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 Thomas L. Copas and Herbert A. Pennock, serving under the Special Technical Activities 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," which 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*, which 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.

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.

Available Publications and Studies in Progress

The 100 published Syntheses of Highway Practice that have been prepared under this project to date 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. A check or money order must accompany orders totaling $10.00 or less.

Work is currently under way on the 23 topics listed in Table 2. Questions on these topics should be addressed to the project investigators, Thomas L. Copas and Herbert A. Pennock, who can be reached at (202) 334-3242.

Submission and Selection of Topics

One part of 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 10 or 11 syntheses per year. This number plus some alternate topics are selected by the committee at the Fall meeting. Topics selected for the FY '83 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. State highway and transportation department personnel may submit suggestions for synthesis topics directly to the NCHRP Program Director or, if desired, through their State TRB Representative. Topics suggested must be accompanied by a brief scope statement or discussion of the problem.

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 30 to 40 man-days 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 contains an index to published syntheses and topics now under study, as well as those expected to be started through 1983.

The NCHRP Projects Engineer responsible for Project 20-5 is Robert J. Reilly, who can be reached at (202) 334-3224.

Table 1
COMPLETED TOPICS

No.	Title, Pages, Price
	Syntheses
1.	Traffic Control for Freeway Maintenance (1969) 47 pp., $2.20
2.	Bridge Approach Design and Construction Practices (1969) 30 pp., $2.00
3.	Traffic-Safe and Hydraulically Efficient Drainage Practice (1969) 38 pp. (microfiche only)*
4.	Concrete Bridge Deck Durability (1970) 28 pp. (microfiche only)*
5.	Scour at Bridge Waterways (1970) 37 pp. (microfiche only)*
6.	Principles of Project Scheduling and Monitoring (1970) 43 pp., $2.40
7.	Motorist Aid Systems (1971) 28 pp., $2.40
8.	Construction of Embankments (1971) 38 pp. (microfiche only)*
9.	Pavement Rehabilitation - Materials and Techniques (1972) 41 pp., $2.80
10.	Recruiting, Training, and Retaining Maintenance and Equipment Personnel (1972) 35 pp., $2.80
11.	Development of Management Capability (1972) 50 pp., $3.20
12.	Telecommunications Systems for Highway Administration and Operations (1972) 39 pp., $2.80
13.	Radio Spectrum Frequency Management (1972) 32 pp., $2.80
14.	Skid Resistance (1972) 66 pp., $4.00
15.	Statewide Transportation Planning - Needs and Requirements (1973) 41 pp. (microfiche only)*
16.	Continuously Reinforced Concrete Pavement (1973) 23 pp., $2.80
17.	Pavement Traffic Marking - Materials and Application Affecting Serviceability (1973) 44 pp., $3.60
18.	Erosion Control on Highway Construction (1973) 52 pp., $4.00
19.	Design, Construction, and Maintenance of PCC Pavement Joints (1973) 40 pp., $3.60
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 only)*
23.	Getting Research Findings Into Practice (1974) 24 pp., $3.20
24.	Minimizing Deicing Chemical Use (1974) 58 pp., $4.00
25.	Reconditioning High-Volume Freeways in Urban Areas (1974) 56 pp., $4.00
26.	Roadway Design in Seasonal Frost Areas (1975) 104 pp., $6.00
27.	PCC Pavements for Low-Volume Roads and City Streets (1975) 31 pp. (microfiche only)*
28.	Partial-Lane Pavement Widening (1975) 30 pp., $3.20
29.	Treatment of Soft Foundations for Embankments (1975) 25 pp., $3.20
30.	Bituminous Emulsions for Highway Pavements (1975) 76 pp., $4.80
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., $3.20
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., $4.80
38.	Statistically Oriented End-Result Specifications (1976) 40 pp., $4.00
39.	Transportation Requirements for the Handicapped, Elderly, and Economically Disadvantaged (1976) 54 pp., $4.40
40.	Staffing and Management for Social, Economic, and Environmental Impact Assessment (1977) 43 pp., $4.00
41.	Bridge Bearings (1977) 62 pp., $4.80
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
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., $2.40
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., $3.20
49.	Open-Graded Friction Courses for Highways (1978) 50 pp., $4.00
50.	Durability of Drainage Pipe (1978) 37 pp., $3.60
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., $5.60
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., $6.00
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) 49pp., $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) (in publication)
94.	Photologging (1982) (in publication)
95.	Statewide Transportation Planning (1982) (in publication)
96.	Pavement Subsurface Drainage Systems (1982) (in publication)
97.	Transit Ownership/Operation Options for Small Urban and Rural Areas (1982) (in publication)
98.	Resealing Joints and Cracks in Rigid and Flexible Pavements (1982) (in publication)
99.	Resurfacing with Portland Cement Concrete (1982) (in publication)
100.	Managing State Highway Finance (1982) (in publication)
	Research Results Digests
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

*These syntheses are available from TRB in microfiche form only at a cost of $4.50 each.

Table 2

TOPICS BEING STUDIED

No.	Title	No.	Title
9-12	Welding and Inspection Practices in Bridge Fabrication	14-02	Maintenance Management of Traffic Signal Equipment and Systems
11-05	Utilization of Information Systems in Construction Engineering Management	14-03	Reducing Construction Delays, Damage, and Costs Through Improved Highway-Utility Coordination
12-06	Shallow Foundations for Highway Structures	14-04	Asphalt Overlay Design Procedures
12-11	Bridge Designs to Reduce and Facilitate Maintenance and Repair	14-05	Material Certification and Material-Certification Effectiveness
13-01	Construction Contract Claims: Causes and Methods of Settlement	14-06	Maintenance Management Systems
13-02	Methods of Cost-Effectiveness Analysis for Highway Projects	14-07	Maintenance Activities Accomplished by Contract
13-07	Storm Water Management for Transportation Facilities	14-08	Criteria for Use of Asphalt Friction Surfaces
13-08	Bridge Posting Practices	14-09	Energy Conservation in Transportation
13-09	Highway Inventory Systems	14-11	Research, Development, and Implementation Activities and Organization of State Highway and Transportation Departments
13-10	Risk Assessment Processes for Hazardous Materials Transportation	14-12	Use of Epoxies with Concrete
13-11	Historic Bridges: Criteria for Decision Making	14-22	Distribution of Wheel Loads on Highway Bridges
14-01	Practical Guidelines for Minimizing Tort Liability		

Table 3

NCHRP PROJECT COMMITTEE SP20-5

Chairman
Ray R. Biege, Jr.
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Verdi Adam
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Pennsylvania Dept. of Transportation

Theodore F. Morf
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Edward A. Mueller
Reynolds, Smith and Hills

David K. Phillips
Federal Highway Administration

Robert J. Betsold
Federal Highway Administration

K. B. Johns
Transportation Research Board

Table 4

SYNTHESIS TOPICS SELECTED FOR THE FY '83 PROGRAM

No.	Title	No.	Title
15-01	Toll Financing of Highway Improvements	15-12	Maintenance Management of Street and Highway Signs
15-02	Durability of Prestressed Concrete Highway Structures	15-13	Railroad-Highway Grade-Crossing Surfaces
15-03	Detecting Deterioration in Highway Structures	15-14	Impact of Reductions-In-Force on State Highway Design, Construction, Maintenance, and Operations
15-04	Equipment for Obtaining Pavement Management Data	15-15	Bridge Expansion Devices
15-05	Effects of Permit and Illegal Overloads on Pavements	15-16	Productivity Requirements for Monitoring and Control of Construction Quality
15-06	Hazardous Highway Element Identification Procedures	15-17	Use of Key Performance Indicators in Transportation Surveillance and Strategic Planning
15-07	Life-Cycle Cost of Pavement Types	15-18	Automating Office Procedures in Transportation Agencies
15-08	Personnel Planning to Meet Future Needs		
15-09	Protective Coatings for Bridge Steel		
15-10	Prefabricated Structural Systems		
15-11	Traffic Data Collection and Analysis: Methods and Procedures		

Table 5

INDEX TO SYNTHESES AND STUDIES*

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

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