

TRANSIT COOPERATIVE RESEARCH PROGRAM

Sponsored by the Federal Transit Administration

Responsible Senior Program Officer: Gwen Chisholm Smith

Research Results Digest 104

SYNTHESIS OF INFORMATION RELATED TO TRANSIT PROBLEMS

This is a staff digest of the progress and status of TCRP Project J-7, "Synthesis of Information Related to Transit Problems," for which the Transportation Research Board is the agency conducting the research. Individual studies for the project are managed by Donna L. Vlasak, Senior Program Officer, with assistance from Jon M. Williams, Program Director, Synthesis Studies, serving under the Studies and Special Programs Division of the Transportation Research Board, Stephen R. Godwin, Director.

BACKGROUND

The Transit Cooperative Research Program (TCRP) was established in 1992. The U.S. Department of Transportation proposed the TCRP, and it was authorized in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. The program was reauthorized in the Transportation Equity Act for the 21st Century (TEA-21) and the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). On May 13, 1992, a memorandum agreement outlining operating procedures was executed by three cooperating organizations: the Federal Transit Administration (FTA); the National Academies, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a non-profit educational and research organization established by the American Public Transportation Association (APTA). The memorandum agreement was updated on January 12, 1999.

INTRODUCTION

Transit administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experi-

You can submit your recommendation at: <http://www.trb.org/SynthesisPrograms/Suggest.aspx> under "Synthesis Topic Submittals." Topics suggested must be accompanied by a brief (one or two paragraphs) scope statement, including a discussion of the problem. A title (preferably 10 words or less) and the name and affiliation of the submitter are also necessary. Identification of information sources is appreciated. If a topic is not selected, it must be resubmitted the following year to be considered. Annually, synthesis topics are typically due by the end of March. The TCRP Oversight Panel for the project meets in May/June to select new topics based on funding available.

Interested in writing a synthesis? For details contact Donna L. Vlasak by e-mail at dvlasak@nas.edu or by phone at 202/334-2974 or Jon Williams at jwilliams@nas.edu or by phone at 202/334-3245.

ence 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 the transit industry. Much of it derives from research or 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 transit community, the Transit Cooperative Research Program Oversight and Project Selection (TOPS) Committee authorized the Transportation Research Board to undertake a continuing study. This study, TCRP Project J-7, "Synthesis of Information Related to Transit Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute a TCRP report series, Synthesis of Transit Practice.

THE SYNTHESIS PROGRAM

This 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 current knowledge available on those measures found to be the successful in resolving specific problems. To develop these syntheses in a comprehensive manner and to ensure inclusion of significant knowledge, TRB employs a consultant to gather and analyze available information from numerous sources, including a large number of transit agencies. A panel of experts in the subject area is established to guide the consultants in organizing and evaluating data collected on each topic and to review the synthesis report.

For each topic, the project objectives are (1) to locate and assemble documented information; (2) to learn what practice has been used for solving or alleviating problems; (3) to identify all ongoing research; (4) to learn what problems remain largely unsolved; and (5) to organize, evaluate, and document the useful information that is acquired.

Each synthesis is an immediately useful document that records practices that were acceptable within the limitations of the knowledge available at the time of

its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that which is now on hand; eventually the synthesis may need to be updated or redone. If you believe that a synthesis should be updated, it would be appreciated if you would contact TRB and let us know.

Selection of Topics

TCRP Project Panel J-7 meets each year (typically in May) to select topics for study using funds from the upcoming fiscal year. The membership of this committee is given in Table 1. Current funding allows for initiation of approximately seven syntheses per year.

The following factors are considered in the selection process for synthesis topics:

- The problem should be widespread enough to generate broad interest in the synthesis.
- The topic should be timely and critical with respect to economic impact, safety, or social impact.
- The topic is appropriate if current practice is nonuniform or inconsistent from agency to agency, or if the validity of some practices appears to be questionable.
- The quality and quantity of useful available information should indicate a need to organize and compress that which has already been learned and written on the topic.
- The topic should not be one where ongoing research or other activities in progress might be expected to render the synthesis obsolete shortly after completion.

The continued success of this project depends on a constant supply of worthy synthesis topics solicited annually from a variety of sources, including transit officials, equipment and service suppliers, research organizations, FTA, APTA, and TRB committees. The interest of those who have recommended topics is sincerely appreciated, and they are urged to continue.

Conduct of the Studies

Throughout the year, following the J-7 project panel's selection of topics, studies are initiated in the order of priority assigned by the committee. A panel consisting of practitioners and researchers is formed for each topic. At its first meeting, this topic panel thoroughly discusses the topic, refines the tentative scope, suggests sources of information, and selects the consultant based on expression of interest received in response to an industry-wide solicitation.

Table 1 TCRP Project Panel J-7

	Name	Affiliation
Chair	Dwight A. Ferrell	Metropolitan Atlanta Rapid Transit Authority, Atlanta, GA
Member	Debra W. Alexander	Capital Area Transportation Authority, Lansing, MI
Member	Donna DeMartino	San Joaquin Regional Transit District, Stockton, CA
Member	Mark W. Fuhrmann	Metro Transit, Minneapolis/St. Paul, MN
Member	Robert H. Irwin	Consultant, Sooke, BC, Canada
Member	Jeanne Krieg	Eastern Contra Costa Transit Authority, Antioch, CA
Member	Paul J. Larrousse	National Transit Institute, New Brunswick, NJ
Member	David A. Lee	Connecticut Transit, Hartford, CT
Member	Frank T. Martin	Atkins, Tallahassee, FL
Member	Bradford J. Miller	Pinellas Suncoast Transit Authority (PSTA), St. Petersburg, FL
Member	Hayward M. Seymore, III	Kitsap Transit, Bremerton, WA
Member	Frank Tobey	First Transit, Inc., Moscow, TN
Member	Pam Ward	Consultant, Ottumwa, IA
Liaison	Michael Baltes	Federal Transit Administration, Washington, D.C.
Liaison	Jarrett Stoltzfus	Federal Transit Administration, Washington, D.C.
Liaison	Kevin Dow	American Public Transportation Association, Washington, D.C.
Liaison	Jennifer A. Rosales	Transportation Research Board, Washington, D.C.

Following this meeting, an agreement is negotiated with the consultant to gather information on the topic, synthesize it, and draft a report. Typically, the agreement covers a period of 9 months. Information gathering and preparation of the first draft of the synthesis report usually takes 5 months. This draft is then reviewed by the topic panel with the consultant, often at a second panel meeting. Subsequent drafts and a meeting are scheduled if needed, although this rarely occurs.

After the staff is substantially satisfied with the report, a final draft is sent to the members of the TCRP Project Panel J-7 for their approval. At the same time, members from the topic panel have their last chance to review the report. Comments from these reviews are incorporated into the final report, which is usually published as a TCRP Synthesis of Transit Practice.

Studies in Progress as of January 2012

Work is currently under way on the topics listed in Table 2. Questions on these topics should be addressed to the Project Study Manager, Donna L. Vlasak (e-mail: dvlasak@nas.edu and 202/334-2974) or the Synthesis Studies Manager, Jon Williams (e-mail: jwilliams@nas.edu and 202/334-3245).

Table 2 Synthesis Studies—In Progress as of January 2012

No.	Title
SA-26	Implementation and Outcomes of Fare-Free Transit Systems
SA-27	Off-Board Transit Fare Payment Using Proof-of-Purchase Verification
SA-28	Use of Electronic On-Street Signage in Transit
SA-29	Energy Savings Strategies for Transit Agencies
SB-19	Ridesharing as a Complement to Transit
SB-20	Proactive Use of Social Media in Public Transportation
SB-21	Transit Station and Stop Adoption Programs
SB-22	Use of Market Research Panels in Transit
SB-23	Integrating Passenger Ferry Service with Mass Transit
SD-04	Rail Transit Track Inspection Practices
SE-06	Elevator and Escalator Maintenance and Safety Practices
SF-15	Practices for Wayside Rail Transit Worker Protection
SF-16	Improving Transit Safety Through Rewards and Discipline
SF-17	Transit Operator Distraction Policies

Available Publications

The Syntheses of Transit Practice that have been completed under this project are listed in Table 3. Copies of these syntheses can be obtained from the Publications Office, Transportation Research Board, 500 Fifth Street, N.W., Washington, D.C., 20001; by calling 202/334-3213; and through the Internet at:

<http://www.trb.org/bookstore>. Please send check orders to: TRB, Dept. 289, Washington, D.C., 20055 or fax to: 202/334-2519.

Index of Topic Studies

Table 4 is a key word index of published syntheses and studies currently in progress.

Table 3 Published TCRP Syntheses

No.	Title/Pages/Price
1	Safe Operating Procedures for Alternative Fuel Buses (1993) 48 pp., \$16.00
2	Low-Floor Transit Buses (1994) 43 pp., \$12.00
3	Incentive Programs to Improve Transit Employee Performance (1994) 44 pp., \$12.00
4	Integration of Bicycles and Transit (1994) 58 pp., \$12.00
5	Management Information Systems (1994) 77 pp., \$19.00
6	The Role of Performance-Based Measures in Allocating Funding for Transit Operations (1994) 52 pp., \$11.00
7	Regulatory Impacts on Design and Retrofit of Bus Maintenance Facilities (1994) 50 pp., \$12.00
8	Retrofit of Buses to Meet Clean Air Regulations (1994) 48 pp., \$12.00
9	Waste Control Practices at Bus Maintenance Facilities (1995) 26 pp., \$10.00
10	Bus Route Evaluation Standards (1995) 54 pp., \$12.00
11	System-Specific Spare Bus Ratios (1995) 46 pp., \$12.00
12	Transit Bus Service Line and Cleaning Functions (1995) 48 pp., \$14.00
13	Risk Management for Small and Medium Transit Agencies (1995) 31 pp., \$13.00
14	Innovative Suburb-to-Suburb Transit Practices (1995) 50 pp., \$14.00
15	System-Specific Spare Rail Vehicle Ratios (1995) 43 pp., \$13.00
16	Changing Roles and Practices of Bus Field Supervisors (1996) 45 pp., \$13.00
17	Customer Information at Bus Stops (1996) 64 pp., \$18.00
18	Bus Occupant Safety (1996) 55 pp., \$15.00
19	Passenger Transfer System Review (1996) 37 pp., \$14.00
20	Transit-Focused Development (1997) 55 pp., \$16.00
21	Improving Transit Security (1997) 36 pp., \$15.00
22	Monitoring Bus Maintenance Performance (1997) 48 pp., \$16.00
23	Inspection Policy and Procedures for Rail Transit Tunnels and Underground Structures (1997) 95 pp., \$25.00
24	AVL Systems for Bus Transit (1997) 47 pp., \$16.00
25	Light Rail Vehicle Compression Requirements (1997) 34 pp., \$15.00
26	Bus Transit Fare Collection Practices (1997) 29 pp., \$14.00
27	Emergency Preparedness for Transit Terrorism (1997) 73 pp., \$21.00
28	Managing Transit Construction Contract Claims (1998) 50 pp., \$17.00
29	Passenger Counting Technologies and Procedures (1998) 50 pp., \$23.00
30	ADA Paratransit Eligibility Certification Practices (1998) 38 pp., \$16.00
31	Paratransit Contracting and Service Delivery Methods (1998) 35 pp., \$16.00
32	Transit Advertising Revenue: Traditional and New Sources and Structures (1998) 58 pp., \$20.00
33	Practices in Assuring Employee Availability (1999) 69 pp., \$27.00
34	Data Analysis for Bus Planning and Monitoring (2000) 62 pp., \$27.00
35	Information Technology Update for Transit (2000) 98 pp., \$31.00
36	Identifying and Reducing Fraudulent Third Party Tort Claims Against Public Transit Agencies (2000) 58 pp., \$25.00
37	Communicating with Persons with Disabilities in a Multimodal Environment (2001) 48 pp., \$26.00
38	Electronic Surveillance Technology on Transit Vehicles (2001) 57 pp., \$28.00
39	Transportation on College and University Campuses (2001) 62 pp., \$28.00
40	A Challenged Employment System: Hiring, Training, Performance Evaluation, and Retention of Bus Operators (2001) 72 pp., \$29.00
41	The Use of Small Buses in Transit Service (2002) 72 pp., \$15.00
42	Use of Flexible Funds for Transit Under ISTEA and TEA-21 (2002) 40 pp., \$15.00

Table 3 (Continued)

No.	Title/Pages/Price
43	Effective Use of Transit Websites (2002) 79 pp., \$16.00
44	Training for On-Board Bus Electronic (2002) 63 pp., \$15.00
45	Customer-Focused Transit (2002) 100 pp., \$17.00
46	Diversity Training Initiatives (2003) 59 pp., \$15.00
47	Corporate Culture as the Driver of Transit Leadership Practices (2003) 91 pp., \$17.00
48	Real-Time Bus Arrival Information Systems (2003) 61 pp., \$15.00
49	Yield to Bus Programs—State of the Practice (2003) In Press
50	Use of Rear-Facing Position for Common Wheelchairs on Transit Buses (2003) 42 pp., \$14.00
51	Transit Advertising Sales Agreements (2004) 99 pp., \$18.00
52	Transit Operator Health and Wellness Programs (2004) 80 pp., \$17.00
53	Operational Experiences with Flexible Services in Transit Systems (2004) 57 pp., \$16.00
54	Maintenance Productivity Practices (2004) 92 pp., \$18.00
55	Geographic Information Systems Applications in Transit (2004) 60 pp., \$16.00
56	Performance-Based Measures in Transit Fund Allocation (2004) 74 pp., \$16.00
57	Computer-Aided Scheduling and Dispatch in Demand-Responsive Transit Services (2004) 79 pp., \$17.00
58	Emergency Response Procedures for Natural Gas Transit Vehicles (2005) 53 pp., \$15.00
59	Strategic Planning and Management in Transit Agencies (2005) 44 pp., \$15.00
60	Practices in No-Show and Late Cancellation Policies for ADA Paratransit (2005) 49 pp., \$16.00
61	Maintenance Staffing Levels for Light Rail Transit (2005) 41 pp., \$16.00
62	Integration of Bicycles and Transit (2005) 70 pp., \$17.00
63	On-Board and Intercept Transit Survey Techniques (2005) 91 pp., \$19.00
64	Bus Use of Shoulders (2006) 91 pp., \$35.00
65	Transit Agency Participation in Medicaid Transportation Programs (2006) 48 pp., \$31.00
66	Fixed-Route Transit Ridership Forecasting and Service Planning Methods (2006) 51 pp., \$31.00
67	Bus Transit Service in Land Development Planning (2006) 62 pp., \$32.00
68	Methods of Rider Communication (2006) 95 pp., \$35.00
69	Web-Based Survey Techniques (2006) 104 pp., \$35.00
70	Mobile Data Terminals (2007) 150 pp., \$47.00
71	Paratransit Manager's Skills, Qualifications, and Needs (2007) 52 pp., \$36.00
72	Use of Biodiesel in a Transit Fleet (2007) 61 pp., \$38.00
73	AVL Systems for Bus Transit Update (2007) 104 pp., \$50.00
74	Policies and Practices for Effectively and Efficiently Meeting ADA Paratransit Demand (2008) 54 pp., \$40.00
75	Uses of Higher Capacity Buses in Transit Service (2008) 72 pp., \$45.00
76	Integration of Paratransit and Fixed-Route Transit Services (2008) 48 pp., \$40.00
77	Passenger Counting Systems (2008) 73 pp., \$45.00
78	Transit Systems in College and University Communities (2008) 88 pp., \$47.00
79	Light Rail Vehicle Collisions with Vehicles at Signalized Intersections (2008) 40 pp., \$37.00
80	Transit Security Update (2008) 141 pp., \$57.00
81	Preventive Maintenance Intervals for Transit Buses (2010) 71 pp., \$47.00
82	Transit Fare Arrangements for Public Employees (2010) 81 pp., \$49.00
83	Bus and Rail Transit Preferential Treatments in Mixed Traffic (2010) 202 pp., \$68.00
84	Current Practices in Greenhouse Gas Emissions Savings from Transit (2010) 77 pp., \$49.00
85	Effective Use of Citizen Advisory Committees for Transit Planning and Operations (2010) 63 pp., \$43.00
86	Relationships Between Streetcars and the Built Environment (2010) 52 pp., \$42.00
87	Practices in the Development and Deployment of Downtown Circulators (2011) 113 pp., \$57.00
88	Strollers, Carts, and Other Large Items on Buses and Trains (2011) 162 pp., \$63.00
89	Public Participation Strategies for Transit (2011) 87 pp., \$54.00
90	Video Surveillance Uses by Rail Transit Agencies (2011), 79 pp., \$52.00
91	Use and Deployment of Mobile Device Technology for Real-Time Transit Information (2011)
92	Transit Asset Condition Reporting (2011)
93	Practices to Protect Bus Operators from Passenger Assault (2011)
94	Innovative Rural Transit Services (2011)
	Track Maintenance Costs on Rail Transit Properties (2008) (Web-Only Doc) 43

Table 4 Index to TCRP Synthesis and Studies

Absenteeism	33, 52	– Rapid Transit	75, 83
Accidents		– Retrofitting	8
– Light Rail	79	– Route Evaluation Standards	10
Advertising		– Service Line and Cleaning	12
– Buses/Trains, on	32, 51	– Shoulders	64
– Stations/Stops	32, 51	– Small Buses	41
– Websites	43	– Stops, Customer Information at	17, 37, 48
Advisory Committees	85	– Strollers, Integration with	88
Alternative Fuels	1	– Suburb-to-Suburb Service	14
– Safe Operating Procedures, Buses	1	– System-Specific Spare Ratios	11
Asset Management	92	– Traffic Operations	49
Automated Onboard Systems, Vehicle Health	81	– Waste Control at Maintenance Facilities	9
Automated Vehicle Location (AVL) Systems	24, 34, 48, 53, 55, 73, 77, 91, 93, 94	Bus Field Supervisors	
Automatic Passenger Counters (APC)	29, 66, 73, 77	– Changing Roles and Practices	16
Automatic Vehicle Monitoring	24, 34, 48, 53, 55, 73	Bus Garages (see Bus Maintenance Facilities)	
		Bus Maintenance Facilities	
		– Cleaning	12
Bicycles		– Regulations on Design and Retrofit of	7
– Integration with Buses	4, 62	– Waste Control	9
– Integration with Ferries	4, 62	Bus Route Evaluation Standards	10, 14
– Integration with Rail	4, 62	Bus Stops	
Biodiesel	72	– Information at	17, 37, 48
Buff Load (see Compression Requirements)		– Locations	53
Built Environment	86	– Safety Design	18
Buses		– Signs	17, 37
– Alternative Fuels	1	Claims (see Liability)	
☐ Compressed Natural Gas	1	Circulators	87
☐ Ethanol	1	Codes (see Regulations, Standards)	
☐ Liquefied Natural Gas	1	College and University Campuses	39, 78
☐ Liquefied Petroleum Gas	1	Communications	
☐ Methanol	1	– Riders	68, 89
– Automated Vehicle Location Systems	24, 34, 48, 53, 55, 94	Commuter Benefits,	82
– Bicycle, Integration with	4, 62, 88	Compression Requirements	
– Biodiesel	72	– Light Rail Vehicles	25
– Bypass Lanes	83	Computer-Aided Dispatch	73, 91, 93
– Cleaning	12	Congestion Mitigation	84
– College and University Campuses	39, 78	Construction Contract Claims	28
– Downtown Circulators	87	Contracts	
– Driver Availability	33, 40, 52	– Advertising	32, 51
– Electronic Equipment	44	– Disputes and Resolution	28
– Fare Collection	26	– Information Technology Services	35
– Field Supervisors	16	– Maintenance	54
– Fuel and Fluid Storage	7	– Paratransit Services	31, 71
– Higher Capacity	75	Customer Service	43, 45
– Intercity	94	– Automated Vehicle Location	73
– Low-Floor	2	– Awareness	43, 45, 48, 49, 68
– Maintenance	54, 81	– Bicycles on Transit	62
– Maintenance Facilities	7, 9, 12	– Complaint Resolution	38
– Natural Gas	58	– Computer-Aided Scheduling and Dispatch	57, 91
– Occupant Safety	18, 38, 50, 58	– Employee Fare Programs	82
– Passenger Transfer	19	– Geographic Information Systems	55
– Rail, Integration with	83	– Information at Bus Stops	17, 48

Table 4 (Continued)

– Management Role	16, 47
– Passengers with Disabilities	30, 31, 37, 50, 53, 60, 74
– Passengers with Strollers, Carts and Other Large Items	88
– Public Participation	89
– Service Line and Cleaning	12
– Surveys	63, 69
– Transfers	19
Design	
– Bicycle Storage and Transport	62
– Bus	
□ Clean Air Regulations, to Meet	8
□ Low-Floor Transit Buses	2
□ Safety	18, 50, 58, 93
– Bus Maintenance Facilities	7
– Bus Stops	18
– Engines	7, 8
– Regulatory, Impacts on	7, 8
– Small Buses	41
– Streetcar Systems	86
– Surveillance Technology	38
– Survey Questionnaires	63, 69
– Tunnels	23
– Websites	43
Dispatch	57
– Bus	53, 60,
Diversity	
– Training	46
Driver	
– Health and Wellness	52
– Hiring	40
– Performance Evaluation	40
– Retention	40
– Training	40, 44, 45, 49, 57
Dynamic Message Signs	91
Electronic Surveillance	38, 90
Emergency Procedures	
– Bus	58
Emissions, Greenhouse Gas	84
Employee Assistance Programs	16, 52, 82
Environment, The	
– Clean Air Act	1, 7, 8
– Emissions, Biodiesel	72
– Greenhouse Gas Emissions	84
– Waste Control	9
Fare Collection	
– Bus	26, 34
– Downtown Circulators	87
– Electronic Registering Fareboxes (ERFs)	29
– Evasion	93
– Unlimited Access Systems	39
Ferries	
– Bicycles, Integration with	4, 62
Fleet Management	15, 24, 35
Flexible Transit Service	53
Fixed-Route Transit	66, 74
Fraudulent Claims	36
Fuel Systems	72
Funding Allocation	
– Bicycle Services	62
– Circulators	87
– Infrastructure	92
– Maintenance	53
– Medicaid Transportation Programs	65
– Performance-Based	56
– Role of Performance-Based Measures	6
– Spare Bus Ratios, System-Specific	11
– Spare Rail Vehicle Ratios	15
– Surveillance	90
– Systems Costs	48
– Under ISTEA and TEA-21	42
Funding, Flexible	42
Geographic Information Systems	55
Global Positioning Systems (GPS)	
– Bus	24, 53, 73, 78, 91
Greenhouse Gas Emissions	84
Incentive Programs	
– Employee	3, 33, 52, 82
Information Technology (IT)	5, 35, 43, 57
– Automatic Vehicle Location	73
– Geographic Information Systems	55
– Global Positioning Systems	70
– Mobile Device Technology	91
– Supervisors, Impact on	16
– Web-Based Surveys	69
Infrastructure	92
Inspection	
– Bus Maintenance	81
– Rail Tunnels and Underground Structures	23
– Track	95
Integrated Service	76
Intelligent Transportation Systems (ITS)	
– Advanced Public Transportation Systems (APTS)	35
– Automated Vehicle Location Systems	24, 34, 48, 53, 55, 73, 77, 91
– Automated Vehicle Monitoring (AVM)	24, 34, 48, 53, 55, 73
– Automatic Passenger Counters	29, 34, 77
– Global Positioning Systems (GPS)	24, 53

Table 4 (Continued)

– Transfer Automation	19	– Real-Time Bus Arrival Information Systems	43, 48, 91
– Mobile Data Terminals	70	Planning	
– Mobile Device Technology	91	– Advisory Committees	85
Internet	43	– Strategic	59
Liability		Policy Development	
– Construction Contract Claims	28	– No-Show and Late Cancellation	60
– Fraudulent Third Party Claims	36	– Greenhouse Gas Emissions	84
– Institutional	49	Policy Procedures	
– Risk Management	13	– Rail Tunnel and Underground Structures	
Light Rail Vehicles (LRV)		Inspection	23
– Compression Requirements	25	– Safe Operation for Alternative Fuel Buses	1
– Operations	79	Productivity	
– System-Specific Spare Ratios	15	– Employee	3, 16, 22, 33, 54
Light Rail Transit	61, 79, 83	– Transit System	54, 56, 60
Low-Floor Buses	2	Public Involvement in Transit Planning	85, 89
Maintenance		Quality Assurance	
– Bus Maintenance Facilities	7, 9	– Bus Maintenance	81
– Light Rail Transit	61, 43 (web-only)	Queue Jump/Bypass Lanes	83
– Line and Cleaning Functions	12	Rail	
– Monitoring Performance	22, 44	– Bicycle, Integration with	4, 62
– Preventive	81, 92	– Integration with Large Items	88
– Productivity	53, 54	– Light Rail Vehicle Compression Requirements	25
Management	44, 47, 59, 71	– Passenger Transfers	19
Management Information Systems (see Information Technology)		– Security	21, 90
Marketing		– Station Area Development	20
– Bicycles on Transit	62	– Streetcars	86
– Circulators	87	– Suburb-to-Suburb Service	14
Mobile Data Terminals	70	– System-Specific Spare Ratios	15
Monitoring Maintenance Performance	22, 54	– Tunnel and Underground Structures	23
Non-Emergency Medical Transportation	65	Real-Time Transit Information	91
Paratransit Services	30, 31, 60, 65, 71, 74, 76	Recruitment	
Parking and Storage		– Bus Drivers	16, 33, 40
– Bicycles	62	– Management	47
Partnerships,	65	– Security Personnel	21
Passengers		– Supervisors	16
– Comfort	12	Regulations	
– Communicating with	37, 68, 89	– Air Quality	1, 7, 8, 84
– Information Display	91	– Alternative Fuel Buses	1, 72
– Ridership Counts	29, 34	– Americans with Disabilities Act (ADA)	2, 7, 16, 17, 24, 30, 31, 37, 50, 53, 60, 65, 74, 76
– Safety	18, 21, 50, 58, 80, 88	– Buses on Shoulders	64
– Satisfaction	45, 64, 69	– Drugs and Alcohol	16
– Transfer Systems	19	– EPA	7
Performance-Based Measures		– Family Leave Medical Act	33
– Funding Allocation	56	– Leave Policies	33
– Diversity Training	46	– Local and State	7
– Role in Funding Allocation	6	– Occupational Safety and Health Administration	7, 52
Performance Evaluation		– Resource Conservation and Recovery Act	9
– Bus Operators	40	– Retrofitting	7, 8
– Circulators	87		

Table 4 (Continued)

– Suburb-to-Suburb Service	14
– Waste Management	9
Retrofitting	
– Bus	8, 49
– Bus Maintenance Facilities	7
– Engine	7, 8
– Regulatory, Impacts on	7
Revenues	
– Advertising	51
Ridership	63
– Forecasting	66
Risk Management	90
– Medium Agencies	13
– Small Agencies	13
Safety	
– Alternative Fuel Bus Operation	1
– Bus Drivers	93
– Bus Occupant	18, 38, 50, 64
– Bus Route Evaluation	10
– Communications	68
– Light Rail Vehicle Compression Resistance	25
– Infrastructure	92
– Track Workers	95
– Traffic Operations	49
– Video Surveillance	90
Scheduling	
– Adherence	49
– Automatic Vehicle Location Systems	24, 48, 53, 55, 73, 91
– Bus Driver Availability	33
– Bus Route Evaluation	10
– Bus Stop Information	17, 48
– Bus Transfers	19
– Computer-Aided	57
– Demand-Responsive	53, 57
– Downtown Circulators	87
– Flexible Route	53
– Maintenance, Bus	81
– Paratransit	74, 76
– Point Deviation	53
– Ridership Data Collection	29, 34, 63
– Small Buses	41
– Suburb-to-Suburb	14
Security	
– Automatic Vehicle Location	73
– Bus Drivers, for	33, 93
– Crime Prevention	21, 38, 80
– Passenger Security Inspections	80
– Technology Systems	35, 38
– Terrorism	27, 80
– Violence Reduction	21, 93
Service	
– Planning	66, 89, 94
– Quality	15, 45, 53, 57
– Small Buses	41
Service Line and Cleaning	12
Spare Ratios	
– System-Specific Buses	11
– System-Specific Rail Vehicles	15
Standards	
– Alternative Fuels	1
– Bus Route Evaluation	10, 14
– Maintenance	54
State of Good Repair	92
Streetcars	86
Suburb-to-Suburb Commuting	14
Supervisors	
– Bus Field	16
– Relations with Drivers	33
Surveillance	90
Surveys	
– On-Line and Intercept	63
– Web-Based	69
Terrorism	27, 80
Tort Claims	36
Track Maintenance	43 (web-only), 95
Training	
– Bus Drivers	18, 30, 40
– Diversity Training	46
– Information Technology	35, 44
– Management, Paratransit	71
– Riders, Paratransit	74
– Supervisors	16
– Technicians	81
Transfers	19
Transit-Focused Development	20
Transit, Public Involvement	89
Transit, Security	90, 93
Transit Signal Priority	83
Transitways	83
Transportation Demand Management	39
Tunnels	23
Underground Structures	23
Unions	54
U-Pass	78
Vandalism	93
Video Surveillance	90
Violence (see Security)	
Waste Control	
– Bus Maintenance Facilities	9



Transportation Research Board

500 Fifth Street, NW
Washington, DC 20001

THE NATIONAL ACADEMIES™

Advisers to the Nation on Science, Engineering, and Medicine

The nation turns to the National Academies—National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council—for independent, objective advice on issues that affect people's lives worldwide.

www.national-academies.org

Subscriber Categories: Public Transportation • Operations and Traffic Management • Design Planning and Forecasting • Vehicles and Equipment • Maintenance and Preservation • Energy Environment • Society • Finance



These digests are issued in order to increase awareness of research results emanating from projects in the Cooperative Research Programs (CRP). Persons wanting to pursue the project subject matter in greater depth should contact the CRP Staff, Transportation Research Board of the National Academies, 500 Fifth Street, NW, Washington, DC 20001.

COPYRIGHT INFORMATION

Authors herein are responsible for the authenticity of their materials and for obtaining written permissions from publishers or persons who own the copyright to any previously published or copyrighted material used herein.

Cooperative Research Programs (CRP) grants permission to reproduce material in this publication for classroom and not-for-profit purposes. Permission is given with the understanding that none of the material will be used to imply TRB, AASHTO, FAA, FHWA, FMCSA, FTA, or Transit Development Corporation endorsement of a particular product, method, or practice. It is expected that those reproducing the material in this document for educational and not-for-profit uses will give appropriate acknowledgment of the source of any reprinted or reproduced material. For other uses of the material, request permission from CRP.