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Robert C. Deen
Kentucky Department of Transportation

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# Transportation Research Reports

Issued by the
Division of Research

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Kentucky Bureau of Highways
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Lexington, Kentucky 40508

## Sponsoring Agency Name and Address

## Abstract
A bibliographic listing of research reports issued by the Division of Research, Kentucky Bureau of Highways.
The contents of this report reflect the views of the author who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Bureau of Highways. This report does not constitute a standard, specification, or regulation.
The history of transportation research in Kentucky has been continuous with and closely parallels that of the Department of Transportation and its predecessor, the Department of Highways. The Kentucky Department of Highways was organized in 1912; this was soon followed in 1914 by the establishment of a Road Materials Testing Laboratory at the University of Kentucky. The testing services offered by that laboratory were used to evaluate the quality of materials for road building and to enforce specification requirements for highway construction. Testing and research were continued jointly by the Kentucky Department of Highways and the University of Kentucky Department of Civil Engineering until 1928; materials testing services were then transferred to Frankfort where a testing laboratory was provided. Research, however, continued at the University in the Department of Civil Engineering. Those arrangements continued until about 1939 when it became apparent a more intensified and productive research program was needed by the Department of Highway. Realizing from previous experience that research should be a separate entity from testing, a bilateral agreement between the Department of Highways and the University of Kentucky was entered into to construct and operate a materials research laboratory on the campus of the University. A building was eventually erected in 1941; full staffing by the Department of Highways was not achieved until after World War II in 1946. During this period, research was a branch of the Division of Design. In 1949, it achieved full divisional status and became the Division of Research in the Kentucky Department of Highways.

From the beginning, it was evident that certain problems associated with design, construction, and maintenance of highway facilities should be studied and investigated. Subjects such as quality, soundness, and durability of road aggregates; design and control of bituminous mixes; effects of freezing-thawing and wetting-drying and of chemicals and traffic upon concrete; many aspects of soils and soil engineering; and construction techniques and methods have posed researchable problems and have been under continual surveillance. These general subjects have been the most researched items in the history of highways, and even now a large portion of the research efforts are channeled toward "physical" research. Many problems have been solved, but many new ones have been discovered. Nevertheless, these materials are the substances of which roads are built; and it is towards the proper and efficient utilization of materials that physical research is aimed. Many functions involving design, construction, and maintenance of the transportation facility emerge or evolve from the knowledge of materials.

During the past decade or two, there has been a significant trend to expand transportation research programs to include the socio-economic and environmental aspects of transportation development. It is anticipated that the research program will continue to expand in these areas with increased efforts in the study of the social, economic, and environmental impacts; investigation of the legal and administrative techniques and problems associated with transportation systems; and the development of more reliable methods and techniques of predicting the demand and(or) need for highway and other transportation facilities.

The listings contained herein are an updating of Research Report 320, Chronological Listing of Research Reports, and Research Report 321, Subject Listing of Research Reports, issued in January 1972. The first listing herein is a summary of reports issued by the Division of Research since 1939 by year. The second listing is by subject areas; this listing has been greatly expanded over the subject matter listing in 1972. All reports have been categorized according to a subject-area list used by the Transportation Research Board. The subject-area list is included here as Table 1. Any report can be categorized under more than one of the subject areas, depending upon the major thrusts of the particular report.
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2. Cooperative Investigation of Joint Spacing in Concrete Pavements, Louis Campbell, 1940.


5. An Outline of Prospective Research, L. E. Gregg, December 1945.


1946


19. A Summary of Experiments with Air Entrainment in Cement Concrete, September 1946.


1947


35. Supplementary Report No. 1 on Experiments with Air Entrainment in Cement Concrete, October 1947; also Experiments with Air Entrainment in Cement Concrete, L. E. Gregg, Bulletin No. 5, Engineering Experiment Station, University of Kentucky, September 1947.

1948


1949


1950


1951


64. Report No. 3 on a Concrete Pavement without Transverse Joints, W. B. Drake, February 1951.


68. Final Report on Evaluation of Plant Mix Surface Treatments by Road Test Sections, W. B. Drake, July 1951.


70. Memorandum Report on Vibratory Compaction of Base Courses, November 1951.

71. Observation on Seal Coats, Tack Coats, Penetration Macadam, and Blade Spread Hot Mix in 1951, W. B. Drake and H. J. Field, Jr., December 1951.


1952


75. Report No. 1 on a Bank Gravel Base Containing Calcium Chloride, W. B. Drake, February 1952.


82. Report No. 1 on a Limestone-Calcium Chloride Stabilized Base, W. B. Drake, August 1952.


85. A Compendium on Class I, Type C Mixes, E. G. Williams, December 1952.

86. Progress Report No. 2 on a Survey of Acidity in Drainage Waters and the Condition of
Highway Drainage Installations, J. H. Havens, December 1952.

87. Report No. 4 on a Concrete Pavement without Transverse Joints, W. B. Drake, December 1952.


89. Report No. 2 on an Investigation of Lean Concrete Mixes as Base Courses for Bituminous Surfaces, D. H. Sawyer, December 1952.

1953

90. Report No. 2 on a Test Road for the Evaluation of Sandstone as an Aggregate in Plant-Mix Bituminous Pavements, E. G. Williams, April 1953.


92. Report No. 1 on Vibratory Compaction of a Macadam Base, E. G. Williams, December 1953.


1954

96. Pavement Investigation, Middletown-Eastwood Portion of U.S. 60 Louisville-Shelbyville Road, W. B. Drake, June 1954.


100. Application of Wire Mesh Reinforcement to Asphaltic Concrete Pavement Overlays, Franklin-Shelby County Project FI 172(12), E. G. Williams, December 1954.


1955


109. *Observations of Stabilized Turf Shoulders, Warren County Project No. 1 16(2) and 1 113(5) U.S. 31W and U.S. 68 Bowling Green-Cave City Road*, E. G. Williams, November 1955.


1956


1957


137. Dense Graded Aggregate Base Development, W. B. Drake, April 1959; prepared for presentation at the 16th Annual Meeting of Kentucky Crushed Stone Association.


143. The Use of Epoxy Resin for Sealing Cracks in a Reinforced Concrete Bridge, Milton Evans, Jr., July 1959.


159. Experimental Paving Project Using Curtiss-Wright's Coal-Modified, Coal-Tar Binder (First Year Performance), J. F. Hardymon, March 1961; also Bulletin No. 60, Engineering Experiment Station, University of Kentucky, June 1961.


166. Memorandum Report on Proposed Special Specification for Sand-Asphalt,


188. Progress Report, Class I, Type B, Plant-Mix


190e. Laboratory Test Results on Natural Sand Produced by the Kapco Construction Company in Logan County, R. D. Hughes, November 1962.


Station, University of Kentucky, September 1964.


212. Weighing Vehicles in Motion, April 1964.


217. Memorandum Report on Construction of a Class I, Type A Surface Containing Paradise Slag Aggregate (Experimental), Drakesboro-Paradise Road (KY 176); SP 89-43-68, R. L. Florence, October 1964.


221a. Use of Preformed, Compressed, Neoprene Seals in Joints of Concrete Bridge Decks, R. D. Hughes, July 1964.

1965


223a. Laboratory Test Results on Concrete Mixtures Containing Water-Reducing, Set-Retarding Admixtures, J. H. Havens, April 1965.

224. Freeze-Thaw Characteristics of Aggregates, G. R. Laughlin, J. W. Scott, and J. H. Havens, March 1965; also Bulletin No. 76, Engineering Experiment Station, University of Kentucky, September 1965.


226. Insulation of Concrete Bridge Decks, W. A. Mossbarger, Jr., July 1965.

227. Weighing Vehicles in Motion, September 1965.


1966


244. Impact of I-75 on the Local Economy between Walton and Georgetown, R. C. Deen, February 1966.

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254. The Crab Orchard and Osgood Formations, the Case for Slope Instability, R. C. Deen, April 1968.


266. Landslides in Kentucky, R. C. Deen and J. H. Havens, September 1968; also presented at Landslide Seminar, University of Tennessee, September 18-20, 1968.


268. Proposed Experimental Design and Construction Features, Boyd County, F(10), SP 10-165-23L, Cannonsburg-Ashland Road (US 60), October 1968.


273. Settlement of Highway Bridge Approaches 1969


284. *Weighing Vehicles in Motion*, University of Kentucky Research Foundation, November 1969.


1970


Evaluation of Cored Specimens from Timber Caisson beneath Pier No. 2 of the US 25 Bridge over the Ohio River between Covington and Cincinnati; F141 (1), J. H. Havens and A. S. Rahal, December 1970.


Establishment of Wood Plants on Roadsides (Southeastern Kentucky), S. E. Whitaker, January 1971.


Grooving Pavement Centerlines for Lane Demarcation, W. M. Seymour, October 1971.


Experimental Overlay of Glazon over Two Bridge Decks, A. S. Rahal, January 1972.

Chronological Listing of Research Reports, January 1972.

Subject Listing of Research Reports, January 1972.


Stress Histories of Bridge Members from Scratch Gage Records, R. D. Hughes, February 1972.

Degradation of Limestone Aggregates during...


1973


374. *In Situ Shear Strength Parameters by Dutch Cone Penetration Tests*, T. C. Hopkins, C. T. Gorman, and V. P. Drnevich, September 1973; also *Proceedings, Ohio River Valley Soils*


397. *High-Intensity Reflective Materials for Signs*, R. L. Rizenbergs, August 1974; also presented to 33rd Annual Meeting of Southeastern Association of State Highway and


411. Fatigue Analysis from Strain Gage Data and Probability Analysis, R. C. Deen and J. H. Havens, November 1974; also Record 579, Transportation Research Board, 1976.


1975


421. Temperature Distributions in Asphaltic Concrete Pavements, H. F. Southgate and R. C. Deen, March 1975; also Record 549, Transportation Research Board, 1975.

422. At-Grade Intersections versus Grade-Separated Interchanges (An Economic Analysis of Several Bypasses), K. R. Agent, March 1975; also At-Grade Versus Grade-Separated Interchanges, Traffic Engineering, Institute of Traffic Engineers, June 1975.


433. Transverse, Pavement Markings for Speed Control and Accident Reduction, K. R. Agent, September 1975.


1976

440. A High-Accident Spot-Improvement Program, K. R. Agent, J. A. Deacon, and R. C. Deen, January 1976; also Transportation Engineering Journal, American Society of
Civil Engineers, May 1976.


450. *Speed Reduction in School Zones*, C. V. Zegeer, J. H. Havens, and R. C. Deen, June 1976; also Record XXX, Transportation Research Board, 197X.

451. *Highway Accidents at Bridges*, K. R. Agent and R. C. Deen, June 1976; also Record XXX, Transportation Research Board, 197X.


453. *Pedestrian Accidents in Kentucky*, C. V. Zegeer and R. C. Deen, June 1976; also Record XXX, Transportation Research Board, 197X.


458. *Accidents on Rural, Two-Lane Roads and Their Relation to Pavement Friction*, R. L. Rizenbergs, J. L. Burchett, and L. A. Warren, November 1976; also Record XXX, Transportation Research Board, 197X.


460. *A Possible Explanation of Concrete Pop-Outs*, J. H. Havens and R. C. Deen, December 1976; also Record XXX, Transportation Research Board, 197X.


LISTING OF
RESEARCH REPORTS
BY SUBJECT AREA
TRANSPORTATION ADMINISTRATION


207. Kentucky Highway Research Program, J. H. Havens and R. C. Deen, March 1964; also Bulletin No. 73, Engineering Experiment Station, University of Kentucky, September 1964.


321. Subject Listing of Research Reports, January 1972.


463. Transportation Research Reports Issued by the Division of Research, R. C. Deen, January 1977.
PERSONNEL MANAGEMENT


TRANSPORTATION ECONOMICS


244. Impact of I-75 on the Local Economy between Walton and Georgetown, R. C. Deen, February 1966.


DESIGN


114. Model Study of Flow through Culverts, E. M. West, March 1956; also Bulletin No. 40, Engineering Experiment Station, University of Kentucky, June 1956.


Performance of a Reinforced Concrete Pipe Culvert under Rock Embankment, R. C. Deen, August 1968; also Record 262, Highway Research Board, 1969.


Legal Aspects and Guidelines Pertaining to Drainage of Surface Waters, D. W. McLellan, Jr. and Victor Fox, April 1970.


Accident and Economic Analyses of Access Control on Several Bypasses, K. R. Agent, September 1972.

Energy Absorption Devices, J. H. Havens, September 1972; also presented to the 31st Annual Convention of Southeastern Association of State Highway Officials, October 1972.


Loads on Box Culverts under High Embankments, H. F. Girdler, April 1974.


At-Grade Intersections versus Grade-Separated Interchanges (An Economic Analysis of Several Bypasses), K. R. Agent, March 1975; also At-Grade Versus Grade-Separated Interchanges, Traffic Engineering, Institute of Traffic Engineers, June 1975.


Accidents Associated with Highway Bridges, K. R. Agent, May 1975.

HIGHWAY DRAINAGE


114. Model Study of Flow through Culverts, E. M. West, March 1956; also Bulletin No. 40, Engineering Experiment Station, University of Kentucky, June 1956.


294. Legal Aspects and Guidelines Pertaining to Drainage of Surface Waters, D. W. McLellan, Jr. and Victor Fox, April 1970.
ROADSIDE DEVELOPMENT


109. Observations of Stabilized Turf Shoulders, Warren County Project No. I 16(2) and 1 113(5) U.S. 31W and U.S. 68 Bowling Green-Cave City Road, E. G. Williams, November 1955.


304. Establishment of Wood Plants on Roadsides (Southeastern Kentucky), S. E. Whitaker, January 1971.

PAVEMENT DESIGN

2. Cooperative Investigation of Joint Spacing in Concrete Pavements, Louis Campbell, 1940.


5. Summary Report of Concrete Investigations in Research Projects C-1, C-2, and C-17, S. T. Collier, December 1945.


87. Report No. 4 on a Concrete Pavement without Transverse Joints, W. B. Drake, December 1952.

89. Report No. 2 on an Investigation of Lean Concrete Mixes as Base Courses for Bituminous Surfaces, D. H. Sawyer, December 1952.


100. Application of Wire Mesh Reinforcement to Asphaltic Concrete Pavement Overlays, Franklin-Shelby County Project F1 172(12), E. G. Williams, December 1954.

116. The Application of Kentucky Flexible Pavement Design Method to WASHO Test Road Conditions, W. B. Drake, March 1956; also Bulletin No. 40, Engineering Experiment Station, University of Kentucky, June 1956.


212. Weighing Vehicles in Motion, April 1964.


268. Proposed Experimental Design and Construction Features, Boyd County, SP 10-165-23L, Cannonsburg-Ashland Road (US 60), October 1968.

269. Rational Analysis of Kentucky Flexible Pavement Design Criterion, H. F. Southgate,
R. C. Deen, and J. H. Havens, November 1968.


Continuously Reinforced Concrete Pavement; I 71-21 (15) 37, J. H. Havens, December 1970.


Construction of Full-Depth Asphaltic Concrete Pavements, J. D. Ross and H. F. Southgate, September 1972.

Tar Concrete Pavement Construction and Performance, J. G. Rose, December 1972.


Temperature Distributions in Asphaltic Concrete Pavements, H. F. Southgate and R. C. Deen, March 1975; also Record 549, Transportation Research Board, 1975.


2. Cooperative Investigation of Joint Spacing in Concrete Pavements, Louis Campbell, 1940.


64. Report No. 3 on a Concrete Pavement without Transverse Joints, W. B. Drake, February 1951.

68. Final Report on Evaluation of Plant Mix Surface Treatments by Road Test Sections, W. B. Drake, July 1951.

71. Observation on Seal Coats, Tack Coats, Penetration Macadam, and Blade Spread Hot Mix in 1951, W. B. Drake and H. J. Field, Jr., December 1951.


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89. Report No. 2 on an Investigation of Lean Concrete Mixes as Base Courses for Bituminous Surfaces, D. H. Sawyer, December 1952.

90. Report No. 2 on a Test Road for the Evaluation of Sandstone as an Aggregate in Plant-Mix Bituminous Pavements, E. G. Williams, April 1953.


96. Pavement Investigation, Middletown-Eastwood Portion of U.S. 60 Louisville-Shelbyville Road, W. B. Drake, June 1954.

100. Application of Wire Mesh Reinforcement to Asphalitic Concrete Pavement Overlays, Franklin-SHELBY County Project Fl 172(12), E. G. Williams, December 1954.


109. Observations of Stabilized Turf Shoulders, Warren County Project No. 116(2) and 113(5) U.S. 31W and U.S. 68 Bowling Green-Cave City Road, E. G. Williams, November 1955.


134. 17-Year Report on the Owensboro-Hartford...


Experimental Paving Projects Using Curtiss-Wright's Coal-Modified, Coal-Tar Binder, J. F. Hardyman, June 1960; also Kentucky's Bituminous Pavement Research on Modified Coal Tar, W. B. Drake, Bulletin No. 56, Engineering Experiment Station, University of Kentucky, June 1960.


Experimental Paving Project Using Curtiss-Wright's Coal-Modified, Coal-Tar Binder (First Year Performance), J. F. Hardyman, March 1961; also Bulletin No. 60, Engineering Experiment Station, University of Kentucky, June 1961.


Memorandum Report on Structural Repair of Concrete Pavement, Barren County Project U 543(3), J. H. Havens, June.


Memorandum Report on Inspection-Performance Report; Plant-Mix, Initial Treatment; Morgantown-Woodbury Road, Butler County, R. L. Florence, April 1963.

Weighing Vehicles in Motion, April 1964.


Weighing Vehicles in Motion, September 1965.


Experimental Concrete Pavement Containing...


284. Weighing Vehicles in Motion, University of Kentucky Research Foundation, November 1969.


452. Effect of Pavement Texture on Traffic Noise, K. R. Agent and C. V. Zegeer, June 1976; also Record XXX, Transportation Research Board, 197X.

458. Accidents on Rural, Two-Lane Roads and Their Relation to Pavement Friction, R. L. Rizenbergs, J. L. Burchett, and L. A. Warren, November 1976; also Record XXX, Transportation Research Board, 197X.


451. *Highway Accidents at Bridges*, K. R. Agent and R. C. Deen, June 1976; also Record XXX, Transportation Research Board, 197X.

MATERIALS AND CONSTRUCTION


68. Final Report on Evaluation of Plant Mix Surface Treatments by Road Test Sections, W. B. Drake, July 1951.

71. Observation on Seal Coats, Tack Coats, Penetration Macadam, and Blade Spread Hot Mix in 1951, W. B. Drake and H. J. Field, Jr., December 1951.


85. A Compendium on Class I, Type C Mixes, E. G. Williams, December 1952.

89. Report No. 2 on an Investigation of Lean Concrete Mixes as Base Courses for Bituminous Surfaces, D. H. Sawyer, December 1952.

90. Report No. 2 on a Test Road for the Evaluation of Sandstone as an Aggregate in Plant-Mix Bituminous Pavements, E. G. Williams, April 1953.

92. Report No. 1 on Vibratory Compaction of a Macadam Base, E. G. Williams, December 1953.


Application of Wire Mesh Reinforcement to Asphaltic Concrete Pavement Overlays, Franklin-Shelby County Project FI 172(12), E. G. Williams, December 1954.


A Field and Laboratory Examination of Weathering Effects on Petroleum and Blended Petroleum-Natural Asphalts in Paving Mixtures, E. G. Williams, November 1956.

Comparative Laboratory Evaluation of a Modified Class I Base Mixture, J. H. Havens and W. B. Drake, July 1957.

Comparative Laboratory Evaluation and Field Observations of a Modified Class I Base, L. H. Strunk, February 1958.


Experimental Paving Projects Using Curtiss-Wright's Coal-Modified, Coal-Tar Binder, J. F. Hardyman, June 1960; also Kentucky's Bituminous Pavement Research on Modified Coal Tar, W. B. Drake, Bulletin No. 56, Engineering Experiment Station, University of Kentucky, June 1960.


Experimental Paving Project Using Curtiss-Wright's Coal-Modified, Coal-Tar Binder (First Year Performance), J. F. Hardyman, March 1961; also Bulletin No. 60, Engineering Experiment Station, University of Kentucky, June 1961.


203. Memorandum Report on Inspection-Performance Report; Plant-Mix, Initial Treatment; Morgantown-Woodbury Road, Butler County, R. L. Florence, April 1963.


217. Memorandum Report on Construction of a Class I, Type A Surface Containing Paradise Slag Aggregate (Experimental), Drakesboro-Paradise Road (KY 176); SP 89-43-68, R. L. Florence, October 1964.


268. Proposed Experimental Design and Construction Features, Boyd County, F(10), SP 10-165-23L, Cannonsburg-Ashland Road (US 60), October 1968.


CEMENT AND CONCRETE


5. Summary Report of Concrete Investigations in Research Projects C-1, C-2, and C-17, S. T. Collier, December 1945.


15. Outline of Proposed Study of Sand Used as Concrete Fine Aggregates, March 1946.


19. A Summary of Experiments with Air Entrainment in Cement Concrete, September 1946.


35. Supplementary Report No. 1 on Experiments with Air Entrainment in Cement Concrete, October 1947; also Experiments with Air Entrainment in Cement Concrete, L. E. Gregg, Bulletin No. 5, Engineering Experiment Station, University of Kentucky, September 1947.


64. Report No. 3 on a Concrete Pavement without Transverse Joints, W. B. Drake, February 1951.


87. Report No. 4 on a Concrete Pavement without Transverse Joints, W. B. Drake, December 1952.
89. Report No. 2 on an Investigation of Lean Concrete Mixes as Base Courses for Bituminous Surfaces, D. H. Sawyer, December 1952.


Concrete Pavement, Barren County Project U 543(3), J. H. Havens, June 1962.


223a. Laboratory Test Results on Concrete Mixtures Containing Water-Reducing, Set-Retarding Admixtures, J. H. Havens, April 1965.


460. A Possible Explanation of Concrete Pop-Outs, J. H. Havens and R. C. Deen, December 1976; also Record XXX, Transportation Research Board, 197X.
Cooperative Investigation of Joint Spacing in Concrete Pavements, Louis Campbell, 1940.


Report No. 1 on an Investigation of Lean Concrete Mixes as Base Courses for Bituminous Surfaces, S. T. Collier, January 1951.


Final Report on Evaluation of Plant Mix Surface Treatments by Road Test Sections, W. B. Drake, July 1951.

Memorandum Report on Vibratory Compaction of Base Courses, November 1951.

Observation on Seal Coats, Tack Coats, Penetration Macadam, and Blade Spread Hot Mix in 1951, W. B. Drake and H. J. Field, Jr., December 1951.


Memorandum Report on Vibratory Compaction of a Macadam Base, E. G. Williams, December 1953.


A Machine-Laid Surmountable Bituminous


217. Memorandum Report on Construction of a Class I, Type A Surface Containing Paradise Slag Aggregate (Experimental), Drakesboro-Paradise Road (KY 176); SP 89-43-68, R. L. Florence, October 1964.


226. Insulation of Concrete Bridge Decks, W. A. Mossbarger, Jr., July 1965.


268. Proposed Experimental Design and Construction Features, Boyd County, F(10), SP 10-165-23L, Cannonsburg-Ashland Road (US 60), October 1968.


GENERAL MATERIALS


100. **Application of Wire Mesh Reinforcement to Asphaltic Concrete Pavement Overlays**, Franklin-Shelby County Project F1 172(12), E. G. Williams, December 1954.


221a. Use of Preformed, Compressed, Neoprene Seals in Joints of Concrete Bridge Decks, R. D. Hughes, July 1964.


MINERAL AGGREGATES


15. Outline of Proposed Study of Sand Used as Concrete Fine Aggregates, March 1946.


75. Report No. 1 on a Bank Gravel Base Containing Calcium Chloride, W. B. Drake, February 1952.


82. Report No. 1 on a Limestone-Calcium Chloride Stabilized Base, W. B. Drake, August

90. Report No. 2 on a Test Road for the Evaluation of Sandstone as an Aggregate in Plant-Mix Bituminous Pavements, E. G. Williams, April 1953.


137. Dense Graded Aggregate Base Development, W. B. Drake, April 1959; prepared for presentation at the 16th Annual Meeting of Kentucky Crushed Stone Association.


149. Report on Rockcastle (Pottsville)

A Discussion of the Durability of Expanded Shale Aggregate for Exposed Concrete Structures (Bridges), J. H. Havens, November 1960.


Laboratory Test Results on Natural Sand Produced by the Kapco Construction Company in Logan County, R. D. Hughes, November 1962.


Memorandum Report on Construction of a Class I, Type A Surface Containing Paradise Slag Aggregate (Experimental), Drakesboro-Paradise Road (KY 176); SP 89-43-68, R. L. Florence, October 1964.

Memorandum Report on Manufactured (Crushed), Limestone, Fine Aggregate for Portland Cement Concrete; Proposed Special Provision, J. H. Havens, October 1964.


Freeze-Thaw Characteristics of Aggregates, G. R. Laughlin, J. W. Scott, and J. H. Havens, March 1965; also Bulletin No. 76, Engineering Experiment Station, University of Kentucky, September 1965.


Construction and Performance of Trial Sections of Treated Shoulders on the Mountain Parkway Extension, R. L. Florence and T. C. Hopkins, June 1968.


Pavement Surface Texture Measurement
Methods, ASTM Subcommittee E.17.23, June 1971.


MAINTENANCE
MAINTENANCE, GENERAL
MAINTENANCE MANAGEMENT


143. The Use of Epoxy Resin for Sealing Cracks in a Reinforced Concrete Bridge, Milton Evans, Jr., July 1959.


459. Modification of Kentucky's Adequacy-Rating Techniques, C. V. Zegeer and R. L.
Rizenbergs, November 1976.
<table>
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TRAFFIC AND OPERATIONS
HIGHWAY SAFETY


339. Accidents on Interstate and Parkway Roads
Accident and Economic Analyses of Access Control on Several Bypasses, K. R. Agent, September 1972.

Energy Absorption Devices, J. H. Havens, September 1972; also presented to the 31st Annual Convention of Southeastern Association of State Highway Officials, October 1972.


Auto-Utility Trailer Combinations on Rural Highways in Kentucky, B. S. Siria and R. C. Deen, December 1973; also Record 489, Transportation Research Board, 1974.


High-Intensity Reflective Materials for Signs, R. L. Rizenbergs, August 1974; also presented to 33rd Annual Meeting of Southeastern Association of State Highway and Transportation Officials, October 10-19, 1974.


422. At-Grade Intersections versus Grade-Separated Interchanges (An Economic Analysis of Several Bypasses), K. R. Agent, March 1975; also At-Grade Versus Grade-Separated Interchanges, Traffic Engineering, Institute of Traffic Engineers, June 1975.


433. Transverse, Pavement Markings for Speed Control and Accident Reduction, K. R. Agent, September 1975.


450. Speed Reduction in School Zones, C. V. Zegeer, J. H. Havens, and R. C. Deen, June 1976; also Record XXX, Transportation Research Board, 197X.

451. Highway Accidents at Bridges, K. R. Agent and R. C. Deen, June 1976; also Record XXX, Transportation Research Board, 197X.

453. Pedestrian Accidents in Kentucky, C. V. Zegeer and R. C. Deen, June 1976; also Record XXX, Transportation Research Board, 197X.


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Auto-Utility Trailer Combinations on Rural Highways in Kentucky, B. S. Siria and R. C. Deen, December 1973; also Record 489, Transportation Research Board, 1974.


Fatigue Analysis from Strain Gage Data and Probability Analysis, R. C. Deen and J. H. Havens, November 1974; also Record 579, Transportation Research Board, 1976.


The Effectiveness of School Signs with Flashing Beacons in Reducing Vehicle Speeds, C. V. Zegeer, July 1975.

Pedestrian Accidents in Kentucky, C. V. Zegeer and R. C. Deen, November 1975.


Speed Reduction in School Zones, C. V. Zegeer, J. H. Havens, and R. C. Deen, June 1976; also Record XXX, Transportation Research Board, 197X.

Effect of Pavement Texture on Traffic Noise,
### TRAFFIC CONTROL AND OPERATIONS

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</tr>
</tbody>
</table>
Flashing Beacons in Reducing Vehicle Speeds,  
C. V. Zegeer, July 1975.

430. First-Year Effects of the Energy Crisis on  
Traffic in Kentucky (Rural Highways), K. R.  
Agent, D. R. Herd, and R. L. Rizenbergs, July  
1975; also Record 567, Transportation  

433. Transverse, Pavement Markings for Speed  
Control and Accident Reduction, K. R. Agent,  
September 1975.

439. Evaluation of Paint-Stripe Beads, K. R. Agent  

440. A High-Accident Spot-Improvement Program,  
K. R. Agent, J. A. Deacon, and R. C. Deen,  
January 1976; also Transportation  
Engineering Journal, American Society of  
Civil Engineers, May 1976.

444. Characteristics of Traffic Streams on Rural  
Multilane Highways, J. G. Pigman and J. G.  
Mayes, April 1976.

446. A Survey of Use of Left-Turn-On-Red, K. R.  
Agent, May 1976.

449. Evaluation of Thermoplastic  
Pavement-Striping Materials (Louisville and  
Jefferson County), J. G. Pigman and K. R.  
Agent, May 1976.

450. Speed Reduction in School Zones, C. V.  
Zegeer, J. H. Havens, and R. C. Deen, June  
1976; also Record XXX, Transportation  
Research Board, 197X.

456. Development of Warrants for Left-Turn  
Phasing, K. R. Agent, August 1976.

462. Raised-Aggregates, Lane-Delineation Stripe, J.  
TRAFFIC FLOW

276. Lateral Distribution of Traffic on a Four-Lane and Six-Lane Section of I 75 South of Covington, R. L. Lynch and G. N. Hamby, June 1969.


450. Speed Reduction in School Zones, C. V. Zegeer, J. H. Havens, and R. C. Deen, June 1976; also Record XXX, Transportation Research Board, 197X.

TRAFFIC MEASUREMENTS


276. Lateral Distribution of Traffic on a Four-Lane and Six-Lane Section of I 75 South of Covington, R. L. Lynch and G. N. Hamby, June 1969.

284. Weighing Vehicles in Motion, University of Kentucky Research Foundation, November 1969.


SOILS, GEOLOGY, AND FOUNDATIONS
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<tr>
<td>254.</td>
<td>The Crab Orchard and Osgood Formations, the Case for Slope Instability, R. C. Deen, April 1968.</td>
</tr>
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</table>


FOUNDATIONS (SOILS)


70. Memorandum Report on Vibratory Compaction of Base Courses, November 1951.

75. Report No. 1 on a Bank Gravel Base Containing Calcium Chloride, W. B. Drake, February 1952.

82. Report No. 1 on a Limestone-Calcium Chloride Stabilized Base, W. B. Drake, August 1952.


89. Report No. 2 on an Investigation of Lean Concrete Mixes as Base Courses for Bituminous Surfaces, D. H. Sawyer, December 1952.


109. Observations of Stabilized Turf Shoulders, Warren County Project No. 116(2) and 113(5) U.S. 31W and U.S. 68 Bowling Green-Cave City Road, E. G. Williams, November 1955.


137. Dense Graded Aggregate Base Development, W. B. Drake, April 1959; prepared for presentation at the 16th Annual Meeting of Kentucky Crushed Stone Association.


162. Performance Survey of Reinforced Concrete Pipe Culverts, R. C. Deen and R. D. Hughes,
March 1961.


254. **The Crab Orchard and Osgood Formations, the Case for Slope Instability**, R. C. Deen, April 1968.


262. **Performance of a Reinforced Concrete Pipe Culvert under Rock Embankment**, R. C. Deen,
August 1968; also Record 262, Highway Research Board, 1969.


MECHANICS (EARTH MASS)


254. The Crab Orchard and Osgood Formations, the Case for Slope Instability, R. C. Deen, April 1968.

266. Landslides in Kentucky, R. C. Deen and J. H. Havens, September 1968; also presented at Landslide Seminar, University of Tennessee, September 18-20, 1968.


435. Effects of Water on Slope Stability, T. C.


LEGAL STUDIES
LEGAL STUDIES


294. Legal Aspects and Guidelines Pertaining to Drainage of Surface Waters, D. W. McLellan, Jr. and Victor Fox, April 1970.
TRANSPORTATION PLANNING
COMMUNITY VALUES

244. *Impact of I-75 on the Local Economy between Walton and Georgetown*, R. C. Deen, February 1966.


LAND USE

244. Impact of I-75 on the Local Economy between Walton and Georgetown, R. C. Deen, February 1966.

