NCHRP

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

SYNTHESIS 311

Performance Measures of Operational Effectiveness for Highway Segments and Systems

A Synthesis of Highway Practice

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP SYNTHESIS 311

Performance Measures of Operational Effectiveness for Highway Segments and Systems

A Synthesis of Highway Practice

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TRANSPORTATION RESEARCH BOARD

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FOREWORD

By Staff
Transportation
Research Board

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research and much from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, *Synthesis of Highway Practice*.

The synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

This report of the Transportation Research Board will be of interest to local, regional, state, and federal officials, as well as to other transportation professionals who work with them in examining the use of performance measures for the monitoring and operational management of highway segments and systems. The current state of the practice includes a wide and varied approach to performance measures, with more than 70 performance measures being identified in this synthesis. Those identified as being used the most successfully were those related to conditions experienced by the traveler, such as travel time, speed, and delay. Based on the survey results, the dimensions of operational performance that were the most relevant were the quantity of travel and the quality of travel.

This synthesis contains overview information culled from survey responses from state transportation agencies and metropolitan planning organizations. This information was combined with that from recent literature findings and ongoing research to address current practices across the nation.

A panel of experts in the subject area guided the work of organizing and evaluating the collected data and reviewed the final synthesis report. A consultant was engaged to collect and synthesize the information and to write this report. Both the consultant and the members of the oversight panel are acknowledged on the title page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

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Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of Kimberly Fisher, Senior Program Officer, Transportation Research Board; Lisa A. Klein, Transportation Planner, Metropolitan Transportation Commission; Mark C. Larson, Director of Measurement, Office of Performance Planning and Measurement, Minnesota Department of Transportation; Henry Lieu, Transportation Engineer, Federal Highway Administration; Gordon Morgan, Manager, Highway Data Section, Florida Department of Transportation; Vincent Pearce, Office of Travel Management, Federal Highway Administration; James L. Powell, ITS Coordinator—Systems Central Region, Parsons Transportation Group; Jim Skinner, Planner, Program and Policy Analysis Bureau, Montana Department of Transportation; and William Walsek, Planning Director, Maryland State Highway Administration.

This study was managed by Donna Vlasak, Senior Program Officer, who worked with the consultant, the Topic Panel, and the Project 20-5 Committee in the development and review of the report. Assistance in project scope development was provided by Stephen F. Maher and Jon Williams, Managers, Synthesis Studies. Don Tippman was responsible for editing and production. Cheryl Keith assisted in meeting logistics and distribution of the questionnaire and draft reports.

Crawford F. Jencks, Manager, National Cooperative Highway Research Program, assisted the NCHRP 20-5 Committee and the Synthesis staff.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

PERFORMANCE MEASURES OF OPERATIONAL EFFECTIVENESS FOR HIGHWAY SEGMENTS AND SYSTEMS

SUMMARY

This synthesis examined the use of performance measures for the monitoring and operational management of highway segments and systems. The current state of the practice includes a wide and varied approach to performance measures, with more than 70 performance measures identified in this synthesis. An assessment of the relative strengths and weaknesses of these measures was performed. The measures that were identified as being used the most successfully directly reported conditions experienced by the traveler, such as travel time, speed, and delay. Measures that are derived from these basic units, primarily indices, were found to be less relevant to the operational environment than to policy planners. Based on the results of the survey of state departments of transportation and metropolitan planning organizations, the dimensions of operational performance that were the most relevant were the quantity of travel and the quality of travel.

Through this synthesis of research and practice, several research needs were identified to enhance and expand the state of the practice. These needs include developing common definitions for emerging performance measures such as travel reliability and other indices, as well as data quality and reporting guidelines that consider estimated standard errors. Guidelines for forecasting and considering alternate policy and development scenarios, and measures that support evacuations from natural and man-made disasters are also needed.