User and Non-User Benefit Analysis for Highways

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American Association of State Highway and Transportation Officials

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Foreword

This manual and accompanying CD-ROM provide a valuable resource for people who analyze the benefits and costs of highway projects. These analysts have the difficult and often cumbersome responsibility of performing complex benefit–cost calculations and presenting the results to decision makers, the media, and the public. It has been the practice of the American Association of State Highway and Transportation Officials (AASHTO) to publish materials to support transportation planners in state, regional, and local governments who evaluate highway investments. This manual is the merger of two, related research efforts that should simplify the efforts of these planners.

The first of these efforts, NCHRP Project 02-23, "User Benefit Analysis for Highways," was conducted by the research team of ECONorthwest, in association with Kittelson & Associates, Inc., and Parsons Brinckerhoff, Inc. This effort yielded a major update of the original, 1977 AASHTO user benefit manual. The update incorporated new theory, new measurement methodologies, and new procedural guidance for the measurement of user benefits associated with highway improvements. It also introduced a CD-ROM containing the manual itself, worksheets and a software "Wizard" for guiding the analyst through the user benefit measurement process. The user benefit manual was adopted and published by AASHTO in 2003, and is commonly referred to as the "Red Book".

In response to requests by users of the Red Book, a second research effort was undertaken as an extension of NCHRP Project 02-23. It is entitled "Non-User Benefit Analysis for Highways: A Supplement to AASHTO's User Benefit Analysis for Highways" and was completed in 2007. Its purpose was to add non-user benefit measurement capability to the user-benefit capabilities of the AASHTO Red Book. This project was supported by an agreement between NCHRP and the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the National Academy of Sciences. The research team was lead by ECONorthwest, with assistance from Kittelson & Associates. Inc.

By combining these two, related resources, practitioners now have a single, integrated resource to assist in evaluating highway improvements that incorporates both user and non-user benefits. The theory and methods for estimating the benefits and costs of highway projects are presented in an integrated fashion, first for user benefits and then for non-user benefits. The CD-ROM contains an electronic copy of this manual in Portable Document Format (PDF). It also contains practical materials and resources for conducting and presenting benefit–cost analyses of highway improvements. These resources include the following:

- *Analytical Tools*. An interactive Microsoft Excel "wizard" is provided. This wizard takes the user through a series of dialogs where information about a project is collected and then calculates and presents the results of a benefit–cost analysis in a printable format. A series of Microsoft Excel spreadsheets also are included to help analysts organize data and make calculations to carry out

benefit–cost analyses. These spreadsheets are electronic versions of the calculation worksheets in the manual. The analyst can choose to examine just user benefits, non-user benefits or both. In addition, experience with the use of the Wizard by the research team and planners in the field has been exploited to improve the Wizard interface and add more flexibility to characterize highway projects.

- *Presentation Materials*. Microsoft PowerPoint slideshows that can be easily customized are provided to help practitioners prepare presentations about the results of benefit–cost analyses of highway projects. The slideshows complement the guidebook and can be used for presentations to decision-makers, the public, and the media. A library of relevant, royalty-free images for use in presentations and documents is also provided.

- *A Resource Library*. The CD-ROM contains resources to support practitioners as they evaluate the costs and benefits of highway projects. These resources include a glossary of terms used in the manual, a list of transportation organizations and website links where additional data may be found for benefit–cost analyses, and a list of websites that contain useful electronic maps and geographic information systems data.

Preface

This document updates and expands the American Association of State Highway and Transportation Officials (AASHTO) *User Benefit Analysis for Highways*, also known as the Red Book. This AASHTO publication helps state and local transportation planning authorities evaluate the economic benefits of highway improvements. This update incorporates improvements in user-benefit calculation methods and, for the first time, provides guidance for evaluating important non-user impacts of highways. Previous editions of the Red Book provided guidance regarding user benefit measurement only. This update provides a framework for project evaluations that accurately account for both user and non-user benefits.

The preparation of this update was done on behalf of the National Academy of Sciences, National Cooperative Highway Research Program (NCHRP) under project Number 02-23. This project is supported by an agreement between NCHRP and the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the National Academy of Sciences. The prime contractor for the research is ECONorthwest.

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CHAPTER 1

Overview

Preface: Why Use This Manual?

Transportation planners and policy makers are charged with the responsibility of identifying and selecting the projects that deserve implementation. Often, there are competing project designs to serve the same purpose. The project-selection process is complicated further, in most cases, by limited budgets and a host of candidate projects that might benefit the community. In these situations, analytic tools are needed to evaluate the relative merits of each candidate project and ultimately provide a means for allocating resources to that set of projects that will maximize the total benefits. The purpose of this manual is to assist in this process by providing the tools necessary to evaluate the costs and benefits related to transportation improvement projects.

General Purpose

There are many different types of benefits related to transportation improvements. Part One of this manual focuses on *user benefits*, or benefits that are enjoyed by travelers that are directly affected by a transportation improvement. User benefits are determined by travel costs in three distinct areas: travel time costs, operating costs, and accident costs. Taken together, the total of these costs is essentially the price that travelers must pay to travel. When a comparison is made between the costs of traveling and the number of trips taken at each price level, a relationship is determined between the cost of travel and the demand for trips. When all users are aggregated together, the difference between the travel "price" that travelers are required to pay and what they would have been willing to pay is the user benefit affiliated with the trip. Any reduction in travel costs (i.e., trip price), then, will result in a benefit to the traveler. For example, with a cost reduction, users who were already making the trip receive the benefit of making the same trip at a lower cost.

Focusing first on user benefits is appropriate because most of the economic benefits of transportation projects come from the reduction in user costs. When trips in a particular corridor are perceived as costly, perhaps due to long travel times or high accident rates, travelers sacrifice taking some trips in that corridor, and the economic activity associated with those trips is lost. Reducing user costs makes the

perceived cost of travel cheaper, and facilitates trip making and the accompanying economic activities. By balancing these accompanying user benefits against project costs, we can determine which projects will provide the optimal level of net benefits to society.

Obviously, however, a project will also impact people other than direct users of the facility. These effects are referred to as *indirect benefits* or *non-user benefits*. Examples of indirect benefits include environmental impacts, effects on urban growth, economic influences, and the distribution of costs and benefits attached with the project. The methods for measuring non-user benefits are different in some ways from the methods used to measure user benefits. To facilitate exposition of those differences, non-user benefit measurement is discussed in Part 2 of this manual, beginning at Chapter 8.

Regardless of whether one examines a project's benefits from the user or non-user perspective, the general framework for measuring project benefits is similar. Project benefit estimation requires that each project being evaluated be compared against some alternative outcome. The alternative outcome could be a "Base Case" or "No-Build Scenario" that maintains current facility conditions into the future. The alternative scenario could also be a different improvement project. In either case, to conduct the project benefit analysis, benefit levels are estimated for two different scenarios. When measuring user benefits, for example, the difference in user costs (that is, the combined effect on user benefits due to changes in travel costs, operating costs, and accident costs) is the impact to the users linked to the project. Since an improvement should result in a *reduction* in these costs, the difference in these cost levels is used to determine the total user benefit of the project. Measurement of non-user benefits also requires a comparison of the project outcome with some alternative outcome. The non-user project benefits are also measured as the difference of the two outcomes.

Complicating Issues

The preceding discussion provides the simplest overview of determining the user benefits connected to the transportation projects. To summarize, this manual provides the tools needed to estimate benefits from changes in travel time costs, operating costs, and accident costs—the factors that directly affect travelers' transportation choices.

Naturally, applying these principles to specific project applications is a much more complicated endeavor in the real world. Complicating issues that need to be addressed include:

- How do you measure the benefits of something that does not yet exist, especially when it interacts in a complicated way with other products or services?

- What do you do if some benefits or costs are not susceptible, at all, to measurements? What if the saving or loss of human life potentially is involved?

- What if the benefits and/or costs play out over a period of time? How should these delays be incorporated in the analysis?