

# RESEARCH RESULTS DIGEST

April 1992

Number 184

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.

**Area of Interest: 24 Pavement Design and Performance**  
(01 highway transportation)

**Responsible Staff Engineer: Daniel W. Dearasaugh, Jr.**

## NCHRP Research on Pavements

*An NCHRP digest of the progress and status of pavements engineering research under the National Cooperative Highway Research Program*

### INTRODUCTION

Since its inception in 1962, the National Cooperative Highway Research Program (NCHRP) has included numerous studies of interest to pavement engineers. As an easy reference, this Digest outlines the status of all NCHRP research related to highway pavements (see Tables 1 through 5). NCHRP projects are primarily applied research -- studies aimed at producing results usable by the practitioner. Most NCHRP research in this area focuses on design, materials, construction, evaluation, and management of pavements.

### Design

The NCHRP was formed shortly after the AASHO Road Test, and the first pavement research project resulted in guidelines for satellite pavement studies. The 1972 AASHO *Interim Guide for Design of Pavement Surfaces*, the 1981 AASHTO *Interim Guide for Design of Pavement Surfaces*, as well as the 1986 AASHTO *Guide for Design of Pavement Structures* were produced through NCHRP

projects. Currently, NCHRP has an ongoing study which has procedures for analysis and design of pavements through mechanistic means as an ultimate objective.

### Materials

NCHRP projects have focused on aggregates, asphalt, and PC concrete, as well as admixtures and additives. A major recent NCHRP project developed an Asphalt-Aggregate Mixture Analysis System (AAMAS) which provided an initial step in relating asphalt mix design to performance of asphalt pavements.

### Construction

Improved construction techniques, inspection, and acceptance testing have been the focus of NCHRP efforts in this area. As examples, projects have dealt with determination of cement and water content of concrete mixes, aggregate acceptance, and smoothness in pavement construction. NCHRP Syntheses of Highway Practices have been prepared on construction activities, such as consolidation of

concrete, open-graded friction courses, and use of fabrics in asphalt pavements.

### Evaluation and Management

Considerable research aimed at evaluating pavement condition, both on a project and network basis, has been accomplished under the NCHRP Program. The emphasis on, and the benefits of, pavement management systems have focused attention on efforts in this area. Non-destructive testing, use of video images for determining pavement surface distresses, locating voids under the pavement, skid resistance, and pavement roughness and rideability have been subjects of NCHRP pavement condition research. The AASHTO publication, *Guidelines for Pavement Management Systems*, was a product of an NCHRP Project.

### NCHRP ADMINISTRATION

Although the NCHRP is administered by the Transportation Research Board (TRB), it is sponsored by the member departments of the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the Federal Highway Administration (FHWA), U.S. Department of Transportation. NCHRP contributions are voluntary, and the amount is based on each state's Federal-aid apportionment for State Planning and Research (SPR). The NCHRP is carried out under a three-way agreement between AASHTO, FHWA, and the National Academy of Sciences, TRB's parent organization.

### TYPES OF NCHRP PUBLICATIONS

NCHRP's primary delivery mechanism is the *Report* series. Most of the projects listed in Table 1, Research in Progress, and Table 2, Pending Research, will result in published NCHRP Reports. Section (a) of Table 3, NCHRP Publications, lists NCHRP Reports from completed research projects.

A second type of publication, the *Synthesis of Highway Practice*, is addressed in section (b) of Table 3, and in Tables 1 and 2 under Project 20-5, "Synthesis of Information Related to Highway Problems." Synthesis publications are a compilation of existing practices rather than being the result of new research.

The third publication type included herein is the *Research Results Digest*. RRDs are usually issued in the interest of providing early awareness of research results emanating from some NCHRP projects. Pertinent RRDs are listed in section (c), Table 3.

Table 4 lists unedited manuscripts submitted by research agencies in compliance with project contractual requirements. These reports are also available for loan or purchase on written request to the NCHRP.

Table 5 lists relevant reports that were produced for Project 20-7, "Research for the AASHTO Standing Committee on Highways" (SCOH). This ongoing project consists of a series of tasks to obtain the data required by the SCOH to develop engineering and operations policies as a guide for State DOTs. Project 20-7 research sometimes results in an NCHRP Report, but more frequently, the findings are used to develop an AASHTO policy or guideline.

### THE NCHRP STAFF

After the title of each research project listed in Tables 1 and 2, the responsible staff engineer's name appears in parentheses. The NCHRP staff will answer questions concerning ongoing research and can be reached at 202/334-3224.

### OBTAINING PUBLICATIONS

Copies of the publications in Table 3 and Table 4 can be obtained from the Business Office, Transportation Research Board, 2101 Constitution Avenue, NW, Washington, DC 20418. A check or money order payable to the *Transportation Research Board* must accompany orders totaling \$20.00 or less.

TABLE 1 - RESEARCH IN PROGRESS

| Project Number | Title   | Research Agency               | Completion Date |
|----------------|---|-------------------------------|-----------------|
| 1-25(1)        | Effects of Heavy Vehicle Characteristics on Pavement Response and Performance Phase II ( <i>Dearasaugh</i> )  | University of Michigan        | 4/92*           |
| 1-26           | Calibrated Mechanistic Structural Analysis Procedures for Pavements for Pavements ( <i>Dearasaugh</i> )   | University of Illinois        | 6/92            |
| 1-28           | Laboratory Determination of Resilient Modulus for Flexible Pavement Design ( <i>Dearasaugh</i> )  | Georgia Tech                  | 1/93            |
| 14-8A          | Chip Seal Coats for High-Traffic-Volume Asphalt Concrete Pavements ( <i>Dearasaugh</i> )  | Asphalt Institute             | 12/92           |
| 20-5           | Synthesis of Information Related to Highway Problems ( <i>Jencks</i> )<br>Topic 17-05 - Design, Construction, and Maintenance of PCC Pavement Joints<br>Topic 19-09 - Moisture Damage in Asphalt Concrete<br>Topic 21-01 - Performance Characteristics of Open-Graded Asphalt Friction<br>Topic 21-10 - In-Place Recycling of Asphalt Concrete<br>Topic 21-13 - State Highway Pavement Design Practices<br>Topic 22-02 - Uses of Recycled Rubber Tires in Highways<br>Topic 22-07 - Current Practices in Determining Pavement Condition<br>Topic 22-10 - Use of Waste Materials and By-Products in Highway Construction | Transportation Research Board | Varies          |
| 20-7           | Research for AASHTO Standing Committee on Highways ( <i>Dearasaugh</i> )<br>Task 49 - Follow-up on U.S.A. Asphalt Study Tour of Europe  |                               | Varies          |

(Name of Responsible NCHRP Staff Engineer is italicized in parentheses. See text.)

\* Report is in the review process.

TABLE 2 - PENDING RESEARCH

| Project Number | Title  | Funds Available | Expected Start                     |
|----------------|--|-----------------|------------------------------------|
| 1-29           | Enhanced Surface Drainage of Multilane Pavements ( <i>Dearasaugh</i> )   | 400,000         | Early 1993                         |
| 1-30           | Support Under PC Concrete Pavements ( <i>Dearasaugh</i> )  | 150,000         | Early 1993                         |
| 4-18           | Design of Large Stone Mixtures ( <i>Dearasaugh</i> )   | 300,000         | Mid 1992                           |
| 9-7            | Field Procedures and Equipment to Implement SHRP Asphalt Specifications ( <i>Dearasaugh</i> )  |                 | Late 1992                          |
| 20-5           | Synthesis of Information Related to Highway Problems ( <i>Jencks</i> )<br>Task 23-02 - Rapid Test Methods<br>Task 23-07 - Guaranty of Road Construction by the Contractor<br>Task 23-10 - Portland Cement Concrete Resurfacing |                 | Early 1992<br>Mid 1992<br>Mid 1992 |

TABLE 3 - NCHRP PUBLICATIONS

| No. | Title | Research Agency | Pages | Cost (\$) | Year |
|-----|-------|-----------------|-------|-----------|------|
|-----|-------|-----------------|-------|-----------|------|

## (a) NCHRP Reports

|    |   |                                 |    |      |      |
|----|---|---------------------------------|----|------|------|
| 2  | An Introduction to Guidelines for Satellite Studies of Pavement Performance | Highway Research Board          | 19 | 1.80 | 1964 |
| 2A | Guidelines for Satellite Studies of Pavement Performance                    | Roy Jorgensen and Associates    | 85 | 3.00 | 1963 |
| 8  | Synthetic Aggregates for Highway Construction                               | Battelle Memorial Institute     | 13 | 1.00 | 1964 |
| 10 | Theoretical Analysis of Structural Behavior of Road Test Flexible Pavements | Georgia Institute of Technology | 31 | 2.80 | 1963 |
| 21 | Detecting Variations in Load-Carrying Capacity of Flexible Pavements        | Cornell Aero Lab                | 30 | 1.40 | 1964 |
| 22 | Factors Influencing Flexible Pavement Performance                           | Northernwestern University      | 69 | 2.60 | 1963 |

TABLE 3 - NCHRP PUBLICATIONS (Cont.)

| No.                                 | Title  | Research Agency                           | Pages | Cost (\$) | Year |
|-------------------------------------|--|---|-------|-----------|------|
| <b>(a) NCHRP Reports, continued</b> |  |   |       |           |      |
| 27                                  | Physical Factors Influencing Resistance of Concrete to Deicing Agents  | University of Illinois                    | 41    | 2.00      | 1965 |
| 30                                  | Extension of AASHTO Road Test Performance Concepts   | Purdue University                         | 33    | 1.60      | 1966 |
| 35                                  | Prediction of Flexible Pavement Deflections from Laboratory Repeated-Load Tests  | University of California                  | 117   | 5.00      | 1967 |
| 37                                  | Tentative Skid-Resistance Requirements for Main Rural Highway  | Pennsylvania State University             | 80    | 3.60      | 1966 |
| 38                                  | Evaluation of Pavement Joint and Crack Sealing Materials and Practices   | Rensselaer                                | 40    | 2.00      | 1966 |
| 39                                  | Factors Involved in the Design of Asphaltic Pavement Surfaces  | Materials Research and Development        | 112   | 5.00      | 1967 |
| 43                                  | Density and Moisture Content Measurements by Nuclear Methods   | Research Triangle Institute               | 38    | 2.00      | 1966 |
| 46                                  | Effects of Different Methods of Stockpiling and Handling Aggregates  | Miller-Warden Associates                  | 102   | 4.60      | 1965 |
| 52                                  | Measurement of Pavement Thickness by Rapid and Nondestructive Methods  | IIT Research Institute                    | 82    | 3.80      | 1966 |
| 59                                  | Standard Measurements for Satellite Road Test Program  | Texas A & M University                    | 78    | 3.20      | 1967 |
| 61                                  | Evaluation of Studded Tire - Performance Data and Pavement Wear Measurement  | Cornell Aeronautical Laboratory           | 66    | 3.00      | 1967 |
| 66                                  | Identification of Frost-Susceptible Particles in Concrete Aggregates   | The Pennsylvania State University         | 62    | 2.80      | 1967 |
| 67                                  | Relation of Asphalt Rheological Properties to Pavement Durability Gradation Variations and Effects                       | American Oil Company                      | 45    | 2.20      | 1967 |
| 76                                  | Detecting Seasonal Changes in Load-Carrying Capabilities of Flexible Pavements   | Texas A & M University                    | 37    | 2.00      | 1968 |
| 97                                  | Analysis of Structural Behavior of AASHTO Road Test Rigid Pavements  | Duke University                           | 35    | 2.70      | 1966 |
| 100                                 | Research Needs Relating to Performance of Aggregates in Highway Construction   | Virginia Polytechnic Institute            | 68    | 3.40      | 1969 |
| 105                                 | Dynamic Pavement Loads of Heavy Highway Vehicles   | General Motors Corporation                | 94    | 5.00      | 1969 |
| 125                                 | Optimization of Density and Moisture Content Measurements by Nuclear Methods   | North Carolina State University           | 86    | 4.40      | 1970 |
| 128                                 | Evaluation of AASHTO Interim Guides for Design of Pavement Structures  | Materials Research and Development        | 111   | 5.60      | 1971 |
| 135                                 | Promising Replacements for Conventional Aggregates for Highway Use   | University of Illinois                    | 53    | 3.60      | 1971 |
| 139                                 | Flexible Pavement Design and Management - Systems Formulation  | Materials Research and Development        | 64    | 4.40      | 1970 |
| 140                                 | Flexible Pavement Design and Management - Systems Formulation  | Materials Research and Development        | 64    | 4.40      | 1970 |
| 151                                 | Locked-Wheel Pavement Skid Tester Correlation and Calibration Techniques   | The Pennsylvania State University         | 100   | 6.00      | 1973 |
| 154                                 | Determining Pavement Skid Resistance Requirements at Intersections and Braking Sites                                     | The Franklin Institute                    | 64    | 4.40      | 1973 |
| 160                                 | Flexible Pavement Design and Management - Systems Approach Implementation  | Texas A & M University                    | 53    | 4.00      | 1973 |
| 166                                 | Waste Materials as Potential Replacements of Highway Aggregates  | Valley Forge Laboratories                 | 94    | 5.60      | 1973 |
| 168                                 | Rapid Measurement of Concrete Pavement Thickness and Reinforcement Location - Field Evaluation of Nondestructive Systems | Pennsylvania Department of Transportation | 63    | 4.80      | 1973 |
| 172                                 | Density Standards for Field Compaction of Granular Bases and Subbase   | Clemson University                        | 73    | 4.80      | 1973 |
| 176                                 | Studded Tires and Highway Safety-Feasibility of Determining Indirect Effects   | University of Michigan                    | 42    | 4.00      | 1973 |
| 184                                 | Influence of Combined Highway Grade and Horizontal Alignment on Skidding   | University of Michigan                    | 33    | 3.20      | 1974 |
| 192                                 | Predicting Moisture-Induced Damage to Asphaltic Concrete   | University of Idaho                       | 46    | 5.20      | 1982 |
| 195                                 | Minimizing Premature Cracking in Asphaltic Concrete Pavement   | Materials Research and Development        | 51    | 6.00      | 1973 |
| 202                                 | Improved Pavement-Shoulder Joint Design  | Georgia Institute of Technology           | 103   | 7.20      | 1976 |
| 207                                 | Upgrading of Low-Quality Aggregates for PCC and Bituminous Pavements   | The Pennsylvania State University         | 91    | 7.20      | 1979 |
| 213                                 | Bayesian Methodology for Verifying Recommendations to Minimize Asphalt Pavement Distress                                 | Woodward-Clyde Consultants                | 52    | 6.00      | 1978 |
| 215                                 | Pavement Management System Development   | ARE, Inc.                                 | 32    | 5.20      | 1979 |
| 224                                 | Guidelines for Recycling Pavement Materials  | Texas A&M University                      | 137   | 9.20      | 1979 |
| 228                                 | Calibration of Response-Type Road Roughness Measuring Systems  | University of Michigan                    | 81    | 7.60      | 1980 |
| 237                                 | Locating Voids Beneath Pavement Using Pulsed Electromagnetic Wave Techniques   | Georgia Technology Research Corp.         | 40    | 6.80      | 1981 |

TABLE 3 - NCHRP PUBLICATIONS (Cont.)

| No.   | Title  | Research Agency                               | Pages | Cost (\$) | Year |
|---|--|---|-------|-----------|------|
| <b>(a) NCHRP Reports, continued</b>                           |  |   |       |           |      |
| 246   | Predicting Moisture-Induced Damage to Asphaltic Concrete - Field Evaluation                        | University of Idaho                           | 50    | 7.20      | 1982 |
| 252   | Adding Dust Collector Fines to Asphalt Paving Mixtures   | The Pennsylvania State University             | 90    | 8.40      | 1982 |
| 254   | Shoulder Geometrics and Use Guidelines   | Hugh Downs-RK&K                               | 71    | 7.60      | 1983 |
| 259   | Design of Emulsified Asphalt Paving Mixtures   | The Asphalt Institute                         | 97    | 8.80      | 1984 |
| 268   | Influence of Asphalt Temperature Susceptibility on Pavement Construction and Performance           | Texas A & M University                        | 62    | 7.60      | 1984 |
| 269   | Paving with Asphalt Cements Produced in the 1980's   | Texas A & M University                        | 28    | 6.40      | 1984 |
| 274   | Use of Antistripping Additives in Asphaltic Concrete Mixtures - Laboratory Phase                   | Texas A & M University<br>Research Foundation | 50    | 7.60      | 1979 |
| 275   | Pavement Roughness and Rideability   | Ketron, Inc.                                  | 69    | 8.80      | 1984 |
| 277   | Portland Cement Concrete Pavement Evaluation System (COPES)  | University of Illinois                        | 69    | 9.60      | 1985 |
| 281   | Joint Repair Methods for Portland Cement Concrete Pavements - Design and Construction Guidelines   | University of Illinois                        | 83    | 9.20      | 1985 |
| 291   | Development of Pavement Structural Subsystems  | Materials Redevelopment                       | 59    | 8.80      | 1974 |
| 304   | Determining Deteriorated Areas in Portland Cement Concrete Pavements Using Radar and Video Imaging | Gulf Applied Research                         | 107   | 14.00     | 1987 |
| 308   | Pavement Roughness and Rideability - Field Evaluation  | JMJ Research                                  | 48    | 9.00      | 1987 |
| 315   | Potential Benefits of Geosynthetics in Flexible Pavement Systems                                   | Georgia Tech. Research Corp.                  | 56    | 9.00      | 1988 |
| 327   | Determining Asphaltic Concrete Pavement Structural Properties by Nondestructive Testing            | Texas A & M Research Foundation               | 105   | 11.00     | 1989 |
| 332   | Framework for Development of Performance-Related Specifications for Hot-Mix Asphaltic Concrete     | The Pennsylvania State University             | 118   | 12.00     | 1989 |
| 338   | Asphalt-Aggregate Mixture Analysis System - AAMAS  | Brent Rauhut Engineering, Inc.                | 185   | 20.00     | 1990 |
| <b>(b) NCHRP Synthesis of Highway Practice (Project 20-5)</b> |  |   |       |           |      |
|   |  | Transportation Research Board                 |       |           |      |
| 9   | Pavement Rehabilitation - Materials and Techniques   |   | 41    | 2.80      | 1972 |
| 14  | Skid Resistance  |   | 66    | 4.00      | 1972 |
| 16  | Continuously Reinforced Concrete Pavement  |   | 23    | 2.80      | 1973 |
| 19  | Design, Construction, and Maintenance of PCC Pavement Joints                                       |   | 40    | 3.60      | 1973 |
| 27  | PCC Pavements for Low-Volume Roads and City Streets  |   | 31    | 3.60      | 1975 |
| 28  | Partial-Lane Pavement Widening   |   | 30    | 3.20      | 1975 |
| 30  | Bituminous Emulsions for Highway Pavements   |   | 76    | 4.80      | 1975 |
| 32  | Effects of Studded Tires   |   | 46    | 4.00      | 1975 |
| 37  | Lime-Fly As-Stabilized Bases and Subbases  |   | 66    | 4.80      | 1976 |
| 44  | Consolidation of Concrete for Pavements, Bridge Decks, and Overlays                                |   | 61    | 4.80      | 1977 |
| 45  | Rapid-Setting Materials for Patching of Concrete   |   | 13    | 2.40      | 1977 |
| 49  | Open-Graded Friction Courses for Highways  |   | 50    | 4.00      | 1978 |
| 54  | Recycling Materials for Highways   |   | 53    | 5.60      | 1978 |
| 56  | Joint-Related Distress in PCC Pavement - Cause, Prevention, and Rehabilitation                     |   | 36    | 5.20      | 1979 |
| 59  | Relationship of Asphalt Cement Properties to Pavement Durability                                   |   | 43    | 5.60      | 1979 |
| 60  | Failure and Repair of Continuously Reinforced Concrete Pavement                                    |   | 42    | 5.60      | 1979 |
| 63  | Design and Use of Highway Shoulders  |   | 26    | 4.80      | 1979 |
| 64  | Bituminous Patching Mixtures   |   | 26    | 4.80      | 1979 |
| 76  | Collection and Use of Pavement Condition Data  |   | 74    | 8.00      | 1981 |
| 77  | Evaluation of Pavement Maintenance Strategies  |   | 56    | 7.40      | 1981 |
| 92  | Minimizing Reflection Cracking of Pavement Overlays  |   | 38    | 6.80      | 1982 |
| 96  | Pavement Subsurface Drainage Systems   |   | 38    | 6.80      | 1982 |
| 98  | Resealing Joint and Cracks in Rigid and Flexible Pavements   |   | 62    | 7.20      | 1982 |
| 99  | Resurfacing with Portland Cement Concrete  |   | 90    | 8.40      | 1982 |
| 104   | Criteria for Use of Asphalt Friction Surfaces  |   | 41    | 6.80      | 1983 |
| 116   | Asphalt Overlay Design Procedures  |   | 66    | 8.40      | 1984 |
| 122   | Life-Cycle Cost Analysis of Pavements  |   | 136   | 10.80     | 1985 |
| 126   | Equipment for Obtaining Pavement Condition and Traffic Loading Data                                |   | 117   | 11.20     | 1986 |

## (b) NCHRP Synthesis of Highway Practice (Project 20-5), continued

Transportation Research Board

|     |   |     |       |      |
|-----|---|-----|-------|------|
| 134 | D-Cracking of Concrete Pavements  | 33  | 7.60  | 1987 |
| 135 | Pavement Management Practices   | 139 | 12.40 | 1987 |
| 144 | Breaking/Cracking and Sealing Concrete Pavements                                      | 39  | 8.00  | 1989 |
| 152 | Compaction of Asphalt Pavement  | 42  | 8.00  | 1989 |
| 154 | Recycling Portland Cement Concrete Pavement   | 46  | 8.00  | 1989 |
| 158 | Wet-Pavement Safety Programs  | 54  | 8.00  | 1990 |
| 160 | Cold-Recycled Bituminous Concrete Using Bituminous Materials                          | 105 | 11.00 | 1990 |
| 167 | Measurements, Specifications, and Achievement of Smoothness for Pavement Construction | 34  | 8.00  | 1990 |
| 171 | Fabrics in Asphalt Overlays and Pavement Maintenance                                  | 72  | 9.00  | 1991 |

## (c) NCHRP Research Results Digest

|     |   |                                  |    |      |      |
|-----|---|----------------------------------|----|------|------|
| 48  | Surface Condition Rating System for Bituminous Pavement           | University of Minnesota          | 24 | 1.50 | 1974 |
| 82  | Design of Continuously Reinforced Concrete Pavements for Highways | University of Texas              | 12 | 1.00 | 1975 |
| 89  | Guidelines for Skid-Resistant Highway Pavement Surfaces           | Materials Research & Development | 12 | 1.00 | 1975 |
| 106 | Use of Waste Materials in Highway Construction and Maintenance    | Transportation Research Board    | 2  | 1.00 | 1979 |
| 169 | Rapid Replacement of Portland Cement Concrete Pavement Segments   | ARE Inc.                         | 11 | 4.00 | 1988 |
| 181 | Video Image Processing for Evaluating Pavement Surface Distress   | Triple Vision, Inc.              | 4  | 4.00 | 1991 |

TABLE 4 - AGENCY FINAL REPORTS

| Proj. No. | Title   | Year | Research Agency     | Availability* |
|-----------|---|------|---------------------|---------------|
| 1-10B     | Development of Pavement Structural Subsystems                   | 1973 | Woodward-Clyde      | A             |
| 1-27      | Video Image Processing for Evaluating Pavement Surface Distress | 1991 | Triple Vision, Inc. | A             |

\* A—A copy of the uncorrected draft of the agency's report may be obtained on a loan basis by request to the Director, Cooperative Research Programs, Transportation Research Board.

TABLE 5 - AGENCY FINAL REPORTS RECEIVING SPECIAL TREATMENT

| Proj. No. | Title  | Year | Research Agency                  | Available From                                      |
|-----------|--|------|----------------------------------|---|
| 20-7      | Task 24 - AASHTO Guide for Design of Pavement Structures | 1986 |                                  | AASHTO  |
| 20-7      | Task 37 - Hot Mix Asphalt Paving Handbook                | 1991 | James A. Scherocman (Consultant) | AASHTO, FAA,<br>FHWA, NAPA,<br>USACE, APWA,<br>NACE |
| 20-7      | Task 38 - AASHTO Guidelines for Pavement Management      | 1990 | ARE, Inc.                        | AASHTO  |

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MAT. LAB.

| MATERIALS       | ACT  | INF |
|-----------------|------|-----|
| Mtls Supv       |      |     |
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| Geotech         | COPY |     |
| Geot Staff      |      |     |
| Proj Dev        |      |     |
| Pavement        |      |     |
| QC Coord        |      |     |
| Agg & Struc     |      |     |
| Chem & Asph     |      |     |
| Soils & Asph Mx |      |     |
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| File            |      |     |

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