serves on the Strategic Highway Research Program 2 Technical Coordinating Committee for Capacity Research. Mr. Lawton holds a BS in civil engineering from the University of Natal, South Africa, and an MS in civil and environmental engineering from Duke University.

David M. Levinson is Richard P. Braun–CTS Chair in Transportation Engineering and Associate Professor in the Department of Civil Engineering at the University of Minnesota. His research interests include

transportation economics and financing, transportation policy and deployment, integrated transportation and land use planning, travel behavior, and travel demand modeling. His recent research projects include a value pricing project and an evaluation of the MnPASS (I-394 high-occupancy toll lanes) for the Hubert Humphrey Institute of Public Affairs, measurement of the equity and efficiency of the Twin Cities ramp meter system for the Minnesota Department of Transportation, and a study of the needs of transportation-disadvantaged individuals. Dr. Levinson recently spent a year as a visiting academic at the Centre for Transport Studies, Imperial College, London. He has also worked as a transportation planner with the Montgomery County Planning Department of the Maryland–National Capital Park and Planning Commission. Dr. Levinson was the winner of the 2005 New Faculty Award presented by the Council of University Transportation Centers and the American Road and Transportation Builders Association. He is a member of the Transportation Research Board Committee on Transportation Demand Forecasting, and is editor of the *Journal of Transportation and Land Use*. Dr. Levinson received a BS from the Georgia Institute of Technology, an MS from the University of Maryland at College Park, and a PhD from the University of California, Berkeley, all in civil engineering.

Robert Cameron Mitchell is professor emeritus in the Graduate School of Geography at Clark University. Before joining the Clark faculty, he taught at Swarthmore College and at the Pennsylvania State University and was a senior fellow at Resources for the Future in Washington, D.C., from 1976 to 1987. In recent years, Dr. Mitchell has worked extensively with economists to design studies that measure the economic value of environmental policies involving nonmarketed goods, such as oil spill prevention and national water quality improvements. His publications in this field address measurement techniques, notably the use of surveys to value public goods (contingent valuation), and the application of these techniques to a range of environmental issues. Specific cases addressed in Dr. Mitchell's publications include the damages from the Exxon Valdez oil spill; siting of a high-level nuclear waste repository at Hanford; the Three Mile Island nuclear incident; and the reduction of trihalomethanes in the public drinking water system of a small southern Illinois town. Dr. Mitchell is a member of several professional associations, including

the American Sociological Association and the American Association for Public Opinion Research, and is a former member of the editorial board of *Public Opinion Quarterly*. He has served as a consultant to a wide range of companies and organizations, including the State of California's Department of Natural Resources; the Nature Conservancy; the Organisation for Economic Co-operation and Development; the U.S. Environmental Protection Agency; Social Impact Assessment, Inc., La Jolla, California; and the World Bank. In 1998, he received the Association of Environmental and Resource Economists' prize for a publication of enduring value for the book *Using Surveys to Value Public Goods,* authored jointly with Richard Carson. Dr. Mitchell earned a BA in history from the College of Wooster, an MDiv from Union Theological Seminary, and an MA and PhD in sociology from Northwestern University.

Sandra Rosenbloom is Professor of Planning, Adjunct Professor of Natural Renewable Resources, Adjunct Professor of Gerontology, and Adjunct Professor of Women's Studies at the University of Arizona. She served as director of the Roy P. Drachman Institute for Land and Regional Development Studies, a research and public service unit of the university, from 1990 to 2004. Before joining the University of Arizona faculty in 1990, she held an endowed chair as David Bruton Centennial Professor of Urban Design and Planning at the University of Texas, Austin. Dr. Rosenbloom's research explores the intersection between the social sciences and transportation, and she is internationally recognized for her scholarship on the implications for transportation and community development of societal trends—notably, suburbanization, the aging of society, the increased role in the labor force of women with children, and the growth of groups with special needs. She received the Transportation Research Board (TRB) 2004 Roy W. Crum distinguished service award for her outstanding achievements in the field of transportation research. Her other honors include the 1999 Roger Tate Award for pioneering research on mobility options for the elderly, and the government of New Zealand's 1998 Kitahura Lectureship. Her extensive international work has been supported by the European Community, the European Council of Ministers of Transport, the Organisation for Economic Co-operation and Development, and by the governments of Australia, France, and the Netherlands. Dr. Rosenbloom is a member of

the TRB Executive Committee and was a member of the Planning Committee for the 4th International Conference on Women's Issues in Transportation. She chaired the TRB Committee on Paratransit, has served on several other TRB committees and task forces, and was named a National Associate of the National Academies in 2004. Dr. Rosenbloom earned an AB in political science, an MA in public policy, and a PhD in political science, all from the University of California, Los Angeles.

Kenneth A. Small is Research Professor and Professor Emeritus in the Department of Economics at the University of California, Irvine. He chaired the department from 1992 to 1995 and served as Associate Dean of Social Sciences from 1986 to 1992. Dr. Small specializes in urban, transportation, and environmental economics, and his recent research has addressed urban highway congestion, measurement of value of time and reliability, effects of fuel efficiency standards, public transit financing, and fuel taxes. He conducted a project on travel demand modeling for California's 91 Express Lanes for the U.S. Department of Transportation (DOT), investigated the viability of value pricing demonstrations for the U.S. DOT and the California DOT, and studied the viability of public transit with road-pricing measures for the University of California Energy Institute. He has also recently studied travel reliability, transit pricing, and the effects of fuel prices and fuel-efficiency regulation on travel behavior. Dr. Small was associate editor of *Transportation Research, Part B: Methodological* for 4 years and serves on the editorial boards of that journal and of *Regional Science and Urban Economics, Journal of Urban Economics, Transportation,* and *Journal of Transport Economics and Policy*. He has served on several National Research Council committees, including the Committee for a Study on Urban Transportation Congestion Pricing. He received the Distinguished Member Award of the American Economic Association's Transportation and Public Utilities Group in 1999 and the Transportation Research Forum's Distinguished Transportation Research Award in 2004. Dr. Small has advised the European Union, the World Bank, and other government organizations. He earned a BS in physics and an AB in mathematics from the University of Rochester and an MA in physics and a PhD in economics from the University of California, Berkeley.

Brian D. Taylor is Professor and Chair of Urban Planning and Director, Institute of Transportation Studies, at the University of California, Los Angeles (UCLA). His research addresses transportation policy and planning. In particular, his work explores how society pays for transportation systems and how these systems serve the needs of people with low levels of mobility because of low income, disability, location, or age. Much of Dr. Taylor's research focuses on the politics of transportation finance, including the history of freeway planning and finance, emerging trends in highway finance, the linking of subsidies to public transit performance, and the measurement of equity in public transit finance. His research also examines travel demographics, including patterns of public transit use by the central city poor and the constrained travel patterns of working women. Dr. Taylor recently coauthored a study that examined the high-occupancy toll lanes on State Route 91 in Orange County, California, and compared how tolls and sales taxes affect the county's lower income residents. In 2005, he coauthored a review and synthesis of road-use metering and charging systems commissioned by the National Research Council (NRC) Committee for the Study of the Long-Term Viability of Fuel Taxes for Transportation Finance. Before joining the UCLA Department of Urban Planning in 1994, Dr. Taylor held assistant professor and visiting lecturer positions at the University of North Carolina at Chapel Hill and was a transportation planner with the Metropolitan Transportation Commission in Oakland, California. He is a member of the American Planning Association, holds professional certification from the American Institute of Certified Planners, and is a member of the Blue Ribbon Panel of Transportation Experts that advises the National Surface Transportation Policy and Revenue Study Commission. He was a member of the NRC Committee for a Study of Contracting Out Transit Services and is currently serving on the Committee for a Study of Potential Energy Savings and Greenhouse Gas Reductions from Transportation. Dr. Taylor earned a BA in geography from the University of California, Los Angeles (UCLA), an MS in civil engineering and an MCP in city and regional planning from the University of California, Berkeley, and a PhD in urban planning from UCLA.

Beverly G. Ward is a United We Ride Coordination Ambassador with the National Resource Center for Human Service Transportation Coordination and is based in Tampa, Florida. The National Resource Center is operated by the Community Transportation Association of America under a cooperative agreement with the Federal Transit Administration. In her position as ambassador on human service and public transport coordination for Federal Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont), Dr. Ward works with regional, state, and local officials; transit operators; and mobility advocates to improve coordinated human service and public transportation. She was formerly an associate in research at the University of South Florida for more than 17 years. Her research at the university's Louis de la Parte Florida Mental Health Institute, department of anthropology, and Center for Urban Transportation Research addressed policies, systems, and practices relating to housing, mobility, and access. In particular, Dr. Ward analyzed the social impacts of housing and transportation policies on an aging population, persons with disabilities, women, and low-income and minority communities. Her research has been supported by the Centers for Disease Control and Prevention, the National Science Foundation, the Florida Department of Transportation, and the Federal Highway Administration. Before taking up her position at the University of South Florida, Dr. Ward was assistant director of the Alabama Transit Association in Birmingham. She is a member of the Transportation Research Board Committee on Environmental Justice in Transportation and served from 2004 to 2005 on the National Research Council Committee on Research on Women's Issues in Transportation: A Conference. She is also a member of the Harvard Civil Rights Project Transportation Equity Advisory Board. Dr. Ward earned a BA in psychology and film–drama from Vassar College, an MPA from the University of Alabama at Birmingham, and a PhD in applied anthropology from the University of South Florida.

Johanna P. Zmud is a senior policy researcher with the RAND Corporation in Arlington, Virginia. She was formerly president of NuStats, LLC, a survey science consultancy specializing in transportation studies. Her areas of expertise include opinion and behavior measurement, survey methods research, communication research, travel survey design and analysis, and

public transit markets. Dr. Zmud has 22 years of experience in survey design, implementation, and statistical analysis and has managed more than 30 household travel surveys and 100 other surveys, including surveys on tolling and road pricing. She was principal investigator for a recent National Cooperative Highway Research Program (NCHRP) synthesis study that summarized and analyzed public opinion data on tolls and road pricing across the United States and internationally. Dr. Zmud has published papers on a variety of survey-related topics, including quality in survey research among non–English-speaking populations, instrument design, and stated preference applications. She chairs the NCHRP Project Panel on Improved Framework and Tools for Highway Pricing Decisions and the Data and Information Systems section of the Transportation Research Board (TRB) and is a member of several other TRB committees and panels. She is also a former chair of the TRB Committee on Travel Survey Methods and served on the National Research Council Committee on Safety Belt Technology. Dr. Zmud earned a BS from East Carolina University, an MS from the University of Maryland, and a PhD in communication research from the University of Southern California's Annenberg School for Communication and Journalism.

Equity of Evolving Transportation Finance Mechanisms

Transportation plays a key role in the nation's economy and in people's ability to participate in society. As traditional sources of funding for the nation's surface transportation system fail to keep pace with demand, mechanisms based on tolling and road use metering—that is, road pricing—have proliferated. As with all transportation policies, these strategies raise questions about equity.

The committee that developed this report concludes that generalizations about the fairness of high-occupancy toll lanes, cordon tolls, and other evolving mechanisms oversimplify the reality and are misleading. The fairness of a given type of finance mechanism depends on its structure, the transportation alternatives offered to users, and the aspects of equity that are deemed most important.

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