

These Digests are issued in the interest of providing an early awareness of the research results emanating from projects in the NCHRP. By making these results known as they are developed, it is hoped that the potential users of the research findings will be encouraged toward their early implementation in operating practices. Persons wanting to pursue the project subject matter in greater depth may do so through contact with the Cooperative Research Programs staff, Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418

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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 Projects 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 undervalued. 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.

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 page 8) and let us know.

Available Publications and Studies in Progress

The 117 Syntheses of Highway Practice that have been completed 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 \$20.00 or less.

Work is currently under way on the 26 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 11 or 12 syntheses per year. This number plus some alternative topics are selected by the committee at the Fall meeting. Topics selected for the FY '85 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 work-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 1985.

Corrections to Published Syntheses

Pages 7 and 8 contain corrections for some of the published syntheses.

Table 1
COMPLETED SYNTHESSES

No.	Title, Pages, Price	No.	Title, Pages, Price
Syntheses			
1.	Traffic Control for Freeway Maintenance (1969) 47 pp., \$2.20	62.	Potential State Resources for Financing Transportation Programs (1979) 34 pp., \$5.20
2.	Bridge Approach Design and Construction Practices (1969) 30 pp. (microfiche only)*	63.	Design and Use of Highway Shoulders (1979) 26 pp., \$4.80
3.	Traffic-Safe and Hydraulically Efficient Drainage Practice (1969) 38 pp. (microfiche only)*	64.	Bituminous Patching Mixtures (1979) 26 pp., \$4.80
4.	Concrete Bridge Deck Durability (1970) 28 pp. (microfiche only)*	65.	Quality Assurance (1979) 42 pp., \$5.60
5.	Scour at Bridge Waterways (1970) 37 pp. (microfiche only)*	66.	Glare Screen Guidelines (1979) 17 pp., \$4.40
6.	Principles of Project Scheduling and Monitoring (1970) (microfiche only)*	67.	Bridge Drainage Systems (1979) 44 pp., \$5.60
7.	Motorist Aid Systems (1971) 28 pp., \$2.40	68.	Motor Vehicle Size and Weight Regulation, Enforcement, and Permit Operations (1980) 45 pp., \$6.00
8.	Construction of Embankments (1971) 38 pp. (microfiche only)*	69.	Bus Route and Schedule Planning Guidelines (1980) 99 pp., \$8.00
9.	Pavement Rehabilitation - Materials and Techniques (1972) 41 pp., \$2.80	70.	Design of Sedimentation Basins (1980) 53 pp., \$6.80
10.	Recruiting, Training, and Retaining Maintenance and Equipment Personnel (1972) 35 pp., \$2.80	71.	Direction Finding from Arterials to Destinations (1980) 50 pp., \$6.40
11.	Development of Management Capability (1972) 50 pp., \$3.20	72.	Transportation Needs Studies and Financial Constraints (1980) 54 pp., \$6.40
12.	Telecommunications Systems for Highway Administration and Operations (1972) 39 pp., \$2.80	73.	Alternative Work Schedules: Impacts on Transportation (1980) 54 pp., \$6.80
13.	Radio Spectrum Frequency Management (1972) 32 pp., \$2.80	74.	State Transit-Management Assistance to Local Communities (1980) 34 pp., \$6.00
14.	Skid Resistance (1972) 66 pp., \$4.00	75.	Transit Boards-Composition, Roles, and Procedures (1981) 24 pp., \$6.20
15.	Statewide Transportation Planning - Needs and Requirements (1973) 41 pp. (microfiche only)*	76.	Collection and Use of Pavement Condition Data (1981) 74 pp., \$8.00
16.	Continuously Reinforced Concrete Pavement (1973) 23 pp., \$2.80	77.	Evaluation of Pavement Maintenance Strategies (1981) 56 pp., \$7.40
17.	Pavement Traffic Marking - Materials and Application Affecting Serviceability (1973) 44 pp., \$3.60	78.	Value Engineering in Preconstruction and Construction (1981) 23 pp., \$6.40
18.	Erosion Control on Highway Construction (1973) 52 pp., \$4.00	79.	Contract Time Determination (1981) 45 pp., \$7.20
19.	Design, Construction, and Maintenance of PCC Pavement Joints (1973) 40 pp., \$3.60	80.	Formulating and Justifying Highway Maintenance Budgets (1981) 49pp., \$7.20
20.	Rest Areas (1973) 38 pp., \$3.60	81.	Experiences in Transportation System Management (1981) 88 pp., \$8.40
21.	Highway Location Reference Methods (1974) 30 pp., \$3.20	82.	Criteria for Evaluation of Truck Weight Enforcement Programs (1981) 74 pp., \$7.20
22.	Maintenance Management of Traffic Signal Equipment and Systems (1974) 41 pp. (microfiche only)*	83.	Bus Transit Accessibility for the Handicapped in Urban Areas (1981) 73 pp., \$7.60
23.	Getting Research Findings Into Practice (1974) 24 pp., \$3.20	84.	Evaluation Criteria and Priority Setting for State Highway Programs (1981) 32 pp., \$6.40
24.	Minimizing Deicing Chemical Use (1974) 58 pp., \$4.00	85.	Energy Involved in Construction Materials and Procedures (1981) 34 pp., \$6.40
25.	Reconditioning High-Volume Freeways in Urban Areas (1974) 56 pp., \$4.00	86.	Effects of Traffic-Induced Vibrations on Bridge Deck Repairs (1981) 40 pp., \$6.80
26.	Roadway Design in Seasonal Frost Areas (1975) 104 pp., \$6.00	87.	Highway Noise Barriers (1981) 81 pp., \$7.20
27.	PCC Pavements for Low-Volume Roads and City Streets (1975) 31 pp. (microfiche only)*	88.	Underwater Inspection and Repair of Bridge Substructures (1981) 77 pp., \$7.60
28.	Partial-Lane Pavement Widening (1975) 30 pp., \$3.20	89.	Geotechnical Instrumentation for Monitoring Field Performance (1982) 46 pp., \$6.80
29.	Treatment of Soft Foundations for Embankments (1975) 25 pp., \$3.20	90.	New-Product Evaluation Procedures (1982) 34 pp., \$6.80
30.	Bituminous Emulsions for Highway Pavements (1975) 76 pp., \$4.80	91.	Highway Accident Analysis Systems (1982) 69 pp., \$7.60
31.	Highway Tunnel Operations (1975) 29 pp., \$3.20	92.	Minimizing Reflection Cracking of Pavement Overlays (1982) 38 pp., \$6.80
32.	Effects of Studded Tires (1975) 46 pp., \$4.00	93.	Coordination of Transportation System Management and Land Use Management (1982) 38 pp., \$6.80
33.	Acquisition and Use of Geotechnical Information (1976) 40 pp., \$4.00	94.	Photologging (1982) 38 pp., \$6.80
34.	Policies for Accommodation of Utilities on Highway Rights-of-Way (1976) 22 pp., \$3.20	95.	Statewide Transportation Planning (1982) 54 pp., \$7.20
35.	Design and Control of Freeway Off-Ramp Terminals (1976) 61 pp., \$4.40	96.	Pavement Subsurface Drainage Systems (1982) 38 pp., \$6.80
36.	Instrumentation and Equipment for Testing Highway Materials, Products, and Performance (1976) 70 pp., \$4.80	97.	Transit Ownership/Operation Options for Small Urban and Rural Areas (1982) 28 pp., \$6.40
37.	Lime-Fly Ash-Stabilized Bases and Subbases (1976) 66 pp., \$4.80	98.	Resealing Joints and Cracks in Rigid and Flexible Pavements (1982) 62 pp., \$7.20
38.	Statistically Oriented End-Result Specifications (1976) 40 pp., \$4.00	99.	Resurfacing with Portland Cement Concrete (1982) 90 pp., \$8.40
39.	Transportation Requirements for the Handicapped, Elderly, and Economically Disadvantaged (1976) 54 pp., \$4.40	100.	Managing State Highway Finance (1982) 23 pp., \$6.40
40.	Staffing and Management for Social, Economic, and Environmental Impact Assessment (1977) 43 pp., \$4.00	101.	Historic Bridges-Criteria for Decision Making (1983) 77 pp., \$8.00
41.	Bridge Bearings (1977) 62 pp., \$4.80	102.	Material Certification and Material-Certification Effectiveness (1983) 17 pp., \$6.00
42.	Design of Pile Foundations (1977) 68 pp., \$4.80	103.	Risk Assessment Processes for Hazardous Materials Transportation (1983) 26 pp., \$6.40
43.	Energy Effects, Efficiencies, and Prospects for Various Modes of Transportation (1977) 57 pp., \$4.80	104.	Criteria for Use of Asphalt Friction Surfaces (1983) 41 pp., \$6.80
44.	Consolidation of Concrete for Pavements, Bridge Decks, and Overlays (1977) 61 pp., \$4.80	105.	Construction Contract Claims: Causes and Methods of Settlement (1983) 58 pp., \$7.20
45.	Rapid-Setting Materials for Patching of Concrete (1977) 13 pp., \$2.40	106.	Practical Guidelines for Minimizing Tort Liability (1983) 40 pp., \$6.80
46.	Recording and Reporting Methods for Highway Maintenance Expenditures (1977) 35 pp., \$3.60	107.	Shallow Foundations for Highway Structures (1983) 38 pp., \$6.80
47.	Effect of Weather on Highway Construction (1978) 29 pp., \$3.20	108.	Bridge Weight-Limit Posting Practices (1984) 30 pp., \$6.40
48.	Priority Programming and Project Selection (1978) 31 pp., \$3.20	109.	Highway Uses of Epoxy with Concrete (1984) 68 pp., \$8.80
49.	Open-Graded Friction Courses for Highways (1978) 50 pp., \$4.00	110.	Maintenance Management Systems (In Publication)
50.	Durability of Drainage Pipe (1978) 37 pp., \$3.60	111.	Distribution of Wheel Loads on Highway Bridges (In Publication)
51.	Construction Contract Staffing (1978) 62 pp., \$6.00	112.	Cost-Effectiveness of Hot-Dip Galvanizing for Exposed Steel (In Publication)
52.	Management and Selection Systems for Highway Maintenance Equipment (1978) 17 pp., \$4.40	113.	Administration of Research, Development, and Implementation Activities in Highway Agencies (In Publication)
53.	Precast Concrete Elements for Transportation Facilities (1978) 48 pp., \$5.60	114.	Management of Traffic Signal Maintenance (In Publication)
54.	Recycling Materials for Highways (1978) (microfiche only)*	115.	Reducing Construction Conflicts between Highways and Utilities (In Publication)
55.	Storage and Retrieval Systems for Highway and Transportation Data (1978) 30 pp., \$4.80	116.	Asphalt Overlay Design Procedures (In Publication)
56.	Joint-Related Distress in PCC Pavement-Cause, Prevention and Rehabilitation (1979) 36 pp., \$5.20	117.	Toll Highway Financing (In Publication)
57.	Durability of Concrete Bridge Decks (1979) 61 pp., \$6.00	Research Results Digests	
58.	Consequences of Deferred Maintenance (1979) 24 pp., \$4.40	100.	Safe Conduct of Traffic Through Highway Construction and Maintenance Zones (1978) 5 pp., \$1.00
59.	Relationship of Asphalt Cement Properties to Pavement Durability (1979) 43 pp., \$5.60	106.	Use of Waste Materials in Highway Construction and Maintenance (1979) 2 pp., \$1.00
60.	Failure and Repair of Continuously Reinforced Concrete Pavement (1979) 42 pp., \$5.60		
61.	Changeable Message Signs (1979) 37 pp., \$5.60		

*These syntheses are available from TRB in microfiche form only at a cost of \$5.25 each.

Table 2
TOPICS BEING STUDIED

No.	Title	No.	Title
9-12	Welding and Inspection Practices in Bridge Fabrication	15-09	Protective Coatings for Bridge Steel
12-11	Bridge Designs to Reduce and Facilitate Maintenance and Repair	15-10	Prefabricated Bridge Elements and Systems
13-02	Methods of Cost-Effectiveness Analysis for Highway Projects	15-11	Traffic Data Collection and Analysis: Methods and Procedures
13-07	Storm Water Management for Transportation Facilities	16-01	Bridge Inspection Practices - Equipment, Staffing, and Safety
14-07	Maintenance Activities Accomplished by Contract	16-02	Use of Weigh-In-Motion Systems for Data Collection and Enforcement
14-09	Energy Conservation in Transportation	16-03	Maintenance Management of Street and Highway Signs
15-02	Durability of Prestressed Concrete Highway Structures	16-04	Microcomputer Software for Highway and Structural Engineering
15-03	Detecting Defects and Deterioration in Highway Structures	16-05	Freezing and Thawing Resistance of High-Strength Concrete
15-04	Equipment for Obtaining Pavement Condition and Traffic Loading Data	16-06	Wet-Pavement Safety Programs
15-05	Effects of Permit and Illegal Overloads on Pavements	16-07	Use of Fly Ash in Concrete
15-06	Methods for Identifying Hazardous Highway Elements	16-08	Traffic-Safe and Hydraulically Efficient Roadside Drainage Practices
15-07	Life-Cycle Cost Analysis of Pavements	16-09	Managing Urban Freeway Maintenance
15-08	Human Resource Management and Forecasting: Planning to Meet Future Needs	16-10	Bridge Expansion Devices

Table 3
NCHRP PROJECT COMMITTEE SP20-5

Chairman Ray R. Biege, Jr. Consultant	
Verdi Adam Louisiana Dept. of Transp. and Dev.	Bryant Mather USAE Waterways Experiment Station
Robert N. Bothman Oregon Dept. of Transportation	Thomas H. May Pennsylvania Dept. of Transportation
E. Dean Carlson Federal Highway Administration	Theodore F. Morf Consultant
Jack Freidenrich New Jersey Dept. of Transportation	Edward A. Mueller Morales and Shumer Engineers
David Gedney DeLeuw, Cather and Company	Robert J. Betsold (Liaison) Federal Highway Administration
Sanford LaHue American Concrete Pavement Association	K. B. Johns (Liaison) Transportation Research Board

Table 4
SYNTHESIS TOPICS SELECTED FOR THE FY '85 PROGRAM

No.	Title	No.	Title
17-01	System-Wide Safety Improvements	17-13	Optimization of Construction Engineering Oversight on Highway Projects
17-02	Unified Computerized Roadway Information Management Systems (UCRIMS)	17-14	Transportation Telecommunications
17-03	Private Sector Participation in Financing Transportation Projects	17-15	Enforcement of Restricted Access of Large Trucks to the Highway Network
17-04	Effectiveness of Quality Assurance Procedures in Highway Construction and Materials Control	17-16	Quality Assurance in Maintenance
17-05	Design, Construction, and Maintenance of PCC Pavement Joints	17-17	Negotiating for Professional Engineering Services
17-06	Recycling of Portland Cement Concrete Pavement	17-18	Improved Asphalt Specifications
17-07	Durability of Drainage Pipe	17-19	Treatment of Soft Foundations for Highway Embankments
17-08	Rehabilitation of D-Cracked Pavements	17-20	Removing the Legal Impediments to Freeway Incident Management
17-09	Cracking and Sealing Concrete Pavements	17-21	Use of Automatic Vehicle Identification Devices to Track Vehicles on Highways
17-10	Pavement Management	17-22	Undersealing and Jacking Concrete Pavement
17-11	Urban Pedestrian Traffic Control	17-23	Freeway Corridor Management
17-12	Superplasticizer Admixtures in Portland Cement Concrete	17-24	Railroad-Highway Grade-Crossing Surfaces

Table 5

INDEX TO SYNTHESSES AND STUDIES*

- Accident location 21, 91, 15-06
 Aid to motorists 7
 Asphalt
 - cement 59
 - emulsions 30
 - friction courses 49, 104
 - overlays 116
 - patching 64
 - pavements 30, 49, 59, 104
- Bases 37
 Bearings for bridges 41
 Bituminous emulsions 30
 Bituminous patching 64
 Bituminous pavements 30, 49, 59, 104
 Bridges
 - approaches 2
 - bearings 41
 - below-water inspection 88
 - concrete decks 4, 57, 86
 - construction 44, 53
 - design for maintenance 12-11
 - drainage 67
 - durability 4, 57, 86, 15-02, 15-03
 - expansion devices 16-10
 - foundations 42, 107
 - galvanizing 112
 - historic 101
 - inspection 88, 16-01
 - painting 15-09
 - patching 45
 - posting practices 108
 - precast concrete 53, 15-10
 - prefabricated 53, 15-10
 - prestressed, durability 15-02
 - scour 5
 - substructure repair 88
 - welding 9-12
 - wheel load distribution 111
- Bus transit planning 69
 Changeable message signs 61
 Communications 7, 12, 13, 71, 17-14
 Computer Software 16-04
 Computers 55
 Concrete
 - admixtures 17-12
 - bridge decks 4, 57, 86
 - consolidation 44
 - dry-cast 16-05
 - durability 4, 57, 15-02, 16-05
 - epoxies 109
 - fly ash in 16-07
 - overlays 99
 - patching 45
 - pavement recycling 54, 17-06
 - pavements 16, 19, 27, 45, 56, 60, 98, 99, 17-05, 17-08, 17-09
 - precast 53
 - water reducers 16-05, 17-12
- Consolidation of concrete 44
 Construction
 - bases and subbases 37
 - bituminous pavements 30
 - bridge approaches 2
 - bridge decks 4, 44, 57, 86
 - concrete pavements 16, 19, 27, 44, 17-05, 17-09
 - contract claims 105
 - contract time 79
 - embankments 8
 - energy factors 85
 - engineering 17-13
 - erosion control 18
 - management 51, 17-13
 - material certification 102
 - pavements 16, 19, 27, 30, 44, 17-05, 17-09
 - quality assurance 38, 65, 17-04
 - recycling 54, 17-06
 - specifications 38
 - staffing 51, 17-13
 - testing 65
 - traffic control RRD 100
 - value engineering 78
 - utilities 115
 - weather 47
 - welding 9-12
- Continuously reinforced pavements 16, 60
 Contract claims 105
 Contract maintenance 14-07
 Contract time determination 79
 Cost-effectiveness analysis 13-02
 Culverts
 - durability 50
 - inlets 3
- Data collection 15-04, 15-11, 16-02
 Data systems 55
 D-Cracking 17-08
 Deicing chemical use 24
 Deferred maintenance 58
 Design
 - bituminous pavements 30, 116
 - bridge approaches 2
 - bridge bearings 41
 - concrete pavements 16, 19, 27, 17-05
 - frost 26
 - microcomputer software 16-04
 - pavement overlays 99, 116
 - pavements 16, 19, 26, 27, 30, 17-05
 - pile foundations 42
 - roadways 26
 - shoulders 63
 - value engineering 78
- Disadvantaged, transportation for 39
 Drainage
 - bridge 67
 - pavement 96
 - sedimentation basins 70
- Drainage durability 50, 17-07
 Drainage structures 3, 16-08
 Elderly, transportation for 39, 83
 Embankments 8
 Emulsions 30
 End-result specifications 38
 Energy
 - bituminous emulsions 30
 - construction 85
 - transportation use 43, 14-09
- Epoxies 109
 Equipment
 - for bridge inspection 16-01
 - for pavement data 15-04
 - management 52
 - procurement 52
 - selection 52
- Expansion devices for bridges 16-10
 Field testing equipment 36, 15-04
 Finance/budgets 62, 72, 80, 100, 117, 17-03
 Fly ash 37, 16-07
 Foundations
 - embankments 8, 29
 - pile 42
 - shallow 107
 - soft strata 29
- Freeways
 - maintenance 1, 25, 16-09
 - off-ramps 35
 - repair 25
- Friction courses 49, 104
 Frost susceptibility 26
 Fuel taxes 62
 Galvanizing 112
 Geotechnical data 33
 Geotechnical exploration 33
 Geotechnical instrumentation 89
 Glare screen 66
 Handicapped, transportation for 39, 83
 Hazardous materials transportation
 - risk assessment 103
- Historic bridges 101
 Information for motorists 7, 71
 Inspection of bridges 88
 Instrumentation, geotechnical 89
 Joints, concrete pavement 19, 56, 98, 17-05, 17-08
 Joints and cracks, sealing 98
 Laboratory testing equipment 36
 Land use 93
 Legal liability 106
 Lime-fly ash 37
 Location reference methods 21
 Low-volume pavements 27

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

- Maintenance
- bituminous pavements 30, 64, 98
 - bridges 88, 12-11
 - budgets 80
 - concrete pavements 19, 29, 45, 56, 60, 98, 17-05
 - contract 14-07
 - costs 58, 98
 - deferred 58
 - equipment 52
 - freeways 1, 25, 16-09
 - management 10, 22, 46, 52, 58, 80, 110, 16-03
 - management systems 110
 - pavement costs 77, 98
 - pavement joints 19, 56, 98, 17-05, 17-08
 - pavements 9, 19, 25, 30, 45, 56, 60, 64, 98, 17-05, 17-08
 - personnel 10
 - records 46
 - recycling 54
 - reporting 46
 - rest areas 20
 - scheduling 16-09
 - signs 16-03
 - traffic control 1, 25, RRD 100
 - traffic signals 22, 114
 - tunnels 31
- Management
- construction 51, 17-13
 - data 55
 - maintenance 10, 22, 46, 52, 58, 80, 110
 - personnel 11, 15-08
 - research 113
 - roadway information 17-02
 - S.E.E. assessments 40
 - training 11
- Material certification 102
- Materials testing equipment 36
- Median glare screen 66
- Microcomputer software 16-04
- Mileposts 21
- Monitoring of projects 6
- Motorist aid systems 7
- Motorist information 71
- Needs studies 72
- New-product evaluation 90
- Noise barriers 87
- Off-ramps 35
- Open-graded surfaces 49
- Overlays 9, 49, 92, 99, 116, 17-09
- Overload effects 15-05
- Painting steel bridges 15-09
- Patching 9, 45, 64
- Pavements
- asphalt 30, 49, 59, 116
 - bases 37
 - bituminous 30, 49, 59, 104, 116
 - concrete 16, 19, 27, 44, 56, 60, 99, 17-05, 17-09
 - condition data 76, 15-04
 - construction 16, 19, 27, 30, 44, 17-05
 - CRCP 16, 60
 - distress 9
 - drainage 96
 - durability 59
 - effects of overloads 15-05
 - evaluation 76, 15-04
 - friction courses 49, 104
 - frost design 26
 - joints 19, 56, 98, 17-05, 17-08
 - life-cycle costs 15-07
 - low-volume 27
 - maintenance 9, 19, 25, 30, 45, 56, 60, 64, 98, 17-05, 17-08
 - maintenance costs 77, 98
 - management 17-10
 - overlays 9, 92, 99, 116, 17-09
 - patching 9, 45, 64
 - recycling 54, 17-06
 - rehabilitation 9, 25, 92, 17-08
 - skid resistance 14, 16-06
 - striping 17
 - studded tires 32
 - widening 28
- Pedestrian traffic control 17-11
- Permit operations 68
- effects on pavements 15-05
- Personnel
- construction engineering 51, 17-13
 - planning 15-08
 - Training 10, 11
- Photologging 94
- Pile foundations 42
- Pipe durability 50, 17-07
- Planning
- personnel 15-08
 - statewide transportation 15, 95
 - transit 69, 73
 - transportation 73
- Poor, transportation for 39
- Posting of bridges 108
- Pothole repair 45, 64
- Pozzolans 37, 16-07
- Precast concrete 53, 15-10
- Prefabricated structural systems 15-10
- Prestressed concrete durability 15-02
- Priority programming 48, 84
- Private sector financing 17-03
- Programming 48, 72, 84
- Project scheduling 6
- Quality assurance 38, 65, 17-04
- Radio communications 12, 13, 17-14
- Radio frequency management 13
- Recycling highway materials 54, 17-06
- Reference methods 21
- Reference posts 21
- Reflection cracking 9, 92
- Rehabilitation
- freeways 25
 - pavements 9, 56, 92, 99, 17-08
- Research
- implementation 23
 - management 113
- Rest areas 20
- Right-of-way
- utilities 34
 - value engineering 78
- Risk assessment, hazardous materials 103
- Roadway information systems 17-02
- Safety 1, 3, 7, 14, 32, 49, 66, 91, 15-06, 16-06, 16-08, 17-01, RRD 100
- Scheduling of projects 6
- Scour 5
- Sedimentation basins 18, 70
- Shoulders 63
- Sign maintenance 16-03
- Signs, changeable message 61
- Size regulation and enforcement 68
- Skid resistance 14, 16-06
- Snow and ice control 24
- Soft foundations 29
- Software, microcomputer 16-04
- Soil erosion 18
- Specifications 38, 65
- Spectrum management 13
- Stabilization of bases 37
- Staffing
- bridge inspection 16-01
 - construction 51, 17-13
 - maintenance 10
 - S.E.E. assessments 40
- Statewide transportation planning 15, 95
- Statistical specifications 38, 65
- Storm water management 13-07
- Stream scour 5
- Striping 17
- Structures (see bridges)
- Structures, precast 53
- Studded tires 32
- Subbases 37
- Subsurface information 33
- Superplasticizers for concrete 16-05, 17-12
- Surface courses 49, 104
- Taxes, fuel 62
- Telecommunications 12, 17-14
- Telephones 12, 17-14
- Testing, construction 65
- Testing equipment 36
- Toll financing 117
- Tort liability 106
- Traffic control
- construction RRD 100
 - devices 61
 - maintenance 1, RRD 100
 - pedestrian 17-11
 - ramps 35
- Traffic data collection 15-11
- Traffic marking 17
- Traffic paint 17
- Traffic safety 1, 3, 32, 35, 66, RRD 100, 16-08
- Traffic signal maintenance 22, 114
- Training of personnel 10, 11
- Transit
- barriers, elderly/handicapped 83
 - boards 75
 - management assistance 74
 - ownership 97
 - planning 69, 73
- Transportation planning 15, 72, 73, 95
- Transportation system management 81, 93
- Truck weights and sizes 68, 82, 16-02
- Tunnels, maintenance & operation 31
- Urban freeway reconditioning 25
- Utilities 34, 115
- Variable message signs 61
- Value engineering 78
- Vibration of concrete 44
- Waste materials RRD 106
- Weather 47
- Weigh-in-motion 16-02
- Weight regulation & enforcement 68, 82, 16-02
- Welding 9-12
- Widening of pavements 28
- Work schedules 73

CORRECTIONS TO PUBLISHED SYNTHESSES

Synthesis 42

- Page 43, equations 68, 69, and 70 and equation following equation 71:
Change ξ to ζ

Page 65, equation A-1:

Change $(+\sin\phi)$ to $(1 + \sin\phi)$

- Page 67, footnote to table
Change N_c^* to N_c and N_b to N_o

Synthesis 53

- Page 47 and 48:
Figure shown as B-3 is B-4; figure shown as B-4 is B-3.

Synthesis 66

- Page 5, caption for Figure 3:
Change to "... as a type II ..."

Synthesis 69

- Foreword, page iv:
Delete paragraph 3.
- Page 13, Table 2, item 2.6;
Page 41, column 2; and
Page 86, box under Toronto, item 2-6:
Change formula to $T_t = \Sigma P_i(t_i + \sqrt{h})$
- Page 45, Table 15, title:
Change to "GUIDELINES FOR SERVICE CHANGES (Port Authority of Allegheny County)."

Synthesis 76

- Page 2, line 5;
Page 16, column 1, line 18; and
Page 23, column 1, line 29:
Change "\$50" to "\$25."
- Page 7 column 2:
Change "i = 1" to "i = 1."
- Page 13, Table 9, under Pennsylvania:
Change "10%" to "100%."

Synthesis 85

- Tables 19 and 20:

The fuel-use factors given in Table 14 were derived from the assumption that trucks would travel one way fully loaded and return empty. Thus the factors given are to be used for the one-way distance that the material is to be hauled. However, in Appendix B, Tables B-2 and B-3, the computations for transport energy erroneously show the haul distance multiplied by 2; therefore, the transport energy values throughout these tables should be half the values shown.

Because the computations in Appendix B are the basis for Tables 19 and 20, these tables also contain the wrong values; the corrected tables are shown here. Although the specific values given in the text of Chapter 6 should be changed to reflect the changes in Tables 19 and 20, the basic statements and conclusions will not change.

Synthesis 92

- Page 5, column 1, line 1 under NEEP-10 PROJECT:
Change date to "1970."
- Page 13, column 1, line 20:
Change "16/yd²" to "lb/yd²"
- Page 19, column 2, top:
All the U.S. customary conversions are incorrect; numbers given should be multiplied by 2.6.

Synthesis 94

- Page 34, Appendix A:
Add the following to the list of laboratories -
CineFilm Laboratory, Inc.
2156 Faulkner Rd., N.E.
Atlanta, Georgia 30324

Synthesis 85

TABLE 19
ENERGY USED TO CONSTRUCT VARIOUS TYPES OF HIGHWAY BASE COURSES (gal/mi-in.)^a

Type of Base	Construction E_c	Transport		Processing E_p	Calorific E_h	Total ^b	
		Short E_t	Long E_t			$E_c + E_t$	All Categories
Crushed Stone	115	272	1,770	299	0	Short 400 Long 1,900	700 2,200
Emulsion-treated local aggregate	126	265	688	1,116	11,412	Short 400 Long 800	12,900 13,300
Hot-mixed asphalt concrete	1,649	390	2,086	452	9,200	Short 2,000 Long 3,700	11,700 13,400
Lean concrete; local or recycled aggregate	246	285	1,205	2,622	0	Short 500 Long 1,500	3,200 4,100
Road-mixed, cement- treated subgrade	182	43	43	2,445	0	200	2,700

^aExpressed as equivalent gallons of diesel fuel per mile of pavement for each inch of thickness. See Appendix B for assumptions made and details of computations.

^bRounded to the nearest 100 gal/mi-in.

Synthesis 85

TABLE 20
ENERGY USED TO CONSTRUCT VARIOUS TYPES OF HIGHWAY PAVEMENT SURFACES (gal/mi-in.)^a

Type of Surface	Construction E_c	Transport		Processing E_p	Calorific E_h	Total ^b	
		Short E_t	Long E_t			$E_c + E_t$	All Categories
Asphalt concrete (HMAC)	1,605	338	2,301	388	10,220	Short 1,900 Long 3,900	12,600 14,500
Portland cement concrete (no steel)	246	380	2,118	5,912	0	Short 600 Long 2,400	6,500 8,300
Reinforced portland cement concrete	246	387	2,125	7,289	0	Short 600 Long 2,400	7,900 9,700

^aExpressed as equivalent gallons of diesel fuel per mile of pavement for each inch of thickness. See Appendix B for assumptions made and details of computations.

^bRounded to the nearest 100 gal/mi-in.

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