NCHRP
National Cooperative Highway Research Program

RESEARCH RESULTS DIGEST

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Continuing Project to Synthesize Information on Highway Problems

A staff digest of the progress and status of NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems," for which the Transportation Research Board is the agency conducting the research. The Principal Investigators responsible for the project are Sally D. Liff and Scott A. Sabol, serving under the Studies and Information Services Division of the Board.

INTRODUCTION

Administrators, practicing engineers, and researchers continually face highway problems on which much information already exists, either in documented form or in terms of undocumented experience and practice. Unfortunately, this information is often fragmented, scattered, and underevaluated. Often it is unknown to the person normally responsible for making decisions related to the topic. As a consequence, full knowledge of what has been learned about a problem is frequently not 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 exists a vast storehouse of information relating to nearly every subject of concern to highway administrators and engineers. Much of it resulted from research and much from successful application of the ideas of practitioners faced with problems in their day-to-day work. Because there has been no systematic means for bringing such useful information together and making it available to the entire highway community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing study, NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems." This study is intended to search out and synthesize useful knowledge from all possible sources and to prepare documented reports on current practices in the subject areas of concern. Reports from this endeavor constitute an NCHRP report series, Synthesis of Highway Practice, that collects and assembles the various forms of information into single concise documents pertaining to specific highway problems or sets of closely related problems.

THE SYNTHESIS PROGRAM

This synthesis series attempts to report on the various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which they are utilized in this fashion will be tempered by the breadth of the user's knowledge in the particular problem area.

Suggestions for synthesis topics may be sent to the NCHRP Program Director at any time (see address on back). Topics suggested must be accompanied by a brief scope statement or discussion of the problem (a paragraph or two). Suggestions for updates of published syntheses are also welcome.

Interested in writing a synthesis? For details, contact Sally D. Liff or Scott A. Sabol at 202-334-3242

To develop these syntheses in a comprehensive manner and to ensure inclusion of significant knowledge, the Transportation Research Board analyzes available information assembled from numerous sources, including state highway and transportation departments. A panel of experts in the subject area is established to guide the researchers in organizing and evaluating the 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 the problems; (3) to identify all ongoing research; (4) to learn what problems remain largely unsolved; (5) to organize, evaluate, and document the useful information that is acquired; (6) to evaluate the effectiveness of the synthesis after it has been in the hands of its users for a period of time.

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 at hand; eventually the synthesis may need to be updated or redone. The readers and users of the syntheses are in the best position to know when this has occurred. Whenever you believe that a synthesis should be updated, it would be appreciated if you would write to TRB (address on back) and let us know.

Available Publications and Studies in Progress

The Syntheses of Highway Practice that have been completed under this project are listed in Table 1. Two Research Results Digests on topics studied under the project are also listed. Copies of these Syntheses and Digests can be obtained from the Publications Office, Transportation Research Board, 2101 Constitution Avenue N.W., Washington, D.C. 20418.

Work is currently under way on the topics listed in Table 2. Questions on these topics should be addressed to the project investigators, Sally D. Liff and Scott A. Sabol, who can be reached at (202) 334-3242.

Submission and Selection of Topics

One part of the project procedures that is not widely understood is the process for submission and selection of topics. NCHRP Project Committee SP20-5 meets each Fall to select topics for study using funds from the upcoming fiscal year. The membership of this committee is given in Table 3. Current funding allows for initiation of about 12 to 14 syntheses per year. This number plus some alternative topics are selected by the committee at the Fall meeting. Topics selected for the current program are listed in Table 4. It is unlikely that those near the bottom of the list will be studied at this time.

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 problem should be timely and critical with respect to economic impact, safety, or social impact.
- The problem 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.

Each year many more topics are suggested for the committee's consideration than can be programmed for study in Project 20-5. Nevertheless, the continued success of this project depends on a constant supply of worthy synthesis topics. The interest of those who have recommended topics is sincerely appreciated, and they are urged to continue. Candidate topics are suggested by members of the committee and from a variety of other sources, including state highway and transportation department personnel, FHWA, and AASHTO and TRB committees.

Conduct of the Studies

Throughout the year, following the project committee'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 scope, suggests sources of information, and identifies and discusses potential topic consultants.

Following this meeting, an agreement is negotiated with a consultant to gather information on the topic, synthesize it, and draft a report. Typically, the agreement covers about 50 workdays over a period of about one year. Information gathering and preparation of the first draft of the synthesis report usually take from 6 to 9 months. This draft is reviewed by the topic panel with the consultant at the second panel meeting. A revised draft is then prepared by the author and reviewed by the topic panel. Subsequent drafts and meetings are scheduled if needed, although this rarely occurs.

After the topic panel is substantially satisfied with the report, a final draft is sent to the members of NCHRP Project Committee SP20-5 for their approval. At the same time, members of 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 an NCHRP Synthesis of Highway Practice.

Index of Topic Subjects

Table 5 is an index to published syntheses and topics under study, as well as those expected to be started through 1993.

Table 1
COMPLETED SYNTHESES

No. Title, Pages, Price

1. Traffic Control for Freeway Maintenance (1969) 47 pp., $2.20
2. Bridge Approach Design and Construction Practices (1969) 30 pp. (microfiche)*
3. Traffic-Safe and Hydraulically Efficient Drainage Practice (1969) 38 pp. (microfiche)*
4. Concrete Bridge Deck Durability (1970) 28 pp. (microfiche)* (supplemented by Synthesis 57)
5. Scour at Bridge Waterways (1970) 37 pp. (microfiche)*
6. Principles of Project Scheduling and Monitoring (1970) 43 pp. (microfiche)*
7. Motorist Aid Systems (1971) 28 pp., $2.40
8. Construction of Embankments (1971) 38 pp. (microfiche)*
9. Pavement Rehabilitation — Materials and Techniques (1972) 41 pp. (out of print)
10. Recruiting, Training, and Retaining Maintenance and Equipment Personnel (1972) 35 pp. (microfiche)*
11. Development of Management Capability (1972) 50 pp. (out of print)
12. Telecommunications Systems for Highway Administration and Operations (1972) 39 pp., $2.80 (superseded by Synthesis 165)
13. Radio Spectrum Frequency Management (1972) 32 pp., $2.80
14. Skid Resistance (1972) 66 pp. (microfiche)*
15. Statewide Transportation Planning - Needs and Requirements (1973) 41 pp. (microfiche)* (superseded by Synthesis 95)
16. Continuously Reinforced Concrete Pavement (1973) 23 pp., $2.80
17. Pavement Traffic Marking — Materials and Application Affecting Serviceability (1973) 44 pp., $3.60 (superseded by Synthesis 138)
18. Erosion Control on Highway Construction (1973) 52 pp. (microfiche)*
19. Design, Construction, and Maintenance of PCC Pavement Joints (1973) 40 pp. (out of print)
20. Rest Areas (1973) 38 pp., $3.60
21. Highway Location Reference Methods (1974) 30 pp., $3.20
22. Maintenance Management of Traffic Signal Equipment and Systems (1974) 41 pp. (microfiche)* (superseded by Synthesis 114)
23. Getting Research Findings Into Practice (1974) 24 pp., $3.20
24. Minimizing Deicing Chemical Use (1974) 58 pp. (microfiche)*
25. Reconditioning High-Volume Freeways in Urban Areas (1974) 56 pp., $4.00
26. Roadway Design in Seasonal Frost Areas (1975) 104 pp. (microfiche)*
27. PCC Pavements for Low-Volume Roads and City Streets (1975) 31 pp. (microfiche)*
28. Partial-Lane Pavement Widening (1975) 30 pp., $3.20
29. Treatment of Soft Foundations for Embankments (1975) 25 pp., $3.20 (supplemented by Synthesis 147)
30. Bituminous Emulsions for Highway Pavements (1975) 76 pp. (microfiche)*
31. Highway Tunnel Operations (1975) 29 pp., $3.20
32. Effects of Studded Tires (1975) 46 pp., $4.00
33. Acquisition and Use of Geotechnical Information (1976) 40 pp., $4.00
34. Policies for Accommodation of Utilities on Highway Rights of Way (1976) 22 pp. (microfiche)*
35. Design and Control of Freeway Off-Ramp Terminals (1976) 61 pp., $4.40
36. Instrumentation and Equipment for Testing Highway Materials, Products, and Performance (1976) 70 pp., $4.80
37. Lime-Fly Ash-Stabilized Bases and Subbases (1976) 66 pp. (microfiche)*
38. Statistically Oriented End-Result Specifications (1976) 40 pp., $4.00
39. Transportation Requirements for the Handicapped, Elderly, and Economically Disadvantaged (1976) 54 pp. (out of print)
40. Staffing and Management for Social, Economic, and Environmental Impact Assessments (1977) 43 pp., $4.00
41. Bridge Bearings (1977) 62 pp. (microfiche)*
42. Design of Pile Foundations (1977) 68 pp., $4.80
43. Energy Effects, Efficiencies, and Prospects for Various Modes of Transportation (1977) 57 pp., $4.80 (supplemented by Synthesis 121)
44. Consolidation of Concrete for Pavements, Bridge Decks, and Overlays (1977) 61 pp., $4.80
45. Rapid-Setting Materials for Patching of Concrete (1977) 13 pp. (out of print)
46. Recording and Reporting Methods for Highway Maintenance Expenditures (1977) 35 pp., $3.60
47. Effect of Weather on Highway Construction (1978) 29 pp., $3.20
48. Priority Programming and Project Selection (1978) 31 pp. (out of print)
49. Open-Graded Friction Courses for Highways (1978) 50 pp., $4.00
50. Durability of Drainage Pipe (1978) 37 pp. (microfiche)*
51. Construction Contract Staffing (1978) 62 pp., $6.00
52. Management and Selection Systems for Highway Maintenance Equipment (1978) 17 pp., $4.40
53. Precast Concrete Elements for Transportation Facilities (1978) 48 pp., $5.60
54. Recycling Materials for Highways (1978) 53 pp. (microfiche)*
55. Storage and Retrieval Systems for Highway and Transportation Data (1978) 30 pp., $4.80
56. Joint-Related Distress in PCC Pavement — Cause, Prevention and Rehabilitation (1979) 36 pp., $5.20
57. Durability of Concrete Bridge Decks (1979) 61 pp. (microfiche)* (supplements Synthesis 4)
58. Consequences of Deferred Maintenance (1979) 24 pp., $4.40
59. Relationship of Asphalt Cement Properties to Pavement Durability (1979) 43 pp., $5.60
60. Failure and Repair of Continuously Reinforced Concrete Pavement (1979) 42 pp., $5.60
61. Changeable Message Signs (1979) 37 pp., $5.60
62. Potential State Resources for Financing Transportation Programs (1979) 34 pp., $5.20
63. Design and Use of Highway Shoulders (1979) 26 pp., $4.80
64. Bituminous Patching Mixtures (1979) 26 pp., $4.80
65. Quality Assurance (1979) 42 pp., $5.60
66. Glare Screen Guidelines (1979) 17 pp., $4.40
67. Bridge Drainage Systems (1979) 44 pp., $5.60
68. Motor Vehicle Size and Weight Regulation, Enforcement, and Permit Operations (1980) 45 pp., $6.00
69. Bus Route and Schedule Planning Guidelines (1980) 99 pp., $8.00
70. Design of Sedimentation Basins (1980) 53 pp., $6.80
71. Direction Finding from Arterials to Destinations (1980) 50 pp., $6.40
72. Transportation Needs Studies and Financial Constraints (1980) 54 pp., $6.40
73. Alternative Work Schedules: Impacts on Transportation (1980) 54 pp., $6.80
74. State Transit-Management Assistance to Local Communities (1980) 34 pp., $6.00
75. Transit Boards-Composition, Roles, and Procedures (1981) 24 pp., $6.20
76. Collection and Use of Pavement Condition Data (1981) 74 pp., $8.00
77. Evaluation of Pavement Maintenance Strategies (1981) 56 pp., $7.40
78. Value Engineering in Preconstruction and Construction (1981) 23 pp., $6.40
79. Contract Time Determination (1981) 45 pp., $7.20
80. Formulating and Justifying Highway Maintenance Budgets (1981) 49 pp., $7.20
81. Experiences in Transportation System Management (1981) 88 pp., $8.40
82. Criteria for Evaluation of Truck Weight Enforcement Programs (1981) 74 pp., $7.20
83. Bus Transit Accessibility for the Handicapped in Urban Areas (1981) 73 pp., $7.60
84. Evaluation Criteria and Priority Setting for State Highway Programs (1981) 32 pp., $6.40
85. Energy Involved in Construction Materials and Procedures (1981) 34 pp., $6.40
86. Effects of Traffic-Induced Vibrations on Bridge Deck Repairs (1981) 40 pp., $6.80
87. Highway Noise Barriers (1981) 81 pp., $7.20
88. Underwater Inspection and Repair of Bridge Substructures (1981) 77 pp., $7.60
89. Geotechnical Instrumentation for Monitoring Field Performance (1982) 46 pp., $6.80
90. New-Product Evaluation Procedures (1982) 34 pp., $6.80
91. Highway Accident Analysis Systems (1982) 69 pp., $7.60
92. Minimizing Reflection Cracking of Pavement Overlays (1982) 38 pp., $6.80
93. Coordination of Transportation System Management and Land Use Management (1982) 38 pp., $6.80
94. Photologging (1982) 38 pp., $6.80
95. Statewide Transportation Planning (1982) 54 pp., $7.20 (supersedes Synthesis 15)
96. Pavement Subsurface Drainage Systems (1982) 38 pp., $6.80

*These syntheses are available from TRB in microfiche form only at a cost of $10.00 each.

Table 1 (continued)

No.	Title, Pages, Price
97.	Transit Ownership/Operation Options for Small Urban and Rural Areas (1982) 28 pp., $6.40
98.	Resealing Joints and Cracks in Rigid and Flexible Pavements (1982) 62 pp., $7.20
99.	Resurfacing with Portland Cement Concrete (1982) 90 pp., $8.40
100.	Managing State Highway Finance (1982) 23 pp., $6.40
101.	Historic Bridges — Criteria for Decision Making (1983) 77 pp., $8.00
102.	Material Certification and Material-Certification Effectiveness (1983) 17 pp., $6.00
103.	Risk Assessment Processes for Hazardous Materials Transportation (1983) 26 pp., $6.40
104.	Criteria for Use of Asphalt Friction Surfaces (1983) 41 pp., $6.80
105.	Construction Contract Claims: Causes and Methods of Settlement (1983) 58 pp., $7.20
106.	Practical Guidelines for Minimizing Tort Liability (1983) 40 pp., $6.80
107.	Shallow Foundations for Highway Structures (1983) 38 pp., $6.80
108.	Bridge Weight-Limit Posting Practices (1984) 30 pp., $6.40
109.	Highway Uses of Epoxy with Concrete (1984) 68 pp., $8.80
110.	Maintenance Management Systems (1984) 49 pp., $8.00
111.	Distribution of Wheel Loads on Highway Bridges (1984) 22 pp., $7.20
112.	Cost-Effectiveness of Hot-Dip Galvanizing for Exposed Steel (1984) 28 pp., $7.20
113.	Administration of Research, Development, and Implementation Activities in Highway Agencies (1984) 49 pp., $8.00
114.	Management of Traffic Signal Maintenance (1984) 134 pp., $10.80 (supersedes Synthesis 22)
115.	Reducing Construction Conflicts between Highways and Utilities (1984) 73 pp., $8.80
116.	Asphalt Overlay Design Procedures (1984) 66 pp., $8.40
117.	Toll Highway Financing (1984) 29 pp., $7.20
118.	Detecting Defects and Deterioration in Highway Structures (1985) 52 pp., $8.00
119.	Prefabricated Bridge Elements and Systems (1985) 75 pp., $8.80
120.	Professional Resource Management and Forecasting (1985) 15 pp., $6.80
121.	Energy Conservation in Transportation (1985) 25 pp., $7.20 (supplements Synthesis 43)
122.	Life-Cycle Cost Analysis of Pavements (1985) 136 pp., $10.80
123.	Bridge Designs to Reduce and Facilitate Maintenance and Repair (1985) 65 pp., $8.40
124.	Use of Weigh-in-Motion Systems for Data Collection and Enforcement (1986) 34 pp., $7.60
125.	Maintenance Activities Accomplished by Contract (1986) 42 pp., $8.00
126.	Equipment for Obtaining Pavement Condition and Traffic Loading Data (1986) 118 pp., $11.20
127.	Use of Fly Ash in Concrete (1986) 66 pp., $8.40
128.	Methods for Identifying Hazardous Highway Elements (1986) 80 pp. (microfiche)*
129.	Freezing and Thawing Resistance of High-Strength Concrete (1986) 31 pp., $7.60
130.	Traffic Data Collection and Analysis: Methods and Procedures (1986) 58 pp., $8.40
131.	Effects of Permit and Illegal Overloads on Pavements (1987) 99 pp., $10.40
132.	System-Wide Safety Improvements: An Approach to Safety Consistency (1987) 20 pp., $6.80
133.	Integrated Highway Information Systems (1987) 31 pp., $7.60
134.	D-Cracking of Concrete Pavements (1987) 34 pp., $7.60
135.	Pavement Management Practices (1987) 139 pp., $12.40
136.	Protective Coatings for Bridge Steel (1987) 107 pp., $11.00
137.	Negotiating and Contracting for Professional Engineering Services (1988) 75 pp., $9.60
138.	Pavement Markings: Materials and Application for Extended Service Life (1988) 45 pp., $8.00 (supersedes Synthesis 17)
139.	Pedestrians and Traffic Control Measures (1988) 75 pp., $9.00
140.	Durability of Prestressed Concrete Highway Structures (1988) 65 pp., $9.00
141.	Bridge Deck Joints (1989) 66 pp., $9.00
142.	Methods of Cost-Effectiveness Analysis for Highway Projects (1988) 22 pp., $7.00
143.	Uniformity Efforts in Oversize/Overweight Permits (1988) 79 pp., $10.00
144.	Breaking/Cracking and Seating Concrete Pavements (1989) 39 pp., $8.00
145.	Staffing Considerations in Construction Engineering Management (1989) 42 pp., $8.00
146.	Use of Consultants for Construction Engineering and Inspection (1989) 64 pp., $9.00
147.	Treatment of Problem Foundations for Highway Embankments (1989) 72 pp., $9.00
148.	Indicators of Quality in Maintenance (1989) 114 pp., $11.00
149.	Partnerships for Innovation: Private Sector Contributions to Innovation in the Highway Industry (1989) 45 pp., $8.00
150.	Technology Transfer in Selected Highway Agencies (1989) 38 pp., $8.00
151.	Process for Recapitalizing Highway Transportation Systems (1989) 43 pp., $8.00
152.	Compaction of Asphalt Pavement (1989) 42 pp., $8.00
153.	Evolution and Benefits of Preventive Maintenance Strategies (1989) 69 pp., $9.00
154.	Recycling Portland Cement Concrete Pavements (1989) 46 pp., $8.00
155.	Freeway Guide Sign Replacement: Policies and Criteria (1991) 37 pp., $8.00
156.	Freeway Incident Management (1990) 23 pp., $7.00
157.	Maintenance Management of Street and Highway Signs (1990) 134 pp., $12.00
158.	Wet-Pavement Safety Programs (1990) 54 pp., $8.00
159.	Design and Construction of Bridge Approaches (1990) 45 pp., $8.00
160.	Cold-Recycled Bituminous Concrete Using Bituminous Materials (1990) 105 pp., $11.00
161.	Computer-Aided Design and Drafting Systems (1990) 24 pp., $7.00
162.	Signing Policies, Procedures, Practices, and Fees for Logo and Tourist-Oriented Directional Signing (1990) 41 pp., $8.00
163.	Innovative Strategies for Upgrading Personnel in State Transportation Departments (1990) 35 pp., $7.00
164.	Measures to Curtail State Fuel Tax Evasion (1990) 14 pp., $7.00
165.	Transportation Telecommunications (1990) 92 pp., $10.00 (supersedes Synthesis 12)
166.	Traffic Signal Control Equipment: State of the Art (1990) 43 pp., $8.00
167.	Measurements, Specifications, and Achievement of Smoothness for Pavement Construction (1990) 34 pp., $8.00
168.	Contract Management Systems (1990) 74 pp., $10.00
169.	Removing Concrete from Bridges (1991) 42 pp., $8.00
170.	Managing Urban Freeway Maintenance (1990) 32 pp., $7.00
171.	Fabrics in Asphalt Overlays and Pavement Maintenance (1991) 72 pp., $9.00
172.	Signal Timing Improvement Practices (1992) 88 pp., $11.00
173.	Short-Term Responsive Maintenance Systems (1991) 43 pp., $9.00
174.	Stormwater Management for Transportation Facilities (1993) (in press)
175.	Moisture Damage in Asphalt Concrete (1991) 91 pp., $10.00
176.	Bridge Paint: Removal, Containment, and Disposal (1992) 60 pp., $9.00
177.	Freeway Corridor Management (1992) 64 pp., $9.00
178.	Truck Escape Ramps (1992) 56 pp., $9.00
179.	Latex-Modified Concretes and Mortars (1992) 58 pp., $9.00
180.	Performance Characteristics of Open-Graded Friction Courses (1992) 44 pp., $8.00 (supplements Synthesis 49)
181.	In-Service Experience with Traffic Noise Barriers (1992) (in press)
182.	Performance and Operational Experience of Truck-Mounted Attenuators (1993) (in press)
183.	Knowledge Based Expert Systems in Transportation (1992) 52 pp., $9.00
184.	Disposal of Roadside Litter Mixtures (1993) (in press)
185.	Preferential Lane Treatments for High-Occupancy Vehicles (1993) (in press)
186.	Supplemental Advance Warnings (1993) (in press)
187.	Rapid Test Methods for Asphalt Concrete and Portland Cement Concrete (1993) (in press)

Research Results Digests (RRD)

100.	Safe Conduct of Traffic Through Highway Construction and Maintenance Zones (1978) 5 pp., $1.00
106.	Use of Waste Materials in Highway Construction and Maintenance (1979) 2 pp., $1.00

Syntheses in Editorial and Publication Process

21-03	Management Training and Development Programs
21-11	Impacts of Hazardous Materials on Highway Maintenance
22-13	Use of Rumble Strips to Enhance Safety

*These syntheses are available from TRB in microfiche form only at a cost of $10.00 each.

Table 2
TOPICS BEING STUDIED

No.	Title	No.	Title
17-05	Design, Construction, and Maintenance of PCC Pavement Joints	23-05	Relationship of Current Construction Specifications to Performance
17-07	Durability of Drainage Pipe	23-06	Corridor Preservation
19-22	Status and Application of GPS Satellite Positioning for Departments of Transportation	23-07	Use of Warranties in Road Construction
20-22	Highway Tort Liability Management Programs	23-09	Severity Indices for Roadside Features
21-06	Development of Professional Highway Maintenance Engineers	23-10	Portland Cement Concrete Resurfacing
21-08	Development and Implementation of Traffic Control Plans for Highway Work Zones	23-11	Changeable Message Signs
21-10	Hot In-Place Recycling of Asphalt Concrete	23-12	Reduced Visibility on the Highway
21-11	Impacts of Hazardous Materials on Highway Maintenance	23-13	Effective Use of Park-and-Ride Facilities
21-13	Highway Pavement Structural Design Practices	24-01	Resolution of Disputes to Avoid Construction Claims
21-14	Criteria for Qualifying Contractors for Bidding Purposes	24-02	International Survey of Roadway Pricing
22-02	Uses of Recycled Rubber Tires in Highways	24-03	Performance and Operational Experience of Permanent and Temporary Crash Cushions
22-04	Underwater Bridge Maintenance and Repair	24-04	Determination of Contract Time for Highway Construction Projects
22-07	Current Practices in Determining Pavement Condition	24-05	Pavement Management Methodologies to Select Projects and Recommend Preservation Treatments
22-10	Recycling and Use of Waste Materials and By-Products in Highway Construction	24-06	Electronic Toll and Traffic Management Systems
22-11	Photographic Enforcement of Traffic Laws	24-07	Pavement Markings
22-12	Truck Operating Characteristics	24-08	Longitudinal Occupancy of Limited/Controlled Access Right-of-Way by Utilities
22-14	Impacts of Highway Bypasses on Rural Communities and Small Urban Areas	24-10	Asphalt Surface Treatments and Thin Overlays
23-01	Accident Data Quality	24-11	Implementation of Technologies from Abroad
23-03	Managing Roadway Snow and Ice Control Operations	24-12	Sealers for Portland Cement Concrete Highway Facilities
23-04	Multimodal Evaluation in Passenger Transportation	24-13	Effects of Highway Widening Improvements on Urban and Suburban Areas

Table 3
NCHRP PROJECT COMMITTEE SP20-5

Chairman
Verdi Adam*
Gulf Engineers & Consultants

Kenneth C. Afferton
New Jersey Dept. of Transportation

Robert N. Bothman*
The HELP Program

Jack Freidenrich*
The RBA Group

John J. Henry
Pennsylvania Transportation Institute

Gloria J. Jeff
Michigan Dept. of Transportation

Bryant Mather*
USAE Waterways Experiment Station

Thomas H. May*
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Jon P. Underwood
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Thomas O. Willett
Federal Highway Administration

J. Richard Young, Jr.
Mississippi Dept. of Transportation

Richard A. McComb (Liaison)
Federal Highway Administration

Robert E. Spicher (Liaison)
Transportation Research Board

* — Term ended November 1992

Table 4
SYNTHESIS TOPICS SELECTED FOR THE FY 1993 PROGRAM

No.	Title	No.	Title
25-01	Applications of 3D and 4D Highway Modeling	25-13	Procedures MPOs Use to Consider the 15 Factors in Developing Plans and Programs Under the ISTEA
25-02	Methodologies Associated with Freight Planning	25-14	Conducting Contract Research
25-03	Left Turn Treatments	25-15	Productivity Measurements within DOTs
25-04	Highway Guiderail and Median Barrier Crashworthiness	25-16	Dynamic Effects of Pile Installations on Adjacent Structures
25-05	Evaluating and Implementing Public-Private Partnership Options in Transportation	25-17	Requirements for Traffic Management System Applications of Highway Advisory Radio
25-06	Managing Bridge Maintenance	25-18	Cathodic Protection for Steel-Reinforced Concrete Bridge Elements
25-07	Pavement Subsurface Drainage Systems	25-19	Evaluation of Sign Legends to Improve Legibility, Conspicuity, and Visibility
25-08	Medium-Size Area Congestion Management Systems	25-20	Evolution and Timeliness of Transportation-Related Training in the Highway Community
25-09	Waterproofing Membranes for Bridge Decks		
25-10	Cost Effective Preventive Maintenance		
25-11	Toll Plaza Design		
25-12	Transportation Systems Management		

Table 5
INDEX TO SYNTHESES AND STUDIES*

*Simple numbers represent published syntheses; hyphenated numbers represent studies in progress.

Table 5 (continued)

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