# TE 192 M37 1979/80 ANNUAL REPORT Of HIGHWAY RESEARCH And DEVELOPMENT In IOWA



HIGHWAY DIVISION OFFICE OF MATERIALS

**DECEMBER 1980** 

### Disclaimer

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# ANNUAL REPORT

# HIGHWAY RESEARCH AND DEVELOPMENT IN IOWA

FOR THE FISCAL YEAR ENDING JUNE 30, 1980

By

VERNON J. MARKS RESEARCH ENGINEER OFFICE OF MATERIALS HIGHWAY DIVISION IOWA DEPARTMENT OF TRANSPORTATION

DECEMBER 1980

AMES, IOWA 50010

(515) 296-1447

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#### RESEARCH AND DEVELOPMENT

The Highway Division of the Iowa Department of Transportation engages in research and development for two reasons: first, to find workable solutions to the many problems that require more than ordinary, routine investigation; and second, to identify and implement improved engineering and management practices.

This report entitled, "Highway Research and Development in Iowa" is submitted in compliance with Section 310.36, Code of Iowa, directing submission of a report of the Secondary Road Research Fund. It is a report on the status of research and development projects which were in progress on June 30, 1980; it is also a report on projects completed during the fiscal year beginning July 1, 1979 and ending June 30, 1980. Detailed information on each of the research and development projects mentioned in this report is available in the Office of Materials-Highway Division, Iowa Department of Transportation.

#### IOWA HIGHWAY RESEARCH BOARD

In developing a progressive, continuing, coordinated program of research and development, the Highway Division is assisted by the Iowa Highway Research Board. This advisory group was established in 1949.

The Research Board consists of 13 regular members; six County Engineers, three Highway Division Engineers, one representative from Iowa State University, one from the University of Iowa, and two engineers employed by Iowa Municipalities. Each regular member may have an alternate who will serve at the request of the regular member. The membership of the Research Board as of June 30, 1980 is listed in Table I.

The Research Board held ten regular meetings during the period of July 1, 1979 to June 30, 1980. Suggestions for research and development were reviewed at these meetings and recommendations were made by the Board.

> TABLE I IOWA HIGHWAY RESEARCH BOARD JUNE 30, 1980

#### Member

W. W. Amundson City Engineer Sioux City, IA 51100

R. Betterton Greene County Engineer Jefferson, IA 50129

F. O. Bloomfield Right-of-Way Director Iowa DOT-Highway Division Ames, IA 50010

#### Alternate

R. Holland City Engineer Bettendorf, IA 52722

P. Dvorak Grundy County Engineer Grundy Center, IA 50638

C. L. Huisman Materials Engineer Iowa DOT-Highway Division Ames, IA 50010

#### SECONDARY ROAD RESEARCH FUND

Section 310.34 of the Iowa Code authorizes the Iowa Department of Transportation to set aside each year an amount not to exceed 1<sup>1</sup>/<sub>2</sub> percent of the receipts in the Farm-to-Market Fund in a fund to be known as the Secondary Road Research Fund. This authorization was first made in 1949, it was repealed in 1963 and reinstated in 1965. When the fund was reinstated, the use was designated to finance engineering studies and research projects. A summary of research and development expenditures from the Secondary Road Research Fund (designated "Farm-to-Market") is itemized in Table II.

The values shown in Table II are actual research expenditures for fiscal year 1980. The Office of Transportation Inventory engineering studies included traffic counts and secondary road inventories. The Iowa Department of Transportation accounting procedure for the Secondary Road Research Fund is based upon obligations for expenditures on research projects and not the actural expenditure. The Fiscal Year 1980 financial summary is.

Beginning Balance 7-1-79

931,827

Receipts		
Interest	75,267	
Fed. Sec. Rd		
(12% of receipts)	274,657	
State RUTF (12% of receipts)	442,722	
External Research Income	2,988	
Sub-Total		795,634
Total Funds Available		1,727,461
Obligation for Expenditures		
Obligated for		
Contract Research	110,525	
Non-Contract		
Engineering Studies	421,730	
Total Expenditures		532,255
BALANCE 6-30-80		1,195,206

#### SECONDARY ROAD TRAFFIC COUNT PROGRAM

During fiscal year 1980, the traffic count program conducted by the Office of Transportation Inventory on the Secondary Road System in 26 Counties required a total of 3,846 4-hour and 75 8-hour manual counts. The traffic data from these counts was used to develop motor vehicle traffic flow maps for each county showing the average annual daily traffic (ADT) on specific road sections in each county. A secondary road inventory was completed in 9 counties. This data provides the county engineer, highway engineer, planner and administrator with essential information needed for the determination of design standard, systematic classification of highways and the development of programs for improvement and maintenance of secondary roads.

This traffic data is also added to the Iowa Department of Transportation's Secondary Road Base Record. This record is utilized for the preparation of numerous reports and studies including the annual vehicle miles of travel, mileage summaries, need studies, special studies, accident analysis, etc.

# TABLE IIRESEARCH AND DEVELOPMENT EXPENDITURESJuly 1, 1979 to June 30, 1980

Project	Primary	Farm-to-Market	Total
140	\$22,825.00	11,825.00	34,650.00
165		50,586.46	50,586.46
186	42,122.23		42,122.23
187	641.79	720.00	1,361.79
188		2,987.58	2,987.58
194		37,907.78	37,907.78
195	1,707.22		1,707.22
197	3,079.91	2,618.34	5,698.25
198		67,164.30	67,164.30
202	7,208.91	6,143.52	13,352.43
204		17,240.31	17,240.31
206	431.31	325.94	757.25
207	8,708.57		8,708.57
208	14,574.71	23,937.13	38,511.84
210	4,263.73		4,263.73
211		23,962.12	23,962.12
212		13,428.89	13,428.89
213	37.00		37.00
220	340.36		340.36
1019	521.86		521,86
Sub-total	106,462.60	258,847.37	365,309.97
NCHRP	35,996.35	5,161.31	41,157.66
HPR-2(118)	412.52	58.55	471.07
HPR-2(119) Total	406.99	57.76	464.75

#### RESEARCH PROJECT DESCRIPTIONS

The following portion of this report briefly describes research projects for which open files were maintained in the Office of Materials, Research Section during all or part of the fiscal year beginning July 1, 1979 and ending June 30, 1980. An open file for each project is maintained for the project's inception to completion; completion is signified by the acceptance of the final report and making of the final payment. Each project description contains an implementation statement of the use now being made, or expected as a result of the research effort.

Project Title: Collection and Analysis of Stream Flow Data

Research Agency: Iowa City Office, Water Resources Division, United States Geological Survey, Department of Interior

Principal Investigator: D. K. Leifeste, U.S.G.S.

<u>Contract Period</u>: Project continued to September 30, 1981 by approval of the Director--Highway Division

Contract Amount: \$47,300 per year (matched by \$47,300 from the Department of Interior)

Funding: 100 percent State funds; 50 percent Primary and 50 percent Farm-to-Market

Iowa DOT Project Control: Mark F. Looschen, Bridge Design

Research Objectives: The objectives of Project HR-140 are to obtain information about the flow of water in Iowa streams with particular emphasis on the magnitude and frequency of floods and to compile and analyze this information for use by highway engineers engaged in the design of bridges, culverts and embankments.

Project Activities: The Water Resources Division employes a staff of engineers and technicians who monitor and maintain a network of water measuring stations on Iowa streams. These measurements, along with data from special studies of selected streams, are compiled and anlyzed to form the basis for predictions of future streamflow.

Progress: The progress during 1979-1980 was in accordance with schedules established by the Water Resources Division.

Implementation: The information obtained from Project HR-140 is used daily by DOT personnel in the design of bridges and culverts.

Project Title: Experimental Steel Fiber Reinforced Concrete Overlay

Research Agency: Greene County and Iowa Department of Transportation, Highway Division

Principal Investigators: R. Betterton, Greene County and Vernon J. Marks, Materials Research Section

Contract Period: December 20, 1972 to completion

Contract Amount: \$110,586

Funding: 100 percent State, Farm-to-Market Funds

Research Objectives: To determine the feasibility of mixing, placing and finishing various fibrous concrete overlays and to evaluate the overall performance, longevity and maintenance characterisitcs of the roadway.

Project Activities: A fibrous Portland Cement Concrete overlay was placed on 3.03 miles of Greene County Road E-53 (old US 30). The 40 different test sections contain various combinations of depth, cement content, steel fiber length and fiber content.

Progress: The fibrous concrete overlay and various control sections were placed in FY 1974. Performance was observed and crack survey reports were distributed annually. A final crack survey report was completed late in 1978. All experimental sections are serviceable and still in place, although some longitudinal cracking is evident.

An additional amount of \$50,586 was spent on this project as the result of a law suit filed against the Iowa DOT by a former employee of Hallett Construction Company, contractor for the project.

Reports: Final report, December, 1978.

Implementation: Future use of the fibrous concrete will then depend primarily on its cost in comparison with other resurfacing techniques. Results from the project have shown that fibrous concrete can be used to produce thin, high performance highway pavement overlays. However, improvements in the cost-effectiveness of fibrous concrete are need if this type of pavement resurfacing is going to be developed to any significant degree. Conventional concrete without fiber reinforcement was less expensive and yielded better performance.

Project Title: Recycled Asphalt Pavement

Research Agency: Kossuth County and Iowa Department of Transportation, Highway Division

Principal Investigator: R. C. Henely, Kossuth County

Contract Period: May 1, 1975 to completion

Contract Amount: \$50,000

Funding: 100 percent State, Farm-to-Market funds

Research Objective: To conserve materials and establish techniques that will lead to more economical reconstruction of asphalt paving.

Project Activities: Plans and specifications and cost estimates were completed early in 1975

Progress: Construction of the proposed project was completed during the summer of 1975. Road Rater testing and friction testing has been completed on the road annually.

Reports: A September 3, 1975 report has been prepared.

<u>Implementation</u>: This project proved that recycling of asphalt concrete is feasible and that additional research was needed to solve related problems. Research Project HR-1008 was constructed in 1976 due to recommendations resulting from this project. In 1977, research project HR-188 established asphalt recycling as a viable method of construction that will conserve energy and materials. Kossuth County has accepted recycled asphalt pavement as a standard reconstruction practice.

Road Rater testing and friction testing have been completed on the road annually. The evaluation phase of the project has been completed. Maintenance costs and procedures will be summarized.

Project Title: The Evaluation of Macadam Stone Shoulders

Research Agency: Iowa Department of Transportation, Highway Division

Principal Investigator: R. A. Shelquist, Materials

Contract Period: May 25, 1975 to completion

Contract Amount: \$8,143

Funding: 100 percent State, Primary funds

Research Objective: To determine the feasibility of using a Macadam Stone shoulder in place of the standard paved shoulder; to determine if there are any major problems associated with the construction and maintenance of Macadam Stone shoulders, and to evaluate the performance of Macadam Stone Shoulders.

Project Activities: This experimental type of shoulder construction was incorporated into a Dallas County project on US 6. Shoulder construction operations were observed and methods and procedures were recorded. Structural number comparisons between Macadam shoulders and recently constructed stabilized and paved shoulders is continuing.

Progress: The shoulder construction work has been completed. A visual observation showed that the shoulders with the asphalt concrete surface were performing well with no spots on the surface. The side with the cover aggregate seal has some damage and open surface. A visual and structural evaluation program will be continued for the duration of the project. Long term effects from traffic and environmental factors will also have to be determined. A final report will be completed in the fall of 1981.

Reports: A construction report was distributed in November, 1977.

Implementation: This project will provide an alternate cost effective shoulder design for high traffic volume roadways.

Project Title: Evaluation of Changes in Productivity Resulting from Removal of Soil for Highway Construction

Research Agency: Iowa State University

Principal Investigators: W. D. Shrader, S. J. Henning, Iowa State University

Contract Period: January 1, 1977 to December 31, 1981

Contract Amount: \$172,085

Funding: 100 percent State funds: 75 percent Primary and 25 percent Farm-to-Market

Research Objective: To evaluate changes in soil productivity caused by removal of soil, to measure the effect on crop yields of returning surface soil, to varying conditions and various tillage practices and to determine the effects of land surface elevation above drainage tile or perched water tables.

Project Activities: A four-year contract has been signed with Iowa State University. Work is completed on the selection of sites in several counties for borrow pits with desirable characteristics.

Progress: Four borrow pit sites have been cropped for the research. Temporary easements or rental arrangements have been established. The four locations selected are representative of a range of soil conditions present in Iowa. All four of the sites were used for agricultural production in 1979 and two sites were in their second year of production. Crop yield reports for 1979 for all four sites were received and evaluated.

Reports: A third Annual Progress Report (1979) was completed and distributed.

<u>Implementation</u>: Following completion of the project, a manual of practices and procedures for selection and treatment of borrow areas will be prepared. The two remaining sites were completed in October and November, 1978.

Project Title: Development of a Minicomputer Controlled Frost, Ice and Snow Detector for Bridge Hazard Monitoring

Research Agency: Cytronics Incorporated

Principal Investigator: P. W. Poppe

Contract Period: January 13, 1977 to May 1, 1979

Contract Amount: \$19,500

Funding: 100 percent State funds: 75 percent Primary and 25 percent Farm-to-Market

Research Objective: To design, develop and deliver a microprocessor controlled frost, ice and snow detector with the capability to accurately detect frost, ice and snow in the presence of de-icing chemicals under normal conditions at bridge sites.

Project Activities: Laboratory testing, design and development work for Phase I were completed early in the project. Several modifications were made in the original equipment in an attempt to improve reliability.

Progress: Field testing of equipment could not be completed due to a lack of frost during the first winter season. Several extensions were granted for this project to allow for modification of equipment and additional field testing in attempts to attain the desired reliability. It was concluded that some of the technical problems could be corrected with additional equipment and testing. However, sensor damage and installation difficulties related to winter maintenance will continue to be major problems. The project was terminated, but final evaluation of the unit will be done by Iowa DOT Maintenance personnel. The frost and ice detector equipment was turned over to the Iowa DOT in the spring of 1979. Problems with damage to bridge deck sensors caused by snow plows and traffic and heater circuit limitation have resulted in a considerable amount of down time. The experience of the past winters again point out the environmental difficulties related to the maintenance and operation of frost and ice detector installations.

Reports: A progress report has been distributed.

<u>Implementation</u>: Modifications have improved the effectiveness of the detector, but further evaluation is necessary. The development of an effective frost, ice and snow detector will result in improved motorist safety, reduced tort liability and reduced annual expenditures for winter maintenance.

<u>Project Title</u>: Evaluation of Air Pollution Control Devices for Asphalt Pavement Recycling Operations

Research Agency: Kossuth County and Iowa Department of Transportation, Highway Division

Principal Investigator: R. C. Henely

Contract Period: April 11, 1977 to completion

Contract Amount: \$50,000

Funding: 100 percent State, Farm-to-Market Funds

Research Objective: To seek acceptable solutions to the air pollution problem created in the asphalt recycling process using modified conventional equipment.

Project Activities: A work plan was completed and the project was let on June 21, 1977. Several contractors and equipment manufacturers showed an interest in the project.

Progress: The project was considered to be very successful. Recycled asphalt proved to be good quality material at a savings of approximately 30 cents per ton over virgin material. Through modifications of equipment, all D.E.Q. requirements for air pollution were easily met and the project gained nationwide and world-wide recognition.

Reports: A progress report was distributed in December, 1977.

Implementation: In the interest of conserving energy and material, the elimination of the problem of air pollution in the asphalt recycling process is a very desirable goal. The "drum in a drum" asphalt plant modification will prevent pollution while allowing normal production utilizing recycled materials. The plant modification is commerically available and will promote recycling and in turn conservation of natural resources.

Project Title: Bonded, Thin-Lift Non-Reinforced Portland Cement Concrete Resurfacing.

Research Agency: Clayton County and Iowa Department of Transportation, Highway Division

Principal Investigator: M. L. Johnson

Contract Period: May 16, 1977 to completion

Contract Amount: \$50,000

Funding: 100 percent State, Farm-to-Market

Research Objective: The research objectives are: 1. To establish methods and procedures for surface preparation for p.c. concrete resurfacing; 2. To establish mixing procedures using super water reducing admixtures and to study the economics and performance of portland cement resurfacing; 3. to determine if this method of overlay can be considered as a viable alternative for concrete pavement restoration.

Project Activities: A contract was signed with Clayton County. The plans and specifications have been completed. The project was let in July, 1977.

Progress: A thin-bonded low slump portland cement concrete overlay was placed on a 1.3 mile portion of a secondary Clayton County road in September, 1977. No major problems were experienced in mixing and proportioning the concrete. An adequate bond was developed and the project has performed well. Evaluation continued through April, 1980 and indicated that all three methods of preparation used, scarification, sandblasting, and waterblasting, provided adequate bond strenghth. Waterblast preparation would not remove traffic paint. Additional research is suggested to determine cost benefits and to aid in equipment development and preparation procedures.

Reports: A final report was completed, June, 1980.

Implementation: This research will determine whether bonded, thin-lift non-reinforced portland cement resurfacing is a viable alternative for concrete pavement restoration and rehabilitation. Based upon the success of this project, a thin-bonded overlay rehabilitation was used on I-80 in Pottawattamie County.

Project Title: An Evaluation of Dense Bridge Floor Concrete

Research Agency: Iowa Department of Transportation, Highway Division

Principal Investigators: J. V. Bergren, R. A. Britson

Contract Period: May, 1977 to completion

Contract Amount: \$3,340

Funding: 100 percent State, Primary funds

Research Objective: To determine the feasibility of mixing, placing and finishing dense portland cement concrete using a super water reducing admixture in a bridge floor. To determine the economics, longevity and maintenance performance of dense portland cement concrete.

Project Activities: The project is located in the Town of Ackley on US 20 in Hardin County. The construction involved the redecking of a multiple span overhead crossing over a railroad. It was proposed that approximately 25 percent of the bridge deck be placed full depth using a concrete containing a super water reducing admixture.

Progress: A portion of a full depth bridge deck using concrete with a high range water reducer was placed in August 1977. Problems were encountered in pumping the concrete and in controlling slump and air content. Cores from the deck yielded good air contents for both the Standard D-57 concrete and the high range water reducer (HRWR) concrete. The calculated one year strength for the D-57 concrete was 6650 psi and 8500 psi for the HRWR concrete. The chloride content was slightly higher in the D-57 concrete. The cores revealed good consolidation of both concretes, even though the bottom surface of the HRWR exhibited an open honeycomb appearance.

Reports: A construction report has been completed, December, 1977.

Implementation: There is still a need for an improved concrete to retard the intrusion of chlorides. This project will determine if the admixture is a solution to the problem of corrosion of steel in bridge decks.

Project Title: Mission Oriented Dust Control and Surface Improvement Processes for Unpaved Roads

Research Agency: Iowa State University

Principal Investigator: J. M. Hoover

Contract Period: July 1, 1977 to March 31, 1981

Contract Amount: \$99,860

Funding: 100% State, Farm-to-Market funds

Research Objective: To identify current practices, products and specifications of potentially economic dust control systems and to plan, design and construct a series of demonstration test sections in several regions in Iowa for the purpose of evaluating materials, construction costs and performance of various dust control methods.

<u>Project Activities</u>: A contract was signed with Iowa State University and an Advisory Committee was selected. Site selection, based on geographic/geologic regions in the State, has been completed. Additional sites were added in order to get adequate representation of soil aggregate characteristics of the various regions.

Progress: Current dust control practices and specifications are being evaluated. Dust collectors were established at all locations and dust collection techniques were continued until construction. Design testing recommendations and construction operations were begun on a number of test plots in several counties. Comparisons of laboratory and field test data are being made. Field testing and observation of the test sections will continue. A final report will be completed in March 1981. Categories of products for use on individual test sections have been recommended to counties.

Reports: Semi-annual progress reports have been submitted.

<u>Implementation</u>: The project will identify alternate practices and the most economical methods of dust control.

Project Title: Field Performance and Evaluation of Slurry Seal Coats

Research Agency: Iowa State University

Principal Investigator: D. Y. Lee

Contract Period: July 1, 1977 to November 26, 1980

Contract Amount: \$91,000

Funding: 100 percent State, Primary funds

Research Objective: To evaluate performance characteristics of materials native to Iowa and applicability of other materials in slurry seals, mix designs and to correlate laboratory tests with field performance.

Project Activities: This project is the second phase of a two part study. Construction on Phase II, a field performance evaluation of slurry seals was delayed due to inflated costs. Under a revised schedule, the project was let in April, 1978 and a time extension through November 26, 1980 was granted with an additional \$11,000 in research construction funding.

Progress: Application of the slurry seal test sections and approximately half of the control sections were completed in September, 1978. Problems were encountered in obtaining the optimum emulsion content. Some test sections failed and were replaced. Resurfacing of the remaining control sections was completed during the 1979 construction season. Evaluation of the test sections is continuing and the project is nearly completed.

Reports: A final report will be completed in November, 1980.

<u>Implemenation</u>: The project will provide a basis for the development and preparation of slurry seal, design methods, criteria, procedures and specifications for the successful application of slurry seal as an economic pavement maintenance alternative.

Project Title: Preliminary Archaeological Investigation Along Proposed Highway Right-of-Way

Research Agency: State Archaeologist (University of Iowa)

Principal Investigator: J. Hotopp

Contract Period: July 1, 1977 to June 30, 1980

Contract Amount: \$75,000

Funding: 100 percent State, Farm-to-Market funds

Research Objective: 1. To determine well in advance of highway construction if proposed planning corridors contain known or probable sites of archaeological value. 2. To locate such sites and describe their limits as accurately as possible without resorting to excavation or other detailed examination.

<u>Project Activities</u>: The Iowa Department of Transportation has an ongoing contract with the State Archaeologist to perform the needed preliminary investigations and prepare the necessary reports.

<u>Progress</u>: Secondary road construction sites with archaeological value are being examined in advance of construction. Under a new Iowa DOT policy, a revolving fund has been established within the Secondary Road Research Fund to initially pay for the services of a survey contractor and to prepare billings to the counties and cities for their proportionate share of costs incurred. Additional funds were allocated to the revolving fund due to an unanticipated heavy load of Phase 2 testing activity. High potential sites, located through Phase 1 surface survey techniques, required additional subsurface examination in order to establish significance.

<u>Reports</u>: Annual reports are completed giving a county by county summary of archaeological survey activities.

<u>Implementation</u>: The project will be beneficial as counties will know what type of projects should be reviewed and the reviews can be conducted in a more timely manner.

Project Title: Upgrading Asphalt Surface Friction by Aggregate Sprinkle Treatments

Research Agency: Iowa Department of Transportation, Highway Division

Principle Investigator: R. A. Shelquist

Contract Period: June 1, 1978 to December 31, 1983

Contract Amount: \$42,500

Funding: 100 percent State, Primary funds

Research Objective: To determine the feasibility and cost effectiveness of using standard asphalt mixtures of local aggregates for 1" and 1½" thick surface courses followed by a surface sprinkle treatment of pre-coated hard, durable chips to produce a long lasting non-skid pavement surface.

Project Activities: Preconstruction plans and arrangements were completed. The contract was let on May 23, 1978. This experimental type of resurfacing was applied on old US 30 between Interstate 35 and the City of Nevada.

Progress: The paving and sprinkle treatments have been completed. Appearance is very good with the exception of some corregation which occurred during application. Texture depth testing by the silly putty method has been completed for all test sections. Friction testing of the sections is also being conducted on a periodic basis.

Reports: Progress Report, October, 1979.

<u>Implementation</u>: This project will be utilized in the evaluation of paving materials and texturing. It will also assist in determining the effectiveness of sprinkle treatment in providing durable friction properties.

Project Title: Fly Ash in Portland Cement Concrete Pavement-Monona County

Research Agency: Monona County and the Iowa Department of Transportation, Highway Division

Principal Investigator: O. D. Ives

Contract Period: February 21, 1978 to completion

Contract Amount: \$16,300

Funding: 100 percent State, Farm-to-Market funds

Research Objective: 1. To evaluate problems related to shipping, storing, and placing fly ash. 2. To establish a procedure for batching, mixing and placing concrete with specified air content. 3. To demonstrate that concrete of comparable quality can be produced.

Project Activities: Plans and specifications were completed and the project was let early in the spring of 1978. Samples of the fly ash were obtained from the source and a history of sample testing was completed prior to construction.

Progress: Paving on Monona County Road E-54 was completed in June, 1978. Minor modifications were made in the batching system, but no special problems were encountered in the paving operation using conventional equipment. General appearance and workmanship of the concrete is satisfactory. The concrete produced has shown to date that it is of a comparable quality to standard portland cement concrete.

#### Reports: Final Report, January, 1980.

<u>Implementation</u>: Laboratory studies and limited field use has shown that the utilization of fly ash in concrete has resulted in a cost savings and material conservation along with the disposal of a waste product. Results of the use of fly ash in p.c. concrete in Monona County have been encouraging. It was recommended that specifications be developed for portland cement concrete using fly ash for paving and structural work.

Project Title: Fly Ash in Portland Cement Concrete Pavement-Woodbury County

Research Agency: Iowa Department of Transportation, Highway Division

Principal Investigator: C. E. Leonard

Contract Period: March, 1978 to completion

Contract Amount: None (no additional cost)

Research Objective: 1. To determine the problems related to shipping, storing and batching fly ash. 2. To establish procedure for mixing, and placing uniform concrete using fly ash. 3. To demonstrate that concrete of comparable quality can be produced.

<u>Project Activities</u>: The proposed research was incorporated into two bridge replacement projects on Iowa 982. The project includes paving two bridge approach sections at two bridge construction sites.

Progress: Construction on these two bridge replacement projects was completed in October, 1978. No problems were observed in handling or in batching fly ash through a central ready mix plant. Objectives of the project were successfully met. This project helped to verify that paving specifications can be met with fly ash mixes without any serious problems.

Reports: Final Report, April, 1980

<u>Implementation</u>: Fly ash can be used successfully in paving mixes. Quality control test results show that specification air content, slump and flexural strength can be achieved with normal paving operations.

<u>Project Title</u>: Wind Tunnel Analysis to Determine the Effect of Adjustment in the Adjacent Topography on Drifting Snow at Highway Grade Separations.

Research Agency: Iowa State University

Principal Investigator: S. L. Ring

Contract Period: June 1, 1978 to July 13, 1979

Contract Amount: \$61,151

Funding: 100 percent State funds: 75 percent Primary and 25 percent Farm-to-Market

Research Objective: 1. To produce blowing and drifting snow using scale models in a wind tunnel. 2. To analyze effects of strategically placed vegetation, snow fences or structures in order to make recommendations for controlling drifting snow at highway grade separations.

Project Activities: A contract agreement was negotiated and model parameters based on highway design criteria were established. A literature search was completed and field interviews to obtain information on drifting snow were conducted.

<u>Progress</u>: Scale models were constructed and tested in the wind tunnel to reproduce snow drifting phenomenon. The model was modified to represent the introduction of plantings and changes in the physical configuration of the adjacent topography. The effects of snow drifting phenomenon were then observed and recommendations for field testing were made.

Reports: Final Report, June, 1979

Implementation: The study will provide design criteria to reduce the economic costs of accidents, vehicle removal, maintenance operations and travel delay caused by the problem of snow drifting at highway grade separations.

Project Title: Transverse Joint Sealing with Various Sealants

Research Agency: Dallas County and the Iowa Department of Transportation, Highway Division

Principal Investigators: G. Hardy, V. J. Marks

Contract Period: July 25, 1978 to December 31, 1983

Contract Amount: \$51,000

Funding: 100 percent State, Farm-to-Market funds

Research Objective: To evaluate the performance of pcc pavement contraction joints utilizing a variety of sealants and joint preparations and to identify an effective joint sealant system.

Project Activities: These experimental pavement joints were incorporated into a Secondary Road paving project in Dallas County during the 1978 construction season. Joint sealing procedures, materials and specifications were determined prior to construction.

Progress: Six different sealant materials were used with three methods of joint cleaning. Other variables were introduced and some cost comparisons were made. Core samples for joint sealant analysis were taken in 1979 and 1980. Visual observations are being made periodically. Evaluation of the various joint sealing procedures is continuing. Attempts to find an effective joint sealant system will continue.

Reports: Progress Report, July, 1979

Implementation: Deterioration of joints and joint related distress of pcc pavements has continued to be a major maintenance problem. This project will identify the most effective methods of joint preparation and sealing.

<u>Project Title</u>: Safer Construction and Maintenance Practices to Minimize Potential Liability by Counties from Highway Accidents

Research Agency: Iowa State University

Principal Investigator: R. L. Carstens

Contract Period: September 1, 1978 to September 30, 1979

Contract Amount: \$38,335

Funding: 100 percent State, Farm-to-Market funds

Research Objective: To give county engineers guidance in the selection and implementation of measures that will reduce the potential liability of counties for accidents resulting from alleged imperfections in highway facilities.

<u>Project Activities</u>: A literature search dealing with tort claims for counties has been completed. An analysis of tort claim experience derived from questionnaire responses from 85 counties was also completed. Studies to evaluate blading operations and methods of developing advisory speeds on curves on unsurfaced roads were also undertaken.

Progress: Analysis of data has been completed. Conclusions from the study indicate that the most frequently recurring allegations against counties involve sign usage and traffic control. Recommendations set forth in the final report stress that importance of correct traffic signing along with proper documentation of facts and data. A number of other detailed recommendations are included in the final report.

Reports: Final Report, September, 1979.

Implementation: This study will assist county engineers in establishing quidelines relating to highway construction and maintenance practices, including the use of traffic control devices that will improve highway safety and reduce the potential liability by counties.

Project Title: Effects of Special Aggregate on Bridge Deck Overlay Frictional Properties

Research Agency: Iowa Department of Transportation, Highway Division

Principal Investigator: V. J. Marks

Contract Period: December 14, 1978 to December 31, 1985

Contract Amount: \$3,150

Funding: 100 percent State, Primary funds

Research Objective: To evaluate the benefit of incorporating a hard, durable aggregate in a dense pc concrete bridge deck overlay to provide frictional property longevity.

Project Activities: Approval was granted and specifications were approved for incorporating the special coarse aggregate into two bridge deck overlay projects on Interstate 35 near Ankeny, Iowa.

Progress: Resurfacing of the bridge decks was completed in the summer of 1979. The use of special aggregates resulted in a more consistent mix with improved workability and greater ease of finishing and texturing. Friction testing is being conducted on the bridges on a regular basis.

Reports: None

Implementation: Hard durable aggregates will help to provide improved frictional property longevity in bridge deck overlays.

Project Title: Cement Produced from Fly Ash and Lime

Research Agency: Iowa Department of Transportation, Highway Division

Principal Investigator: W. Rippie

Contract Period: April 1, 1979 to June 30, 1980

Contract Amount: \$2,510

Funding: 100 percent State funds: 50 percent Primary and 50 percent Farm-to-Market

Research Objective: To determine if a fly ash-lime cement with desirable characteristics can be produced and to determine the combination of ingredients necessary to attain this end.

Project Activities: The materials and supplies have been obtained from various sources and laboratory work is underway. Facilities at the Coal Research Laboratory at the University of West Virginia will be utilized to melt and process materials in the production of the new cement.

Progress: A group of samples was forwarded to the West Virginia Laboratory for processing. Additional laboratory work is being completed.

Reports: None

Implementation: In view of continued shortages of portland cement, utilization of fly ash, a waste product, will conserve energy and increase cement supply for construction projects.

Project Title: Feasibility of Wind-Powered Aeration of Rest Area Lagoons

Research Agency: Iowa State University

Principal Investigator: J. L. Cleasby

Contract Period: June 1, 1979 to September 30, 1979

Contract Amount: \$8,870

Funding: 100 percent State, Primary funds

Research Objective: To evaluate the feasibility of using wind-powered equipment to aerate rest area lagoons to permit existing lagoons to accomodate higher seasonal BOD loadings than were intended in the original lagoon design.

Project Activities: Phase I will include an evaluation of load projections on rest area lagoons, lagoon design, seasonal aeration requirements and Iowa DEQ regulations. The design of the lagoons was studied and a survey of the interstate rest areas was conducted.

<u>Progress</u>: The project has been completed. Conclusions indicate certain disadvantages to wind-powered aearation of rest area lagoons, the greatest being the fact that wind speeds are lowest during the time when the need for aeration is the greatest. Also, equipment costs are higher for wind-powered aeration than for conventional equipment. Rest area lagoons will continue to be monitored, particularly those with apparent problems.

Reports: Final Report, September, 1979

<u>Implementation</u>: The results of this study will result in a substantial savings to the Iowa DOT. The savings arises from a change in environmental quality standards developed for rest area lagoons due to the unique loading. The change will eliminate the need for some reconstruction.

<u>Project Title</u>: Alternative Methods of Stabilizing the Degrading Stream Channels in Western Iowa

Research Agency: Iowa State University

Principal Investigator: R. H. Lohnes

Contract Period: June 1, 1979 to November 30, 1980

Contract Amount: \$79,254

Funding: 100 per State: 25 percent Primary and 75 percent Farm-to-Market

Research Objective: To develop and evaluate several alternative methods of stabilizing the degrading channels of the streams and gullies in the loess hills of western Iowa.

<u>Project Activities</u>: A comprehensive inventory of grade stabilization structures was conducted early in the project. A selected number of successful and problem structures were chosen for detailed documentation and analysis. Phase I consisted of a review of related work already completed and the effects of freeze-thaw cycles on soil cement were studied.

Progress: An inventory and evaluation of grade stabilization structures was obtained in Phase I of the project. Computerized data on a 13 county area in western Iowa was obtained and problem areas were studied. More efficient methods of stabilizing the degrading streams of western Iowa are being studied. Multiple installations of check dams, use of sheet piling and sand-soil cement appear to have some potential. A final report for Phase I is being completed.

Reports: Progress Report, March 1, 1980

Implementation: Bridge structures are expensive to construct and maintain. If more economical methods of grade stabilization can be developed, it will result in the savings of millions of dollars for counties in western Iowa.

Project Title: Pavement Surface on Macadam Base

Research Agency: Adair County and the Iowa Department of Transportation, Highway Division

Principal Investigator: D. J. Lynam

Contract Period: June 26, 1979 to December 31, 1983

Contract Amount: \$100,347

Funding: 100 percent State, Farm-to-Market funds

Research Objective: To determine the feasibility, economics and performance of placing pc concrete on a macadam base while developing design criteria by varying the thickness of the pc concrete and to determine if the macadam base is effective in reducing D-cracking deterioration of concrete produced with limestone of poor durability characteristics.

Project Activities: Construction was completed on approximately two miles of Adair County Road G-61. Seven different roadway typical sections were utilized. A variation in shoulder construction will be incorporated into one section. One mile adjacent to the experimental construction was included in the evaluation of the research.

Progress: Actual construction work was completed on Adair County Road G-61 in the fall of 1979. Minor construction problems were encountered initially in placing the thin section of pcc on the stone base. Road Rater evaluations of the pavement have been made. Some small areas of distress are visable, but the overall appearance of the pavement is good.

Reports; Construction Report, 1980.

Implementation: This study will result in the ability to construct a pavement with improved performance in regard to D-cracking and subgrade failure, hopefully at a lower cost.

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Project Title: The Effect of Deer Reflectors on Deer-Vehicle Accidents

Research Agency: Iowa Conservation Commission, Iowa Department of Transportation, Highway Division

Principal Investigator: L. Gladfelter, H. Dolling, G. Albansoder

Contract Period: June 15, 1979 to September 30, 1983

Contract Amount: \$30,072

Funding: 100 percent State, Primary funds

Research Objective: To evaluate the "Swareflex" and Bosch reflector system in reducing deer-vehicle accidents, to determine a cost benefit ratio for the system and to identify deer crossing areas throughout the State for possible implementation of the system.

Project Activities: Equipment was selected and purchased. Traffic counting equipment has been installed at the designated sites. Deer-vehicle accident records were maintained for one year prior to the installation of the reflectors. The study areas selected are distributed around the State to include different driving conditions, traffic volume and deer densities.

Progress: Records are being maintained on deer-vehicle accidents at all selected sites. Equipment has been selected and installed on all five sites around the State. Silver reflectors purchased from the Robert Bosch Corporation were installed at one site for comparison purposes. A number of Swareflex reflectors had to be replaced due to a design problem.

Additional data will be needed to determine any meaningful results from the installation of the deer reflectors. However, results from the first installation, installed approximately one year ago, indicate a possible decrease in deer-vehicle accidents.

Reports: Annual progress reports will be completed.

Implementation: An effective deer reflector will reduce deer-vehicle accidents and thereby result in savings to the motorist.

<u>Project Title</u>: Performance of Randomly-Oriented Fiber-Reinforced Roadway Soils (A Laboratory and Field Investigation)

Research Agency: Iowa State University

Principal Investigator: J. M. Hoover

Contract Period: July 1, 1979 to June 30, 1982.

Contract Amount: \$143,207

Funding: 100 percent State, Farm-to-Market funds

Research Objective: To conduct a laboratory and field investigation into the potential of improving soil-aggregate surface and roadway subgrade materials and local base course materials by strengthening these materials through fibrous reinforcement.

<u>Project Activities</u>: Work accomplished during the early months of the project illustrates that fiber reinforcement has significant potential for improvement of engineering properties of soil. Preliminary screening tests were performed in soils taken from potential roadway sites. A screening and selection process is being continued on a variety of different fibers.

Progress: Field demonstration sections using a variety of fibers were constructed in Linn and Story Counties during the summer of 1980. One the Linn County project, three different types of three different percentages of fibers were used. The Story County project was constructed on an existing gravel road. Some difficulty was experienced in mixing the fibers into the roadbed due to equipment failure. Results of the use of the fibers to date appear favorable.

Reports: Semi-annual progress reports are being submitted.

Implementation: Due to economic restraints, new and cost effective methods are needed for the improvement of subgrade base course construction. This project will aid in the development of new and improved design procedures.

Project Title: Suitability of Treating Iowa's Marginal Aggregates and Soils by Foamix Process.

Research Agency: Iowa State University

Principal Investigators: D. Y. Lee

Contract Period: October 15, 1979 to May 31, 1980

Contract Amount: \$19,019

Funding: 100 percent State, Farm-to-Market Funds

Research Objective: To investigate, in the laboratory, the suitability of Foamix in treating aggregates and soils locally available for use as cold mix base material and the potential of Foamix in cold mix asphalt pavement recycling.

Project Activities: Four representative local materials were obtained and evaluated, using a Mobil-Conoco Foaming Unit, in conjunction with an asphalt cement from a major asphalt supplier in Iowa.

<u>Progress</u>: Thirteen aggregates and aggregate blends plus two recycled pavement materials were evaluated in the Laboratory using a foamix process in the mix design. Results were good for the majority of the mixes. Field trials with several different aggregate-soil mixtures are recommended. These materials are considered to be of marginal quality and exhibit some potential for the foamix process.

Reports: Final Report, May 1980

Implementation: Higher labor costs and an increasing shortage of materials is forcing county engineers to explore alternate methods of road construction. Foamed asphalt offers some potential for energy conservation and the utilization of marginal, locally available aggregates.

<u>Project Title</u>: Improved Asphalt Surfaces and Asphalt Resurfacing Performance Through Crack Maintenance

Research Agency: Iowa Department of Transportation, Highway Division

Principal Investigators: R. Shelquist, E. O'Connor

Contract Period: November 12, 1979 to March 1, 1985

Contract Amount: \$13,550

Funding: 100 percent State, Primary funds

Research Objective: To provide better asphalt roadways through evaluation of various combinations of cleaning and crack preparation and to identify the most effective maintenance procedure and the most effective preparation in providing improved resurfacing performance.

<u>Project Activities</u>: Originally the proposed research was going to be incorporated into three asphalt roadways each representing different conditions or desired results. However, some revisions in the original plans were necessary due to financial limitations placed on construction and maintenance with selected projects being removed from the program.

Progress: Evaluations were made and bids were taken for a mobile type high pressure industrial waterblaster. A Vanguard 2000 PSI Waterblaster purchased from a Des Moines distributor. This high pressure washer was used extensively for joint and crack maintenance on various primary and interstate highways.

#### Reports: none

Implementation: Better methods of joint and crack maintenance will result in improved riding qualities and may permit the use of thinner overlays on asphalt roadways.

Project Title: Feasibility Study of Strengthening Existing Single Span Steel Beam Concrete Deck Bridges

Research Agency: Iowa State University

Principal Investigators: F. W. Klaiber

Contract Period: March 12, 1980 to May 31, 1981

Contract Amount: \$58,895

Funding: 100 percent State funds: 50 percent Primary and 50 percent Farm-to-Market

Research Objective: The development of economical techniques to increase both the live load and dead load carrying capacity of existing single span steel beam, concrete deck bridges.

Project Activities: A comprehensive literature review was undertaken and is essentially completed. A field review of several different bridges was completed and a one half scale model of a 50' x 30' I beam bridge was constructed for laboratory testing purposes.

Progress: Strain gages are being attached to the concrete deck for measurement of concrete strains. Brackets have been designed and fabricated for attaching the prestressing rods to individual beams and a loading plan has been designed.

Reports: Progress Report, September 12, 1980

Implementation: There are a number of old simple span steel beam concrete bridges that are not in compliance with present bridge standards. This research is proposed as a feasibility study to strengthen these bridges in order to avoid posting load limits.

Project Title: Improvement of Longitudinal Joints in Asphalt Pavement

Research Agency: Iowa Department of Transportation, Highway Division

Principal Investigator; R. A. Shelquist

Contract Period: March 5, 1980 to January 31, 1987

Contract Amount: \$10,700

Funding: 100 percent State, Primary funds

Research Objective: To identify construction procedures that will provide an improved longitudinal centerline joint.

Project Activities: The proposed research was incorporated into an asphalt widening and resurfacing project on Iowa 44 in Guthrie and Dallas Counties. Construction was tentatively scheduled for completion in July and August of 1980.

Progress: A preconstruction meeting was held on April 11, 1980. Asphalt widening and resurfacing was completed on Iowa 44 in August, 1980. Core samples were taken shortly after completion of the project. Evaluation will be an annual visual observation for deterioration of the longitudinal joint.

Reports: none

Implementation: Improved methods for construction of longitudinal joints will result in increased life of asphalt resurfacing resulting from reduced joint deterioration.

Project Title: Emulsion Treated Macadam Base

Research Agency: Dubuque County, Iowa Department of Transportation, Highway Division

Principal Investigator: C. L. Baule

Contract Period: April 28, 1980 to January 15, 1985

Contract Amount: \$156,048

Funding: 100 percent State, Fram-to-Market funds

Research Objective: To identify and construct a cost effect asphalt emulsion bound macadam section and to evaluate the performance of an asphalt bound macadam as compared to unbound macadam.

Project Activities: The proposed experiemtnal pavement was incorporated into a paving project on Dubuque County Road D-53. The seven different macadam sections were placed with standard paving equipment prior to construction. Additional funding was approved for the purchase of two engineering fabrics for use on the macadam sections in order to provide increased structural capacity.

Progress: Construction of the macadam sections was completed in September, 1980. The most serious problem encountered in the project was the inability to obtain complete coating of the emulsion treated materials. More favorable weather conditions and modified construction procedures helped to alleviate this problem. Riding quality and over all appearance of this experimental pavement is good. Evaluation will continue for a five year period.

Reports: A construction report will be submitted in January, 1981.

Implementation: Macadam base projects in the past have provided excellent drainage characteristics. The use of asphalt emulsion binder and engineering fabrics will result in energy savings and improved' stability while still providing a relatively low cost roadway base.

Project Title: Reducing the Adverse Effect of Transverse Cracking

Research Agency: Iowa Department of Transportation, Highway Division

Principal Investigator: V. J. Marks

Contract Period: March 7, 1980 to January 31, 1984

Contract Amount: \$43,000

Funding: 100 percent State, Primary funds

Research Objective: To identify a method of reducing the adverse effect of transverse cracking and improving the performance of asphalt pavement.

Project Activities: The research was incorporated into a Jones County primary project on Iowa 64. Some of the variations from standard construction practices used in this project included the following: 1. Use of an asphalt that is partially blown and less susceptible to temperature variations; 2. Variation in mix designs; 3. The sawing and sealing of transverse joints.

Progress: The sawing and sealing of the experimental joints was completed early in September, 1980. No particular problems were experienced in this research. Density and gradation requirements were satisfactorily met. The performance of the asphalt surface will be evaluated annually primarily by visual appearance.

Reports: A construction report will be completed in January, 1981.

<u>Implementation</u>: With the prevention of transverse cracking and subsequent crack deterioration asphalt surfaced roads will last longer and require less maintenance and less frequent resurfacing.

<u>Project Title</u>: Liability and Traffic Control Considerations for Low Level Stream Crossings

Research Agency: Iowa State University

Principal Investigators: R. L. Carstens

Contract Period: June 1, 1980 to April 30, 1981

Contract Amount: \$28,350

Funding: 100 percent State, Farm-to-Market Funds

Research Objective: To assess the practicality of low level stream crossings, to evaluate the potential of tort liability associated with these crossings and to provide guidance for the selection of traffic control measures and devices to minimize the hazards involved.

Project Activities: A survey of agencies having experience with low level stream crossings was made. A total of 286 questionnaires were mailed out to various agencies in 25 states. Of these, 53.8 percent were completed and returned. Responses from persons having experience with low water crossings were widely varied. Very little similarity in liability and sign usage was reported.

Progress: A phased method of evaluating signing practices was adopted. An assignment of a general pattern of sign usage was made with a more discriminatory assessment of specific patterns that emerged as most favored. Further evaluation indicated a strong preference for a pattern of sign usage including two warning signs plus an advisory plate if needed and a regulatory sign. A formulation of recommendations will be made later in the project.

Reports: Quarterly progress reports have been submitted.

Implementation: The development of adequate signing and traffic control will allow the use of low water stream crossings which will reduce the fund expenditures for bridges.

Project Title: Settlement at Culverts and Bridges

Research Agency: Iowa Department of Transportation, Highway Division

Principal Investigator: W. E. Buss

Contract Period: May, 1980 to January 31, 1984

Contract Amount: \$11,200

Funding: 100 percent State, Primary funds

Research Objective: To identify cost effective construction methods that may prevent settlement at culverts and bridges.

Project Activities: This research was incorporated into a grade, culvert, pavement widening and resurfacing project on Iowa 44 in Dallas County. Various methods of backfilling and bedding will be evaluated.

Progress: The required backfilling procedures for bridges and culverts were completed by the contractor by extra work order. K-Krete, sand and Class A material with moisture control were used on the bridge approaches. K. Krete and Class A, B and C road stone were used in various combinations in the culvert replacement and backfill.

Reports: none

Implementation: The reduction in settlement will result in less maintenance and will provide the best method of backfill at a reasonable cost.

Project Title: Protection of Structural Concrete Substructures

Research Agency: Iowa Department of Transportation, Highway Division

Principal Investigators: J. Risch, J. Whiting

Contract Period: May, 1980 to July 15, 1985

Contract Amount: \$8,000

Funding: 100 percent State, Primary funds

Research Objective: To field test the long term effectiveness of several available products or procedures as to their ability to protect concrete surfaces against the intrusion of chloride ions.

Project Activities: Attempts will be made to determine the extent of the steel corrosion problem. A sufficient number of test applications of commercially available products will be made to permit various appreciation rates and varying degrees of preparation.

<u>Progress</u>: A considerable amount of core sampling of pier columns and chloride analysis will be done in bridge pier columns in the Des Moines and Cedar Rapids areas. Supplies and equipment have been purchased and core sampling has begun.

#### Reports: None

<u>Implementation</u>: A protective system will prevent the intrusion of chlorides into structural concrete and will help to prevent the need for repairs which are both difficult and expensive.

Project Title: Evaluation of Recycled Asphalt Concrete-Kossuth County

Research Agency: Federal Highway Administration, Iowa Department of Transportation, Highway Division

Principal Investigator: R. P. Henely

Contract Period: June, 1976 to February, 1980

Contract Amount: \$30,000

Funding: 100 percent Federal funds

Research Objective: To determine and evaluate the properties of the recycled asphalt, the load bearing capacity and performance of

the completed pavement, pollution control, capacity of the plant and appurtenances, operations aspects of scarification crushing and processing equipment and the economic viability of recycling asphalt pavements on a large scale.

Project Activities: The old asphalt material was ripped, salvaged and stockpiled for crushing. No serious problems were encountered in the mixing and paving operations. An energy savings was realized in using the recycled asphalt, however, an air pollution problem persisted at the mixing plant in spite of efforts to correct it.

<u>Progress</u>: Visual inspection indicated that the recycled asphalt concrete pavement is performing well. Air pollution requirements were not met on this project, but were achieved in a 1977 project.

Reports: Final report, February, 1980.

Implementation: An impressive savings in energy and in the conservation of resources was realized in the completion of this project. More consideration will be given to the recycling of old asphalt pavements in the future.

Project Title: Evaluation of Asphalt Sprinkle Treatment to Provide a Non-Skid Surface

Research Agency: Federal Highway Administration, Iowa Department of Transportation, Highway Division

Principal Investigator: D. D. Jordison

Contract Period: January 18, 1978 to January, 1981

Contract Amount: \$10,000

Funding: 100 percent State, Primary funds

Research Objective: To determine the feasibility and cost effectiveness of using a standard asphalt mixture of local aggregates for surface courses, followed by a sprinkle treatment of non-polishing aggregates to produce a durable, non-skid pavement surface.

Project Activities: During the 1977 construction season, several projects were initiated by the Highway Division of the Iowa DOT using sprinkle applications of high quality aggregate to achieve the desired non-skid surface.

Progress: Several different sprinkle treatment projects using various

aggregates were completed during the 1977 construction season. All projects are performing well, although some aggregate loss was evident soon after construction. Sprinkle treatments appear to be an effective means of providing pavements with higher quality frictional properties. Periodic field reviews will continue. A final report is being prepared.

Reports: "Sprinkle Treatments", FHWA Interim Report-June, 1978

Implementation: The sprinkle treatment procedure saves money by utilizing a limited amount of expensive aggregates, while providing a longer lasting pavement texture and improving the frictional coefficients of the pavement.

