

# TCRP

## REPORT 90

TRANSIT  
COOPERATIVE  
RESEARCH  
PROGRAM

Sponsored by  
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Transit Administration

## Bus Rapid Transit

### *Volume 1: Case Studies in Bus Rapid Transit*



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**TCRP REPORT 90**

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**Bus Rapid Transit**

***Volume 1: Case Studies in  
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## TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions*, published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transportation Association (APTA), *Transportation 2000*, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA, The National Academies, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at any time. It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended end users of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

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### NOTICE

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The members of the technical advisory panel selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and while they have been accepted as appropriate by the technical panel, they are not necessarily those of the Transportation Research Board, the National Research Council, the Transit Development Corporation, or the Federal Transit Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

### Special Notice

The Transportation Research Board of The National Academies, the National Research Council, the Transit Development Corporation, and the Federal Transit Administration (sponsor of the Transit Cooperative Research Program) do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the clarity and completeness of the project reporting.

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# FOREWORD

By *Gwen Chisholm*  
*Staff Officer*  
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*TCRP Report 90: Bus Rapid Transit*, which is published as a two-volume set, identifies the potential range of bus rapid transit (BRT) applications through 26 case studies and provides planning and implementation guidelines for BRT. This report will be useful to policy-makers, chief executive officers, and senior managers.

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Increasing levels of urban congestion create the need for new transportation solutions. A creative, emerging public transit solution is BRT. While a precise definition of BRT is elusive, it is generally understood to include bus services that are, at a minimum, faster than traditional “local bus” service and that, at a maximum, include grade-separated bus operations. The essential features of BRT systems are some form of bus priority, faster passenger boarding, faster fare collection, and a system image that is uniquely identifiable. BRT represents a way to improve mobility at relatively low cost through incremental investment in a combination of bus infrastructure, equipment, operational improvements, and technology.

Despite the potential cost and mobility benefits, however, the transportation profession lacks a consolidated and generally accepted set of principles for planning, designing, and operating BRT vehicles and facilities. Transit agencies need guidance on how to successfully implement BRT in the political, institutional, and operational context of the United States. *Volume 1: Case Studies in Bus Rapid Transit* provides information on the potential range of BRT applications, planning and implementation background, and system description, including the operations and performance elements. *Volume 2: Implementation Guidelines* discusses the main components of BRT and describes BRT concepts, planning considerations, key issues, the system development process, desirable conditions for BRT, and general planning principles. It also provides an overview of system types.

This report was prepared by Herbert Levinson of New Haven, Connecticut, and DMJM+HARRIS of Fairfax, Virginia, in association with Scott Rutherford of Seattle, Washington; Rodney L. Smith of Carter & Burgess, Inc., Houston, Texas; John Cracknell of Maidenhead, United Kingdom; and Richard Soberman of Toronto, Canada. *Volume 1* examines BRT systems and services in 26 cities located in North America, Australia, Europe, and South America; the 26 case studies are on the accompanying CD-ROM (*CRP-CD-31*). The report covers a geographically diverse group of communities and a broad range of applications. For each city’s BRT system, information is provided on design features, operating practices, institutional arrangements, costs, benefits, and relevance.

Both volumes issued under *TCRP Report 90* can be found on the TRB website at [national-academies.org/trb](http://national-academies.org/trb).

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Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
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