ANNUAL REPORT
OF
HIGHWAY DIVISION
HIGHWAY RESEARCH AND DEVELOPMENT
IN IOWA

NOVEMBER 2002

Iowa Department
of Transportation

ANNUAL REPORT
OF
HIGHWAY DIVISION
HIGHWAY RESEARCH AND DEVELOPMENT IN IOWA

FOR THE
FISCAL YEAR ENDING JUNE 30, 2002

OFFICE OF MATERIALS
(515) 239-1447

HIGHWAY DIVISION
IOWA DEPARTMENT OF TRANSPORTATION
AMES, IOWA 50010

NOVEMBER 2002

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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; second, to identify and implement improved engineering and management practices.

This report entitled, "Highway Division Highway Research and Development in Iowa", is submitted in compliance with Sections 310.36 and 312.3A, Code of Iowa, which direct the submission of a report of the Secondary Road Research Fund and the Street Research Fund respectively. It is a report of the status of research and development projects, which were in progress on June 30, 2002; it is also a report on projects completed during the fiscal year beginning July 1, 2001, and ending June 30, 2002. Detailed information on each of the research and development projects mentioned in this report is available in the Office of Materials in the Highway Division of the Iowa Department of Transportation.

IOWA HIGHWAY RESEARCH BOARD

In developing a progressive, continuing and coordinated program of research and development, the Highway Division is assisted by the Iowa Highway Research Board. This advisory group was established in 1949 by the Iowa State Highway Commission to respond to the research denoted in Section 310.36 of the Code of Iowa and now is denoted by 312.3A.

The Research Board consists of 15 regular members; seven county engineers, four Iowa DOT 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 regular members and their alternates are appointed by the Iowa Department of Transportation Highway Division Director for a three-year term. The membership of the Research Board as of June 30, 2002 is listed in Table I.

The Research Board held nine regular meetings during the period of July 1, 2001 to June 30, 2002. Suggestions for research and development were reviewed at these meetings and recommendations were made by the Board.

TABLE I
2001-2002 IOWA HIGHWAY RESEARCH BOARD MEMBERS

Member	Term Expires	Alternate
John Adam Deputy Director Iowa DOT - Statewide Operations Bureau 800 Lincoln Way Ames, IA 50010 (515) 239-1333	12-31-02	Robert Younie Construction Engineer Iowa DOT - Dist. 1 1020 S. 4th Street Ames, IA 50010 (515) 239-1542
Jerald Byg Ames City Engineer 515 Clark Street Ames, Iowa 50010 (515) 239-5163	12-31-03	Richard Fosse City Engineer 410 E. Washington Iowa City, Iowa 52246-5717 (319) 356-5143
Robert Ettema Chair, Dept. of Civil & Env. Engineering The University of Iowa 4105 Seamans Center Iowa City, IA 52242 (319) 384-0596		
Jim George Dallas County Engineer 415 River Street Adel, IA 50003 (515) 993-4289 SS#-025	12-31-02	Charles Marker Cass County Engineer 5 W. 7th Street Atlantic, IA 50022 (712) 243-2442 SS#-015
Roger Gould Process Management Engineer Engineering Bureau Iowa DOT - Highway Division 800 Lincoln Way Ames, IA 50010 (515) 239-1834	12-31-03	James Berger Director of Materials Iowa DOT - Highway Division 800 Lincoln Way Ames, IA 50010 (515) 239-1843
Lowell Greimann Dept of Civil & Const. Engr. Iowa State University 390 Town Engineering Bld. Ames, IA 50011 (515) 294-5586		
Douglas Julius Sioux County Engineer 207 Central Avenue SE P.O. Box 17 Orange City, IA 51041 (712) 737-2248 SS# 084	12-31-03	Jon Ites Buena Vista County Engineer 215 E. 5th Street P.O. Box 368 Storm Lake, IA 50588 (712) 749-2540 SS# 011

Brian Keierleber Buchanan County Engineer 1511 1st Street East Independence, IA 50644-3123 (319) 334-6031 SS# 010	12-31-03	Clark Schloz Jackson County Engineer 201 W. Platt Maquoketa, IA 52060 (563) 652-4782 SS# 049
Randall Krauel Director of Public Works 112 East 5th Carroll, IA 51401 (712) 792-1000	12-31-02	
Kevin Mahoney Director of Highway Division Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1124	12-31-03	Larry Jesse Director of Local Systems Iowa DOT - Highway Division 800 Lincoln Way Ames, IA 50010 (515) 239-1291
Mark Nahra Delaware County Engineer 2139 Highway 38 P.O. Box 68 Delaware, IA 52036 (563) 927-3505 SS# 02		
John Selmer District Engineer Iowa Department of Transportation District 4 63200 White Pole Rd. P.O. Box 406 Atlantic, IA 50022 (712) 243-3355	12-31-03	Glen Miller Construction Engineer Iowa Department of Transportation District 4 63200 White Pole Rd. P.O. Box 406 Atlantic, IA 50022 (712) 243-3355
Christy Van Buskirk Keokuk County Engineer 101 S. Main Sigourney, IA 52591 (641) 622-2610 SS#-054	12-31-04	Roger Schletzbaum Marion County Engineer 402 Willetts Drive Knoxville, IA 50138 (641) 828-2225 SS# 063
Jerry Weber Clayton County Engineer 429 High Street N.E. P.O. Box 456 Elkader, IA 52043-0456 (563) 245-1782 SS#-022	12-31-04	Todd Fonkert Bremer County Engineer 1995 Euclid Avenue Waverly, IA 50677 (319) 352-4302 SS# 009
Wade Weiss Greene County Engineer 114 N Chestnut Jefferson IA 50129 (515) 386-5650 SS#-037	12-31-02	Lyle Brehm Tama County Engineer 1002 E. 5th Street Tama IA 52339-2216 (641) 484-3341 SS#-086

RESEARCH AND DEVELOPMENT PROJECTS

Proposals for research and development are reviewed by the Iowa Highway Research Board, and its recommendations are transmitted to the Director of the Highway Division and the Director of the Department of Transportation. Expenditure of funds for research and development is then authorized on an individual project basis.

These expenditures may be charged to the Primary Road Fund, Farm-to-Market Road Fund or the Street Research Fund, depending on which road system will benefit from the project. If more than one jurisdiction's roads share in the benefits, the costs are shared.

Table II is a record of expenditures for research and development made during the fiscal year ending June 30, 2002. Total expenditure was $1,493,599.85.

IN-HOUSE RESEARCH AND DEVELOPMENT

Research and development projects performed by Iowa DOT personnel are termed "in-house" projects. These projects may involve other departmental and field personnel, in addition to personnel from the Office of Materials, Research Section. In many instances, personnel from other offices are designated as principal investigators, which means that they have a major role in the planning, performance and analysis of the research.

Contract research funds may be used for material and equipment costs for in-house research, but cannot be used for salary or personal expenses of the participating personnel. Consequently, the contract amounts for in-house projects are relatively small. The Office of Materials, Research Section, wishes to express its appreciation to other offices for their assistance.

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

The National Cooperative Highway Research Program (NCHRP) was organized by the American Association of State Highway Officials (now the American Association of State Highway and Transportation Officials--AASHTO). The program is administered by the Transportation Research Board, a branch of the National Academy of Sciences.

The purpose of NCHRP is to provide the funds and direction for research in highway matters of national concern.

The program is funded annually by all of the states in an amount equal to 0.0675 percent of the federal aid allocated to the states for highways. Iowa's obligation and actual expenditure for NCHRP varies and may be influenced by billing practices. The secondary obligations to NCHRP are paid from the Secondary Road Research Fund.

SECONDARY ROAD TRAFFIC COUNT PROGRAM

Secondary road traffic counts and road inventories are conducted annually and funded from the Secondary Road Research Fund as "Non-contract Engineering Studies". The Office of Transportation Data conducted traffic counts in twenty-five counties during fiscal year 2002 as part of the Annual Traffic Count Program. This activity consisted of 310 portable recorder classification counts, 4,700 portable recorder volume counts and 50 manual counts. Traffic volumes from these counts are used to develop Motor Vehicle Traffic Flow Maps for each county showing the Annual Average Daily Traffic "AADT" on specific road sections within each county.

Secondary roads were physically inventoried for geometrics and current condition in ninety counties. This data provides county engineers, highway engineers, planners and administrators with essential information needed to determine design standards, to systematically classify highways, and to develop programs for improvement in maintenance of secondary roads.

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 1½ percent of the receipts to 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. The Iowa Department of Transportation accounting procedure for the Secondary Road Research Fund is based on obligations for expenditures on research projects and not the actual expenditures. The fiscal year 2002 financial summary is:

Beginning Balance 7-1-01		$2,157,086.32
Receipts		
State Road Use Tax Fund (1½% of receipts)...	$1,113,492.46	
Federal Aid Secondary (1½% of receipts)...	0.00	
Research Income	0.00	
Sub-Total		$1,113,492.46
Total Funds Available		$3,270,578.78
Obligation for Expenditures		
Obligated for Contract Research...	872,593.15	
Non-Contract Engineering Studies...	94,127.00	
Total Expenditures		966,720.15
BALANCE 6-30-02		$2,303,858.63

STREET RESEARCH FUND

The Street Research Fund was established in 1989 under Section 312.3A of the Iowa Code. Each year two hundred thousand dollars are set aside from the street construction fund solely for the purpose of financing engineering studies and research projects, which have as their objective the more efficient use of funds and materials available for construction and maintenance of city streets. The Iowa Department of Transportation accounting procedure for the Street Research Fund is based on obligations for expenditures on research projects and not the actual expenditures. The fiscal year 2002 financial summary is:

Beginning Balance (7-1-01)	$ 36,486
FY02 Street Research Funding	200,000
Total Funds Available for Street Research	$236,486

Obligated for Expenditure

HR-296	$ 36,900
TR-465	-7,410 (cancelled)
TR-468	1,000
TR-469	13,983
TR-470	3,000
TR-471	4,600
TR-472	4,000
TR-474	4,984
TR-475	5,000
TR-476	13,875
TR-479	9,683

Total obligated for Expenditure	$89,615	
Ending Unobligated Balance 6-30-02		$146,871

PRIMARY ROAD RESEARCH FUND

The Primary Road Research Fund is from non-obligated funds of the Primary Road Fund. These funds can only be expended on Iowa DOT projects for which the funds were reserved such as contracted research and project specific research supplies or equipment. An estimate of Primary Road Research Fund expenditures is made prior to the beginning of each fiscal year. There is no balance carried forward to the next fiscal year and uncommitted funds remain in the Primary Road Fund. The amount expended for contract research from the Primary Road Research Fund for FY02 was $624,494.32 and the estimate for FY03 is $750,000.

PROJECTS INITIATED DURING FY 2002

The new projects initiated during FY 2002 were:

TR-467, "Investigation of the Modified Beam-in-Slab Bridge System"
TR-468, "Technology Transfer Program for the Iowa Highway Research Board (IHRB)"
TR-469, "Reduction of Concrete Deterioration by Ettringite Using Crystal Growth Inhibition Techniques - Part II - Field Evaluation of Inhibitor Effectiveness"
TR-470, "Development of a Method to Determine Pavement Damage Due to Detours and Haul Roads"
TR-471, "Evaluation of Using Non-Corrosive Deicing Materials and Corrosion Reducing Treatments for Deicing Salts"
TR-472, "Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipment"
TR-473, "Rehabilitation of Concrete Pavements Utilizing Rubblization and Crack and Seat Methods"
TR-474, "Development of a Mix Design Process for Cold-In-Place Rehabilitation Using Foamed Asphalt"
TR-475, "Synthesis of Best Practices for Increasing Protection and Visibility of Highway Maintenance Vehicles"
TR-476, "PCVAL: A Computer Program for Valley Stage-Discharge Curves and Bridge Backwater Calculations"
TR-477, "Total Cost of Transportation Analysis - Phase II"
TR-478, "Evaluation of Composite Pavement Unbonded Overlays"
(Installation and Maintenance of Weigh In Motion Detection System on Iowa Highway 13 in Delaware County)
TR-479, "Investigation Into Improved Pavement Curing Materials and Techniques: Part II (Phase III)"

13 projects

Table II
FINANCIAL SUMMARY OF RESEARCH AND DEVELOPMENT PROJECT EXPENDITURES

July 1, 2001 to June 30, 2002

(Active projects with no current fiscal year expenditures are included)

Project	Total Funds Committed	Project Title	Primary Road Research Fund Expenditures	Secondary Road Research Fund Expenditures	Street Research Fund Expenditures	Total Expenditures
296	82,000	ISU Local Technical Assistance Program (LTAP)	8,200.00	15,312.49	3,974.34	27,486.83
370	10,000	Pipe Rehabilitation With Polyethylene Pipe Liners				
375	22,400	Transportation Research Board Education for County Engineers		3,107.45		3,107.45
388	67,838	Road Network Model Spreadsheet for Service Level Decision Making		17,980.29		17,980.29
391	163,741	Optimal Usage of De-Icing Chemicals When Scraping Ice				
394	672,152	Transportation Program Management System	13,550.96	66,564.01	4,136.29	84,251.26
398	33,832	Hydraulics of Slope-Tapered Concrete Pipe Culverts				
399	299,932	Field Testing of Integral Abutments		1,755.14	2,729.38	4,484.52
401	337,135	Embankment Quality	7,628.33	2,646.56	522.97	10,797.86
408	220,595	Glass Fiber Composite Dowel Bars for Highway Pavement	10,874.29	4,882.28	4,249.99	20,006.56
411	47,993	An Improved Computer Program for River Valley Rating Curves				
412	65,000	Development of a Computer Controlled Underbody Plow				
414	50,000	Superpave Mix Designs for Low Volume Roads				
416	11,674	Development of Materials Training Course for Technicians				
419	30,000	Education on Urban Corridor Issues				
420	98,478	Field Evaluation of Alternative Load Transfer Device Locations in Low Traffic Volume		26,074.11	1,844.67	27,918.78
422	14,000	Pretreatment for Reduction of Asphalt Absorption in Porous Aggregate				
424	178,358	Steel Diaphragms in Prestressed Concrete Girder Bridges	59,542.69			59,542.69
427	26,200	Evaluation of High-Slump Concrete for Bridge Deck Overlays				
428	294,760	Effective Structural Concrete Repair	12,812.47	14,150.26		26,962.73
429	195,060	Evaluation of Appropriate Maintenance Repair and Rehabilitation Methods for Iowa	5,370.14	15,338.92	821.01	21,530.07
430	179,801	Regional Approach to Landslide	6,292.96	11,687.03		17,979.99
431	139,236	Reduction of Concrete Deterioration by Ettringite Using Crystal Growth Inhibition	12,531.10	1,392.38		13,923.48
432	183,903	Ultrathin Portland Cement Concrete Overlay Extended Evaluation	7,776.40	674.11	587.42	9,037.93
433	89,265	HWYNEEDS-Methodology, Analysis and Evaluation		535.53		535.53
434	30,420	Use of Abrasives in Winter Maintenance				
435	117,030	Thin Maintenance Surfaces - Phase II		3,464.55		3,464.55
436	158,028	Retrofit Methods for Distortion Cracking Problems in Plate Girder Bridges	28,740.36	9,874.35		38,614.71
437	43,334	Performance of Strip Seals in Iowa Bridges, Pilot Study	21,599.95	866.70	866.70	23,333.35
438	142,903	Integral Abutment Bridge With Precast Concrete Piles	16,371.71		111.89	16,483.60
440	137,580	Field & Laboratory Evaluation of Precast Concrete Bridges		37,373.97	4,569.38	41,943.35
443	148,938	Evaluation of Rammed Aggregate Piers for Highway Applications in Iowa Soils	13,279.68			13,279.68
444	187,620	Demonstration Project Using Railroad Flatcars for Low Volume Road Bridges		110,306.20		110,306.20
445	176,876	Development of Bridge Load Testing Process for Load Evaluation	38,108.03	12,236.19	4,587.99	54,932.21
446	214,150	Technology Transfer of "As Built Preliminary Surveys" by Total Station GPS, Video Logging & Laser	37,504.94	10,238.52	5,563.38	53,306.84
447	68,200	A Computer Program for the Hydraulic Design of Culverts	3,638.00	2,727.75	682.00	7,047.75
449	58,135	Determination and Evaluation of Alternative Methods for Managing and Controlling Highway Related Dust		31,257.25		31,257.25
450	80,000	Identification of Laboratory Techniques to Optimize Superpave HMA Surface Friction Characteristics				
451	70,718	Investigation Into Improved Pavement Curing Materials and Techniques	38,475.11	7,942.67	7,072.00	53,489.78
452	48,65	Alternative Solutions to Meet the Service Needs of Low Volume Bridges in Iowa (7.03)		31,568.70		31,568.70
453	62,664	Low Water Stream Crossings in Iowa	5,074.74	33,012.77	2,306.18	40,393.69
454	43,640	Durable, Cost Effective Pavement Marking Materials – Phase I				

Project	Total Funds Committed	Project Title	Primary Road Research Fund Expenditures	Secondary Road Research Fund Expenditures	Street Research Fund Expenditures	Total Expenditures
455	37,400	Handbook of Simplified Practice for Traffic Studies	7,480.00	22,440.00	7,480.00	37,400.00
456	107,800	Measuring Main-Channel Slopes for Major Rivers in Iowa	43,000.00			43,000.00
457	73,997	Development of a Manual Crack Quantification and an Automatic Crack Measurement System	39,957.31	26,640.02		66,597.33
458	151,920	Field Testing of Abrasive Delivery Systems in Winter Maintenance	25,964.04	22,433.78		48,397.82
459	27,433	Reuse of Lime Sludge From Water Softening	6,172.23		11,719.46	17,891.69
460	87,924	Living Snow Fences	22,214.22			22,214.22
461	70,000	Soil Stabilization of Non-Uniform Subgrade Soils	25,051.41			25,051.41
462	61,560	Manual for Roadside Control of Trees and Brush	15,730.41	14,030.61	3,741.43	33,502.45
463	99,804	Field Performance Study of Past Iowa Pavement Research: A Look Back	23,022.86			23,022.86
464	30,000	Erosion Control for Highway Applications - A Critical Review of Published Literature	7,990.11		130.14	8,120.25
466	47,049	Evaluation of Unbonded Ultrathin Whitetopping of Brick Streets	6,515.08	2,406.60	15,807.61	24,729.29
467	190,890	Investigation of the Modified Beam-in-Slab Bridge System		29,453.55		29,453.55
468	10,000	Technology Transfer Program for the Iowa Highway Research Board (IHRB)	56.60	50.00		106.60
469	139,832	Reduction of Concrete Deterioration by Ettringite Using Crystal Growth Inhibition Techniques-Part II-Field Evaluation of Inhibitor Effectiveness	2,394.90			2,394.90
470	60,000	Development of a Method to Determine Pavement Damage Due to Detours and Haul Roads	8,282.97			8,282.97
471	100,000	Evaluation of Using Non-Corrosive Deicing Materials and Corrosion Reducing Treatments for Deicing Salts	4,468.16			4,468.16
472	80,000	Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipment	4,378.86			4,378.86
473	178,197	Rehabilitation of Concrete Pavements Utilizing Rubblization and Crack and Seat Methods	1,160.56			1,160.56
474	99,683	Development of a Mix Design Process for Cold-In-Place Rehabilitation Using Foamed Asphalt	700.70			700.70
475	25,000	Synthesis of Best Practices for Increasing Protection and Visibility of Highway Maintenance Vehicles	10,000.00	4,348.76	5,000.00	19,348.76
476	69,375	PCVAL: A Computer Program for Valley Stage-Discharge Curves and Bridge Backwater Calculations				
477	29,635	Total Cost of Transportation Analysis - Phase II (HR-388 - Phase I)				
478	49,520	Evaluation of Composite Pavement Unbonded Overlays (Installation and Maintenance of Weigh In Motion Detection System on Iowa Hwy 13 in Delaware Co.)				
479	96,828	Investigation Into Improved Pavement Curing Materials and Techniques: Part II (Phase III)				
1027	70,000	Secondary Road Research Coordinator		91,700.80		91,700.80
1080	29,997	Synthesis of Dowel Bar Research	22,582.04			22,582.04
		Contract Research Subtotal	624,494.32	686,474.30	88,504.23	1,399,472.85
SPR-PR-PL-1(33)		FY2002 Planning & Research Program (Transportation Inventory Engineering Studies)		94,127.00		94,127.00
		Noncontract Engineering Studies Subtotal		94,127.00		94,127.00
		Grand Total of Expenditures	624,494.32	780,601.30	88,504.23	1,493,599.85

Project Number: HR-296

Project Title: Iowa State University Local Technical Assistance Program (LTAP)

Agency: Iowa State University

Principal Investigator: Stephen J. Andrle

Research Period: October 1, 1986 to December 31, 2002

Research Board Funding: $82,000 per year

Funding Source: 54 percent Federal, 15 percent State Safety, and 31 percent State IHRB (10 percent Primary funds, 45 percent Secondary funds and 45 percent Street funds)

Objective: To promote research, encourage implementation and distribute research data.

Progress: The major tasks are:

1. publishing at least four newsletters per year
2. conducting at least 10 training courses per year
3. distribute publications
4. provide service and information to users
5. present transportation safety information to rural communities by employing a Transportation Safety Circuit Rider

Reports: Newsletters

Implementation: Implementation of research findings and the proper training of state and county employees will improve the quality and reduce the cost of road construction and maintenance.

Project Number: HR-370

Project Title: Pipe Rehabilitation With Polyethylene Pipe Liners

Agency: Dallas County, Jefferson County, Jones County, Mahaska County, Taylor County, and the Iowa Department of Transportation, Highway Division

Principal Investigator: Brad Skinner, Gary Bishop, Dan Waid, Raymond Blessum, James Delozier and Ed Engle

Research Period: June 1, 1994 to December 31, 2001

Research Board Funding: $10,000

Funding Source: 100 percent State – 100 percent Secondary funds

Objective: The objective of the research is to demonstrate and evaluate the applicability of pipe rehabilitation with polyethylene pipe liners.

Progress: Six locations were selected for the installation of polyethylene liners. Culverts rehabilitated included corrugated metal pipe, concrete roadway pipe, and a wooden box culvert. The polyethylene liners used for this research were Culvert-Renew® and Snap-Tite®. Installations were completed in October 1994. The research is also evaluating several additional pipes that were rehabilitated with polyethylene liners (but were not funded). Field visits have shown that several of the liners have moved or show signs of creeping. Movement measurements range from 1-3/8" to 2-5/8." Evaluation and final report development are in progress.

Reports: Construction Report, March 1995

Implementation: If the use of polyethylene liners is successful, it will give engineers an economical alternative to the removal and replacement of deteriorated culverts.

Project Number: HR-375

Project Title: Transportation Research Board Education for County Engineers

Agency: Iowa Department of Transportation, Highway Division

Principal Investigator: Ed Engle

Research Period: November 1, 1994 to December 31, 2004

Research Board Funding: $22,400

Funding Source: 100 percent State – 100 percent Secondary funds

Objective: The objective of the project is to send two county engineers annually to the Transportation Research Board (TRB) Annual Meeting in Washington, D.C. for research education. The two county engineers selected are generally those starting their term as regular members of the Iowa Highway Research Board (IHRB). The experience of attending the TRB Annual Meeting will give county engineers serving on the IHRB a better understanding of research at a national and international level. Additional benefits may be gained as the county engineers begin to develop ideas for research from their experience at the TRB meeting.

Progress: In the time period, 1995 to 2002, a total of 16 county engineers were sent to TRB.

Reports: None

Implementation: The county engineers who attended the conference so far have all felt it was a very good educational experience. They believe the experience will allow them to better serve their counties and the IHRB.

Project Number: HR-388

Project Title: Road Network Model Spreadsheet for Service Level Decision Making

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

Principal Investigator: Steve DeVries

Research Period: May 29, 1996 to May 31, 2002

Research Board Funding: $67,838

Funding Source: 100 percent State – 100 percent Secondary Funds

Objective: To develop and test a new method for making highway service level decisions by modeling a road network, finding the best service levels for given traffic volumes and using the results to make road system management decisions.

Progress: This project is complete and a final report with software was presented to the Board on May 31, 2002. Copies of the software and manual will be distributed to all 99 counties in Iowa by September 2002.

Reports: Final Report, May 31, 2002.

Implementation: Operating, improving and maintaining a ready system is difficult and funds are scarce. This research will develop and test a new method for making the decisions required to manage a road system with all of the inherent tradeoffs to deploy scarce funds for maximum public benefit.

Project Number: HR-391

Project Title: Optimal Usage of De-Icing Chemicals When Scraping Ice

Agency: The University of Iowa

Principal Investigator: Wilfrid A. Nixon

Research Period: May 21, 1996 to December 31, 2003

Research Board Funding: $163,741

Funding Source: 100 percent State – 70 percent Primary funds, 10 percent Secondary funds and 20 percent Street funds

Objective: The objective of the work proposed in this study is to determine the best combination of chemical application and scraping for removing the various types of ice from the road.

Progress: Preliminary testing has resulted in the development of test protocols, which allow for very good repeatability of test results (which is a necessary part of this project, since some effects may be small). Testing since the spring has concentrated on salt (sodium chloride) as a deicer, and has tested various quantities of salt, applied for varying length of time and in various forms (coarse granules, fine powder, etc.).

Reports: None

Implementation: A field guide would be developed which would contain for each chemical tested, the optimal application rate and delay time for that chemical for each ice type. This will improve winter ice removal, thereby, improving safety of the motoring public.

Project Number: HR-394

Project Title: Transportation Program Management System, Phases II - IV

Agency: Iowa County Engineers Association Service Bureau

Principal Investigator: Steve DeVries

Research Period: March 1, 1999 to February 28, 2003

Research Board Funding: $672,152

Funding Source: 100 percent State – 25% Primary funds, 72% Secondary funds, and 3% Street funds

Objective: The objective of this project is to create a centralized, automated system to support project programming and development tracking to:

a) reduce the potential for errors and conflicts.
b) speed up the process and deliver road improvements to the public more expeditiously.
c) decrease the total labor cost required to get programming and development work accomplished.
d) make the status of any project or action available to all parties who need to know on a "real-time" basis.
e) Improve communications and provide an on-line transcript of each projects' history.

Progress: The system facilitates preparation and submission by the counties, review by DOT district planners, and final approval by the Office of Local Systems. TPMS' programming data has been synchronized with the DOT's mainframe STIP, so that the two systems exactly match regarding federal aid projects. The user interface has been refined and improved and will be able to open the system for FY 2004 program edits by mid-November.

On the project development tracking side, the system has been made current with the DOT's list of future lettings and counties are in the process of activating development records for all relevant FY 2003 projects that haven't yet shown up in the DOT's system. Efforts to set up an automatic, daily exchange of project information between TPMS and the DOT's Project Scheduling System, PSS, are nearly complete. This part of the system should be able to go live in October.

Reports: None

Implementation: The results of this project will be a system that will both improve and expedite the current Transportation Program Management process. It will enable local agencies to reduce project errors, conflicts, and delays. All interested parties will be able to get a "real-time" project status at any time.

Project Number: HR-398

Project Title: Hydraulics of Slope-Tapered Concrete Pipe Culverts

Agency: FHWA Office of Engineering Research and Development and GKY and Associate

Principal Investigator: J. Sterling Jones

Research Period: January 17, 1997 to May 1, 1997

Research Board Funding: $33,832

Funding Source: 100 percent State – 100 percent Primary funds

Objective: The objective of this research project is to verify the hydraulic design details of slope tapered pipe culverts.

Progress: FHWA and their contractor have completed all laboratory work and submitted a draft final report in January 1998. Final review comments to this draft report have been submitted by the Office of Bridges and Structures to FHWA so the report can be finalized.

The results of the research show that both the slope tapered inlet configuration and the typical precast concrete pipe apron (Iowa DOT Standard Road Plan RF-3) are more hydraulically efficient than assumed. Also, in the slope taper section, the number of reducer sections required in Iowa DOT's design guidelines could be decreased by one reducer without adversely affecting hydraulic efficiency of the inlet. In general, the research verified assumptions in Iowa DOT's design guidelines for slope tapered concrete culverts.

Reports: Final Report, June 2001

Implementation: Iowa DOT intends to use the new hydraulic design coefficient for a standard concrete pipe apron which results in a slightly improved hydraulic performance for all concrete pipe culverts, not only slope tapered inlets. Also, IDOT's design procedures for the slope tapered pipe culvert will be finalized and distributed.

Project Number: HR-399

Project Title: Field Testing of Integral Abutments

Agency: Iowa State University

Principal Investigator: Robert Abendroth

Research Period: February 1, 1997 to October 31, 2002

Research Board Funding: $299,932

Funding Source: 100 percent State – 50 percent Primary funds, 35 percent Secondary funds and 15 percent Street funds

Objective: Previous research proposed extending the length limitations on some integral abutment bridges. The response of the abutment and pile system to longitudinal bridge movements has not been fully accepted for the extended length designs. This research proposes to:

1. Evaluate the state-of-the-art of integral abutment design.
2. Validate the assumptions that are incorporated in the present pile design procedures for integral abutment bridges.

Progress: Long-term monitoring of strains, displacements, and temperatures has been completed at both integral abutment bridges selected. Lab tests were conducted to determine the coefficient of thermal expansion and contraction of core samples taken from the decks. Analysis of these tests has been completed. The finite-element model for both bridges is complete. A calibration procedure that involves the comparison of analytically predicted and experimentally measured bridge displacement has been completed. Disassembly and removal of data collecting instrumentation from the 2 bridges is under way. Design methodology and examples are taking more time than expected.

The final report is being prepared.

Reports: Interim Report, June 1998

Implementation: The results of this research will be made available to bridge design engineers who have requested further verification of the pile design concepts that have been previously recommended for integral abutment bridges.

Project Number: TR-401

Project Title: Embankment Quality, Phase I, Phase II and Phase III

Agency: Iowa State University

Principal Investigator: Kenneth Bergeson and David J. White

Research Period: May 1, 1997 to March 31, 2002

Research Board Funding: $337,135

Funding Source: 100 percent State – 70 percent Primary funds, 15 percent Secondary funds and 15 percent Street funds

Objective: The primary objectives of this study are as follows:

Phase I - Evaluate the current compaction method and acceptance and to provide suggestions for new compaction procedures and to recommend methods of testing and acceptance.

Phase II - Field testing of alternative embankment acceptance procedures and methods for rapid field identification of the range of soil types in Iowa.

Phase III - Design and construct a project using the recommended design specifications.

Reports: Final Report, June 2002

Implementation: Iowa State University will prepare recommended embankment construction acceptance procedure and field testing procedures for Iowa DOT and grading contractors to use.

Project Number: TR-408

Project Title: Glass Fiber Composite Dowel Bars for Highway Pavement

Agency: Iowa State University

Principal Investigator: Max Porter

Research Period: June 2, 1997 to May 31, 2001

Research Board Funding: $220,595

Funding Source: 100 percent State – 80 percent Primary funds, 10 percent Secondary funds and 10 percent Street funds

Objective: The objective of this research project is to investigate the long-term performance and fatigue behavior of glass fiber composite dowels.

Reports: Final Report, September 2001

Implementation: This research will provide designers with a new set of preliminary design criteria for using the GFC dowels in highway pavement joints as an alternative to epoxy coated steel dowels.

Project Number: TR-411

Project Title: An Improved Computer Program for River Valley Rating Curves

Agency: Iowa State University

Principal Investigator: T. Al Austin

Research Period: July 23, 1997 to December 31, 2001

Research Board Funding: $47,993

Funding Source: 100 percent State – 40 percent Primary funds, 40 percent Secondary funds and 20 percent Street funds

Objective: The objective of this research project is to rewrite the computer program, PCVAL, in a user-friendly format, Visual Basic 5.0, and develop a user's manual to enhance its use.

Progress: This project was terminated by the IHRB at its March 2002 meeting due to staffing issues and extensive delays in satisfactory completion of the project.

Reports: None

Project Number: TR-412

Project Title: Development of a Computer Controlled Underbody Plow

Agency: The University of Iowa

Principal Investigator: Wilfrid A. Nixon

Research Period: August 1, 1997 to December 31, 2002

Research Board Funding: $65,000

Funding Source: 100 percent State – 80 percent Primary funds, 10 percent Secondary funds and 10 percent Street funds

Objective: The objective of this proposed research is to develop a computer controlled underbody plow and then through an expert system, capture and apply the experience of our best ice removal maintenance personnel.

Progress: The MATLAB software package has allowed a base level program for fuzzy control of a snowplow to be developed. This has the capability of providing fuzzy control over a closed feedback loop, in which the force between underbody plow and the road surface (the scraping force) is the primary feedback signal. It also incorporates a number of secondary feedback signals (such as plow angle) into the control loop and a simple weighted algorithm has been used for this.

Reports: Annual Progress Report, July 1999

Implementation: This project is proposed with the primary aim of developing a computer controlled underbody plow for snow and ice removal. The plow assembly will include an expert system utilizing fuzzy logic to obtain optimal response. Once the project is complete, the system will be available for deployment in field situations.

Project Number: TR-414

Project Title: Superpave Mix Designs for Low Volume Roads

Agency: Iowa DOT, Scott County, Mahaska County, Mills County, Cerro Gordo County, Dubuque County, Pocahontas County, Cass County, Linn County, and Louisa County

Principal Investigator: Ed Engle and the respective County Engineer

Research Period: July 1, 1997 to December 31, 2003

Research Board Funding: $50,000

Funding Source: 100 percent State – 100 percent Secondary funds

Objective: To determine what modifications to Superpave criteria will provide the benefits of this mix design on low volume roads without significantly increasing paving costs.

Progress: All of the eight final projects are completed. Annual distress and performance surveys commenced in 1999.

Reports: Construction Report, September 2001

Implementation: The Superpave mix design process shows excellent promise for improving paved road service life. If we can show this is applicable on low volume roads at little or no extra costs, it will naturally be an attractive alternative for counties statewide. This is especially true as state ACC projects are shifted to 100% Superpave.

Project Number: TR-416

Project Title: Development of Materials Training Course for Technicians

Agency: Iowa State University

Principal Investigator: Brian Coree

Research Period: January 1, 1998 to November 30, 2002

Research Board Funding: $11,674

Funding Source: 100 percent State – 70 percent Primary funds, 20 percent Secondary funds and 10 percent Street funds

Objective: The objectives of the proposed research are: 1) develop a "Highway Materials Training Course for Technicians," comprised of a series of stand-alone modules of one and two-day classes covering the major material types relevant to highway works; 2) to develop both the instructor and participant packages; 3) to undertake pilot classroom instruction and to refine the developed instructional materials based upon participant feedback.

Progress: The materials are complete and shall be presented to the IHRB for approval in the Fall 2002.

Reports: None

Implementation: It is anticipated that technicians will benefit from exposure to a more general materials background, and perhaps feel empowered with a degree of ownership with a greater understanding of the importance and relevance of the tests that they routinely perform in the course of their work, and to avoid testing and evaluation errors due to lack of experience. It is anticipated that this program be offered annually by the DOT and that newly hired technicians will be expected to participate.

Project Number: TR-419

Project Title: Education on Urban Corridor Issues Through Computer Animation

Agency: Snyder and Associates

Principal Investigator: Gary Gamer

Research Period: May 21, 1998 to September 30, 2002

Research Board Funding: $30,000

Funding Source: 100 percent State – 45 percent Primary funds, 5 percent Secondary funds and 50 percent Street funds

Objective: The objective of this research is to develop a method of using a combination of photo-imaging and computer animation at much less expense to provide a visual aid to gain public acceptance of an urban safety upgrade project.

Progress: The roadway construction is complete. Filming of the final project will be done during the Fall of 2002. The final report will be presented to the IHRB in early 2003.

Reports: Interim Report, October 1998

Implementation: Implementation of this research will be through an evaluation of how photo-imaging and computer animation can be used in combination to cost-effectively give the average citizen an understanding of how a constructed design will compare to the current conditions. A before and after comparison of a corridor will also show how well the post-construction appearance can be represented by integration of imaging and animation into a video prior to actual construction.

Project Number: TR-420

Project Title: Field Evaluation of Alternative Load Transfer Device Locations in Low Traffic Volume Pavements

Agency: Iowa State University

Principal Investigator: James K. Cable and Curtis Greenfield

Research Period: July 30, 1998 to December 31, 2003

Research Board Funding: $98,478

Funding Source: 100 percent State – 80 percent Secondary funds and 20 percent Street funds

Objective: The objective of this research is to evaluate the placement of load transfer dowels in PCC pavements on low volume roads. The intention is to find strategic dowel placements that would decrease the number of dowels needed and make placement easier.

Progress: Paving was completed in Union County during the summer of 1998. Evaluations, including traffic counts and pavement performance indicators, have been performed for the two paving projects. The project monitoring has continued and is entering the last year. There are differences in the performance, but not enough to make solid recommendations on future construction at this time. The project has resulted in one thesis in 2002 and should remain on schedule at this time.

Reports: None

Implementation: If an optimized dowel placement regimen can be demonstrated, counties will be able to save significantly on paving projects - both from the cost of dowels and reduced labor in placement.

Project Number: TR-422

Project Title: Pretreatment for Reduction of Asphalt Absorption in Porous Aggregate

Agency: Louisa County

Principal Investigator: Ed Engle, John Hinrichsen and Robert Simmering

Research Period: August 1998 to December 2003

Research Board Funding: $14,000

Funding Source: 100 percent State – 40 percent Primary funds, 40 percent Secondary funds and 20 percent Street funds

Objective: The purpose of this research is to evaluate the effectiveness of an acrylic antistripping agent when used as an asphalt absorption inhibitor in asphalt cement concrete (ACC) paving.

Progress: The paving project was completed in the summer of 1998. Evaluations of the pavement are being performed in conjunction with another research project (HR-414) on an annual basis. The additive does not appear to have provided significant reduction in asphalt absorption into the aggregate. A final report is in preparation.

Reports: None

Implementation: Many of the aggregates in Iowa are highly absorptive. This results in ACC requiring high AC contents. If this additive can reduce the amount of AC absorption and hence the overall AC content in the ACC, then considerable cost savings to the county would be realized.

Project Number: TR-424

Project Title: Steel Diaphragms in Prestressed Concrete Girder Bridges

Agency: Iowa State University

Principal Investigator: Robert Abendroth and Fouad S. Fanous

Research Period: January 1, 1999 to February 28, 2003

Research Board Funding: $178,358

Funding Source: 100 Percent State – 65 percent Primary funds, 25 percent Secondary funds, and 10 percent Street funds

Objective: The objectives of the research are:

1. Evaluate the state-of-the-art regarding the role of intermediate diaphragms in distributing lateral loads throughout PC girder bridge structures.
2. Investigate the static and dynamic-load response characteristics of different types and configurations of intermediate diaphragms in PC girder bridges.
3. Establish an economical and efficient intermediate structural steel diaphragm that can be used as an alternate for the intermediate RC diaphragm in Iowa PC girder bridges.

Progress: Five members have been selected for the Project Advisory Committee. After an extended, difficult search, a graduate student has been assigned to work on this project. A survey was prepared and distributed to state bridge engineers. Work on a mathematical model for bridge analysis is progressing. Due mainly to the delay in obtaining the research assistant (graduate student), the project required a no-cost time extension. The final report is being prepared.

Reports: Quarterly Report, April 2002

Implementation: The research results will provide bridge design engineers with a better understanding of the behavior of intermediate diaphragms in PC girder bridges that are subjected to lateral load impacts from over-height vehicles. The proposed research will establish whether an intermediate structural steel diaphragm that has a simplified attachment assembly to a PC girder will essentially provide the same degree of PC girder damage protection than that which is currently being provided by the intermediate RC diaphragms used by the Iowa DOT. If economical and sufficiently stiff intermediate steel diaphragms can be used to replace the conventional intermediate RC diaphragms, bridge construction time and costs should be reduced.

Project Number: TR-427

Project Title: Evaluation of High-Slump Concrete for Bridge Deck Overlays

Agency: Buchanan County

Principal Investigator: Brian Keierleber

Research Period: December 21, 1998 to December 31, 2004

Research Board Funding: $26,200

Funding Source: 100 percent State – 40 percent Primary funds, 30 percent Secondary funds and 30 percent Street funds

Objective: The objective of this research is to evaluate the feasibility of using high-slump concrete for bridge deck overlays and to develop effective mix designs and placement techniques for that concrete.

Progress: Construction of two bridge deck overlays was completed in Fall 2000. Annual evaluations will be performed. A final report will be prepared by December 2004.

Reports: Construction Report, September 2001

Implementation: Current overlay technology uses a very dense concrete, which must be produced on-site and transported and placed with specialized equipment. With higher slump, the concrete could be delivered from local ready mix suppliers and placed in large quantities with standard equipment. Both operations would result in considerable cost savings to the county.

Project Number: TR-428

Project Title: Effective Structural Concrete Repair

Agency: Iowa State University

Principal Investigator: F. Wayne Klaiber and Terry J. Wipf

Research Period: February 1, 1999 to December 31, 2008

Research Board Funding: $294,760

Funding Source: 100 percent State – 45 percent Primary funds, 45 percent Secondary funds, and 10 percent Street funds

Objective: The overall objective will be to develop innovative repair methods/materials that result in cost effective repair of structural concrete elements.

Progress: Work has continued in the area of repairing damaged prestressed concrete (P/C) girders from overheight vehicles with fiber reinforced polymers (FRP). Two bridges (one on IA 65 in Altoona and the other on IA 34 over I 35 near Osceola) were tested prior to strengthening and the I 65 bridge was re-tested after the FRP was installed. A third P/C bridge has been tested in the damaged state. A design procedure and a field implementation manual have been developed for use by designers and maintenance personnel.

To determine other concrete repair problems, a meeting was held with several members of the Iowa DOT Office of Bridges and Structures. It was decided to evaluate (both in the laboratory and field) the effectiveness of wrapping columns with FRP to prevent chloride penetration. Five different sites were selected. Each will be wrapped with FRP from the five different manufacturers so that the effectiveness of different products can be determined. To date, two columns have been wrapped with FRP and a protective topcoat, specified by the manufacturer, was installed.

The laboratory portion of this investigation is also in progress. Slabs have been fabricated in the ISU Structures Laboratory. The five products used in the field will also be installed on laboratory test slabs. After installing the FRP, the slabs will be "flooded" with salt water to determine the permeability of the various FRPs under severe conditions. Concrete samples from the field installation and laboratory slabs will be collected and evaluated periodically for a minimum of 5 years.

Reports: Progress Report, June 2002

Implementation: Results from this investigation will provide technical information that engineers in the bridge field can use to lengthen the useful life of structural concrete bridges.

Project Number: TR-429

Project Title: Evaluation of Appropriate Maintenance Repair and Rehabilitation (MR&R) Methods for Iowa Bridges

Agency: Iowa State University

Principal Investigator: Terry J. Wipf, Fouad S. Fanous and F. Wayne Klaiber

Research Period: February 1, 1999 to December 31, 2002

Research Board Funding: $195,060

Funding Source: 100 percent State – 45 percent Primary funds, 45 percent Secondary funds and 10 percent Street funds

Objective: The primary objective of the proposed research is to compile current information on MR&R techniques and implementation guidelines. The proposed research will provide guidance for designers as well as field personnel.

Progress: A summary of the literature search results (including results from the Iowa County survey) related to MR&R procedures has been prepared. This information will be a part of the draft final report that is currently in preparation. The MR&R procedures determined to be most useful for addressing the county bridge needs have been compiled. This information is being prepared into a format that will constitute a design manual. In addition, design procedures associated with some of the MR&R procedures have been developed for incorporation into the design manual. A time extension of the project was obtained. Work is proceeding on the development of the design manual and the final report will be completed by 4th quarter 2002.

Reports: Progress Report, August 2001

Implementation: The result of this research project will provide MR&R procedures that are systematic and will serve as guidelines to engineers and field personnel.

Project Number: TR-430

Project Title: Regional Approach to Landslide Interpretation and Repair

Agency: Iowa State University

Principal Investigator: Robert Lohnes and Bruce Kjartanson

Research Period: February 1, 1999 to March 31, 2001

Research Board Funding: $179,801

Funding Source: 100 percent State – 35 percent Primary funds and 65 percent Secondary funds

Objective: The objective of the proposed research is to provide Iowa county engineers and highway maintenance personnel with procedures that will allow them to efficiently and effectively interpret and repair or avoid landslides.

The proposed research will provide methods to distinguish areas of potential slope instability, identify incipient failure conditions and recognize the cause or causes of a landslide at a particular location. Based upon those interpretations, the most appropriate methods to restore stability to the site will be apparent.

Reports: Final Report

Implementation: Iowa county engineers and highway maintenance personnel for both the counties and the Iowa DOT will use the products of this research. The products are:

- Landslide susceptibility map. This will provide a guide for preliminary evaluation of landslide potential.
- Report on landslide assessment. This report (or manual) will provide a procedure for assessing the landslide potential of a given site and in situations where landslides have occurred, provide a method to determine the cause or causes of the slide. Recommendations for repairs will be included.
- Workshops on how to use report and map. These workshops will provide "hands-on experience" on how the information included in the other two products can be utilized.

Project Number: TR-431

Project Title: Reduction of Concrete Deterioration by Ettringite Using Crystal Growth Inhibition Techniques

Agency: Iowa State University

Principal Investigator: Robert Cody

Research Period: February 1, 1999 to February 28, 2001

Research Board Funding: $139,236

Funding Source: 100 percent State – 90 percent Primary funds and 10 percent Secondary funds

Objective: The objective of the proposed research is to experimentally determine whether commercial crystallization inhibitor chemicals will prevent or reduce ettringite formation in highway concrete, with the ultimate goal of reducing premature deterioration of highways. The proposed research has the potential to significantly reduce expensive highway repairs that are required because of premature concrete deterioration.

Reports: Final Report, February 2001

Implementation: If experiments prove successful, then applications of crystallization inhibitor solutions mixed with deicing brines, or powered inhibitor chemicals added to rock salt or CMA, might prove to be a highly cost-effective method of reducing secondary mineral damage to existing highways. After application of inhibitor-enhanced brines or solid deicers, solutions containing inhibitor molecules will infiltrate downward into the highly porous and permeable concrete slabs. Concrete slab pore fluids containing the inhibitors potentially will be modified so that ettringite precipitation will be reduced or prevented.

Mixing solid or liquid inhibitor chemicals deicers/anti-icers will require no modifications to existing equipment. Commercial inhibitors are effective in small concentrations (ppm) and the chemicals are not expensive. For example, Dequest 2060, a widely used boiler scale inhibitor costs $1.20/lb in large quantities. Costs of implementing such a program should be low compared to the costs of repairs to highways damaged by secondary mineral growth.

Project Number: TR-432

Project Title: Ultrathin PCC Overlay Extended Evaluation

Agency: Iowa State University

Principal Investigator: James K. Cable

Research Period: July 1, 1999 to December 31, 2004

Research Board Funding: $183,903

Funding Source: 100 percent State – 50 percent Primary funds, 45 percent Secondary funds and 5 percent Street funds

Objective: Evaluation of the following: 1.) conventional methods of slab removal and surface preparation for removal and replacement areas, 2.) the condition of the asphaltic concrete surface under removal and replacement areas, 3.) the cost/benefit of polypropylene fiber addition to the concrete, 4.) the performance of the rehabilitated sections, and 5.) the validation of the design methods of PCA and ACPA.

Progress: Monitoring of the site continues. Spot overlays of 2" without fiber sections were done in August of 2001.

Reports: Interim Report, July 2002

Implementation: The results of this study will be used to develop and validate design procedures for whitetopping and ultrathin whitetopping for the PCA and ACPA

Project Number: TR-433

Project Title: HWYNEEDS - Methodology, Analysis and Evaluation

Agency: Iowa State University

Principal Investigator: Tom Maze and Omar Smadi

Research Period: May 1, 1999 to April 30, 2001

Research Board Funding: $89,265

Funding Source: 100 percent State – 20 percent Primary funds and 80 percent Secondary funds

Objective: This project covers the HWYNEEDS computer program and its use in the Quadrennial Needs Study. The HWYNEEDS program methodology will be analyzed and evaluated to investigate its appropriateness for use in the Quadrennial Needs Study.

Reports: Final Report, March 2001

Implementation: This HWYNEEDS - Methodology, Analysis and Evaluation will be evaluated against the counties needs and conditions.

Project Number: TR-434

Project Title: Use of Abrasives in Winter Maintenance

Agency: The University of Iowa

Principal Investigator: Wilfrid A. Nixon

Research Period: May 1, 1999 to July 31, 2000

Research Board Funding: $30,420

Funding Source: 100 percent State – 10 percent Primary funds, 80 percent Secondary funds and 10 percent Street funds

Objective: The objective of this project is twofold. First, by surveying the literature and the current practice to develop reference guidelines for best practice in abrasive application as a part of winter maintenance activities in Iowa. Second, the project will develop an outline of an experimental program to improve understanding of how abrasives work, and thus improve the guidelines for best practice based on the results of those experiments.

Reports: Final Report, December 2000

Implementation: This research will develop a comprehensive set of recommendations for abrasive use by state, county and city agencies.

Project Number: TR-435

Project Title: Thin Maintenance Surfaces - Phase II and Guidelines for Winter Maintenance on Thin Maintenance Surfaces

Agency: Iowa State University and The University of Iowa

Principal Investigator: Charles Jahren and Wilfrid A. Nixon

Research Period: July 1, 1999 to June 30, 2002

Research Board Funding: $117,030

Funding Source: 100 percent State – 55 percent Primary funds and 45 percent Secondary funds

Objective: There are five principal objectives for this research.

1. Continue monitoring of the performance of previously placed test sections;
2. Investigate possible improvements in the use of seal coat aggregates;
3. Select a seal coat design process to recommend for use by the State of Iowa;
4. Develop a micro-surfacing mix using local limestone; and
5. Develop guidelines for winter maintenance on thin maintenance surfaces.

Progress: The research work for the project is completed. The winter maintenance portion of the research is also complete. The final report for this project will be presented to the Research Board this fall.

Reports: None

Implementation: The results from this research should provide engineers and transportation decision makers with guidelines for the selection of materials, techniques and maintenance practices for thin maintenance surfaces.

Project Number: TR-436

Project Title: Retrofit Methods for Distortion Cracking Problems in Plate Girder Bridges

Agency: Iowa State University

Principal Investigator: Terry J. Wipf

Research Period: July 1, 1999 to August 31, 2002

Research Board Funding: $158,028

Funding Source: 100 percent State – 75 percent Primary funds, 20 percent Secondary funds and 5 percent Street funds

Objective: The objectives of this proposal are to: 1) verify the effects of the bolt loosening on one of the first retrofitted bridges, including long-term continuous monitoring of a retrofitted bridge, 2) investigate the retrofit method's applicability for bridges with I-beam diaphragms, and 3) study the cause and possible remedies for the failure of the retrofitted bolted connection in the two-beam bridges.

Progress: The identification and inspection of bridges to be field tested was completed. Six field load bridge tests have been done. Evaluation of data is in progress. Some problems with the data acquisition system occurred. This problem caused a significant delay in progress and required a time extension to the contract. A new data acquisition system was purchased. Field data from continuous monitoring has been reduced. A PowerPoint presentation of the progress of bridge tests was presented to the committee and a draft on 2 bridge tests has been written. The final report is being prepared.

Reports: Quarterly, July 2002

Implementation: The results of the proposed research study should provide guidance in maintaining steel girder bridges to the Office of Bridge Maintenance and Inspection of the Iowa DOT.

Specifically, the effectiveness of potential retrofit methods to be used by the Iowa DOT will be determined.

Project Number: TR-437

Project Title: Performance of Strip Seals in Iowa Bridges, Pilot Study

Agency: Iowa State University

Principal Investigator: Lowell Greimann and James Bolluyt

Research Period: August 16, 1999 to December 31, 2000

Research Board Funding: $43,334

Funding Source: 100 percent State – 60 percent Primary funds, 20 percent Secondary funds and 20 percent Street funds

Objective: The objectives of this research are to determine the causes of failures of strip seals in Iowa bridges and to identify possible solutions.

Reports: Final Report, April 2001

Implementation: Once the primary causes of the strip seal failures are identified, the solution to failure prevention would be apparent. If the solution is not apparent, further laboratory testing and field evaluation of seals may be appropriate.

Project Number: TR-438

Project Title: An Integral Abutment Bridge With Precast Concrete Piles

Agency: Iowa State University

Principal Investigator: Robert Abendroth

Research Period: July 1, 1999 to December 31, 2002

Research Board Funding: $142,903

Funding Source: 100 percent State – 60 percent Primary funds, 35 percent Secondary funds and 5 percent Street funds

Objective: The research objectives are:

1. Determine the state departments of transportation that permit the use of PCC piles in integral-abutment bridges. For those states that use PCC piles in this type of a bridge, summarize the PCC pile design practices and investigate the abutment to pile connection details.
2. Evaluate the performance of selected PCC piles in the bridge on County Route E43 over Otter Creek in Otter Creek Township of Tama County. This bridge will be referred to as the Tama County Bridge.
3. Establish the longitudinal displacement verses temperature behavior for the abutments of the Tama County bridge.

Progress: The final field-measured data was obtained for the Tama County bridge. To date, a total of 16 months of data on concrete and air temperatures, bridge displacements, pile strains, and abutment rotations have been recorded.

Reports: Quarterly reports are prepared in January, April, July and October of each year.

Implementation: The results obtained from this research will provide bridge design engineers for the Iowa DOT with a better understanding of the behavior of the PCC abutment piles in the Tama County integral-abutment bridge. Engineers with the Bridge Design Section of the Iowa Department of Transportation have expressed concerns regarding the ductility of PCC piles in an integral-abutment bridge, since PCC piles exhibit non-ductile behavior. The experimental measurements of the lateral-displacement of the abutment pile caps, periodic visual inspections of the top portion of selected PCC abutment piles, and recorded longitudinal strains for these selected PCC piles in the Tama County Bridge will provide bridge design engineers with information regarding the performance characteristics of these PCC piles.

Project Number: TR-440

Project Title: Field and Laboratory Evaluation of Precast Concrete Bridges

Agency: Iowa State University

Principal Investigator: F. Wayne Klaiber, Terry J. Wipf and Mark Nahra

Research Period: November 1, 1999 to October 31, 2001

Research Board Funding: $137,580

Funding Source: 100 percent State – 85 percent Secondary funds and 15 percent Street funds

Objective: The primary objective of this research is to determine the strength of deteriorated precast concrete deck bridges (PCDBs). This will be accomplished through the field and laboratory testing of this type of bridge and the individual precast units.

Reports: Final Report, December 2001

Implementation: Results from this research make it possible to more accurately rate similar PCDBs. This information will be valuable for county engineers with such bridges and consultants who work with the various counties.

Project Number: TR-443

Project Title: Evaluation of Rammed Aggregate Piers for Highway Application in Iowa Soils

Agency: Iowa State University

Principal Investigator: John Pitt and David J. White

Research Period: January 1, 2000 to October 31, 2002

Research Board Funding: $148,938

Funding Source: 100 percent State – 50 percent Primary funds, 45 percent Secondary funds and 5 percent Street funds

Objective: The primary objective of this project is to evaluate a new method for soil reinforcement called Geopiers with Iowa soils, with particular emphasis on two problem areas.

1. Reinforcement of soft soils prior to construction of highway embankments in order to minimize settlement.
2. Reinforcement of embankment or cut toe slopes in order to prevent slope failures.

Progress:

- Projects have been selected for full-scale installations in an embankment foundation where the natural soils are soft and unstable and a poorly compacted bridge approach fill.
- Site evaluation prior to installation to determine in site engineering properties of soil with Pressuremeter, Dilatometer and Ko-Stepped Blade has been done.
- The design and construction of Geopiers test sections have been completed and documented.
- Monitoring of the performance of reinforced test sections is underway.

Reports: Quarterly Report, January 2001

Implementation: Results of the evaluation will be prepared in a summary report and made available to state, county and city agencies, which will provide a practical option to improve soft soils, reduce bridge approach settlement, and reinforce slopes and retaining structures.

Project Number: TR-444

Project Title: Demonstration Project Using Railroad Flat Cars for Low Volume Road Bridges

Agency: Iowa State University

Principal Investigator: F. Wayne Klaiber

Research Period: June 25, 2000 to November 30, 2002

Research Board Funding: $187,620

Funding Source: 100 percent State – 100 percent Secondary funds

Objective: The objective of this research is to design and construct two bridges using railroad flat cars (RRFC). The bridges will be instrumented and field load tested at the end of construction, and inspected and load tested periodically thereafter.

Progress: The Winnebago County (WC) bridge was field load tested twice last summer (2001). Test 1 was performed before flatcars were longitudinally connected, and Test 2 was performed immediately after construction was finished.

A laboratory connection specimen representing the longitudinal connection in the Buchanan County (BC) bridge was constructed and service tested in torsion and flexure before being later failed in torsion in Spring 2002. Results from the connection tests and analysis verified the strength in flexure and torsion of this connection for use in railroad flat car bridges.

The BC and WC bridges were both field load tested for the final time in July 2002. This testing took place approximately 12 months after the BC bridge was completed and 9 months after the WC bridge was completed. After reviewing the results, it is clear that the response of the two bridges to Iowa legal loads has not changed since they were initially opened to traffic in 2001.

Computer models have been generated to aid the analysis of RRFC bridges. The models accurately predict the behavior of the RRFC bridges to traffic loads and are in good agreement with the field load test results.

It is anticipated that the project final report will be completed early November 2002.

Reports: None

Implementation: The primary value of the research is to provide strength behavior information for these bridges, so that they can be used to replace deficient bridges in a cost effective manner. In addition, design and construction guidelines will be developed to assist engineers with this type of bridge. Construction of these bridges will be documented to assist others in the construction of additional railroad flatcar bridges.

Project Number: TR-445

Project Title: Development of Bridge Load Testing for Load Evaluation

Agency: Iowa State University

Principal Investigator: Terry J. Wipf, F. Wayne Klaiber and Douglas Wood

Research Period: May 22, 2000 to August 31, 2002

Research Board Funding: $176,876

Funding Source: 100 percent State – 65 percent Primary funds, 30 percent Secondary funds and 5 percent Street funds

Objective: The primary objective of this research is to investigate and develop a load testing process for evaluating and rating bridges on the highway system in Iowa. This is an initial step in the process of establishing an objectively tested bridge rating system.

Progress: Task 1 – Survey of other states – 95 percent complete.

Task 2 – Validation of load testing process – 85 percent complete

- Diagnostic load test evaluation of previously tested bridges
- Comparison of load rating methods
- Proof load test

Task 3 – Assessment of the analytical process – 100 percent complete

Task 4 – Load rating of posted bridges – 100 percent complete

The policy and procedure recommendations of load evaluation are half completed and the project final report is being drafted.

Reports: Quarterly Report – July 2002

Implementation: The results from this investigation will provide technical information and recommendations that engineers can use to more accurately evaluate existing bridges. In addition, the information will provide useful guidelines regarding actual bridge behavior that can be beneficial to engineers responsible for bridge design.

Project Number: TR-446

Project Title: Technology Transfer of "As Built Preliminary Surveys" by Total Station GPS, Video Logging and Laser Scanning

Agency: Iowa State University

Principal Investigator: Kandiah Jeyapalan

Research Period: June 1, 2000 to November 30, 2002

Research Board Funding: $214,150

Funding Source: 100 percent State – 65 percent Primary funds, 30 percent Secondary funds and 5 percent Street funds

Objective: The objectives of this project are to develop a user friendly positioning system using video logging and soft photogrammetry for the purpose of constructing "AS Built" surveys of bridges and culverts and to demonstrate the development and use of local geoid in preliminary and photogrammetric control surveys for Iowa engineers and surveyors.

Reports: Draft Final Report, June 2002

Implementation: The research should prove the feasibility of using soft photogrammetry and video logging for constructing "AS Built" surveys more efficiently. It will also provide methods for creating a local geoid for preliminary and control surveys.

Project Number: TR-447

Project Title: A Computer Program for the Hydraulic Design of Culverts

Agency: Digital Control, Inc.

Principal Investigator: LaDon Jones

Research Period: July 1, 2000 to June 30, 2001

Research Board Funding: $68,200

Funding Source: 100 percent State – 50 percent Primary funds, 40 percent Secondary funds and 10 percent Street funds

Objective: A computer program is needed that combines the data, methods and tasks required for Iowa DOT culvert design into a single, integrated, user-friendly, software package. The program should incorporate into one package the information and tools needed to perform the hydraulic culvert design from start to finish. Such a program will be developed for the Iowa DOT Preliminary Bridge Section, under the guidance of Mr. Dave Claman, with input from the primary users of the program, county, city and consulting engineers.

The culvert program will provide a quick and efficient way of calculating a range of various culvert sizes and types based on drainage area. The program will make it easier for Iowa DOT staff to determine the required size of structures along our highways and will facilitate staff review of consultant submittals of Iowa DOT projects. The program will enable the designer to evaluate various culvert sizes and design discharges quickly and efficiently.

Reports: Final Report, June 2001

Implementation: The computer program will be used by the Iowa DOT and Iowa's cities and counties as a quick, efficient tool for properly sizing and designing various culverts for Iowa roadways.

Project Number: TR-449

Project Title: Determination and Evaluation of Alternative Methods for Managing and Controlling Highway Related Dust

Agency: Iowa State University

Principal Investigator: Robert Lohnes

Research Period: March 1, 2001 to June 30, 2002

Research Board Funding: $58,135

Funding Source: 100 percent state – 100 percent Secondary funds

Objective: The objective of the research is to evaluate currently used and potential technology and products for dust control and to identify new alternative methods for controlling dust.

Progress: This project is complete as of June 2002. A final report will be presented to the Board at the September, 2002 meeting.

Reports: None

Implementation: The observations and conclusions from this study will lead to recommendations on the most effective dust control methods and materials. State, county, and city transportation agencies can implement the recommendations for maintenance of unpaved roads.

Project Number: TR-450

Project Title: Identification of Laboratory Techniques to Optimize Superpave HMA Surface Friction Characteristics

Agency: Perdue University

Principal Investigator: Rebecca S. McDaniel

Research Period: June 1, 2001 to January 31, 2004

Research Board Funding: $70,000

Funding Source: 50 percent Institute for Safe, Quiet, and Durable Highways, 25 percent Indiana DOT, and 25 percent State (100 percent Primary funds)

Objective: The main purpose of this research is to evaluate various blends of aggregates to optimize the combination of micro- and macrotexture to achieve a desired level of friction. Aggregate classifications and properties currently used to provide desirable friction levels for high traffic situations will be evaluated and possibly revised based upon this research.

Progress: A thorough literature review has been conducted as planned for Phase I. A number of interviews with people active in friction measurements have also been conducted. Based on this review of the state of the art, tentative recommendations on suitable polishing and testing methods have been developed. An interim report to the study advisory committee is in preparation summarizing the recommendations. When the committee concurs on test methods to use, the research can proceed to the testing phase.

Reports: None

Implementation: These research findings are expected to identify blends of aggregates that can be used in Iowa to maintain the current baseline of friction. It is anticipated that increase macrotexture will diminish the need for high quality friction aggregates to provide increased microtexture. This will lead to more economical surface courses for use in Iowa by reducing the need to import friction aggregates.

Project Number: TR-451

Project Title: Investigation Into Improved Pavement Curing Materials and Techniques – Phases I & II

Agency: Iowa State University

Principal Investigator: Kejin Wang and James K. Cable

Research Period: December 1, 2000 to September 30, 2002

Research Board Funding: $70,718

Funding Source: 100 percent state – 60 percent Primary funds, 30 percent Secondary funds, and 10 percent Street funds

Objective: To identify and evaluate alternate curing materials and techniques to improve moisture retention in newly placed PCCP, and to develop a method for measuring effectiveness of the compound placed on the pavement at construction time.

Progress:
1. Finished seven designed tests for all reference specimens,
2. Finished Case I study as designed (3 types of curing compounds, sprayed at 3 different times, cured at room temperature); Two hours spraying was also tried for selected curing compound,
3. Finished tests of specimens with curing compound (Iowa currently used curing compound) and cured at 100° F (in oven) before and after spraying.

Part 1 of the project has been completed

Reports: Final Report, Part I, April 2002

Implementation: The results of this research can be used to provide an alternative set of materials for curing of pavements to enhance performance.

Project Number: TR-452

Project Title: Alternative Solutions to Meet the Service Needs of Low Volume Bridges in Iowa

Agency: Iowa State University

Principal Investigator: F. Wayne Klaiber

Research Period: March 1, 2001 to September 30, 2002

Research Board Funding: $48,865

Funding Source: 100 percent State – 100 percent Secondary funds

Objective: The object of this phase of the project is to develop a reference document to address common problems in low-volume road (LVR) bridges. This reference document will not only summarize previous IHRB sponsored research, but will also present pertinent information from other sources. Iowa county engineers need to be surveyed to determine problems they are having with LVR bridges. Also, their solutions to some of the bridge problems they have encountered need to be determined and summarized. A review of the collected data will reveal where inadequate information is available and enable the research team to develop a work plan to address areas where there is inadequate information.

Progress: The literature review portion of this project has been completed and appropriate summaries prepared. Summaries of past IHRB projects that are related to this investigation have also been prepared.

Due to a major oversight, the questionnaire prepared to obtain information from Iowa county engineers, Iowa consultants, etc. was never disseminated. This oversight will be corrected in fall 2002. Although NACE was contacted to obtain e-mailed addresses of the members (so that the questionnaire could be disseminated nationally), the Executive Director declined the request. The reason given was that the NACE membership receives too many questionnaires and thus he doesn't want to have another one sent to them.

Reports: None

Implementation: Local agencies in Iowa and elsewhere are beset by a combination of bridge deficiencies and the lack of funding to address the deficiencies. This research will provide a summary of approaches to this problem and evaluations to show which approaches worked best.

A product of the research will be a reference document that county and city engineers can use to help them decide how best to solve their LVR bridge problems.

Project Number: TR-453

Project Title: Low Water Stream Crossings in Iowa

Agency: Iowa State University

Principal Investigator: Robert Lohnes

Research Period: January 1, 2001 to March 31, 2002

Research Board Funding: $62,664

Funding Source: 100 percent State – 10 percent Primary funds, 80 percent Secondary funds and 10 percent Street funds

Objective: This research will identify possible guidelines for use of low water stream crossings, update previously developed design criteria, and recommend traffic control procedures to adequately advise road users of the existence and proper travel over low water crossings. A manual will be developed to offer clear, easily understood guidelines and accepted standards in an abbreviated format.

Progress: This project was complete and a final report accepted by the Board at their March 2002 meeting.

Reports: Final Report, March 2002

Implementation: The Low Water Stream Crossings Design Guide Manual for Iowa can be used by local agencies when considering low cost options for replacing deficient structures on low volume roads. This will be particularly beneficial with very low volume and minimum maintenance roads where structure replacement funding is unavailable and continuous, all-weather access is not necessary.

Project Number: TR-454

Project Title: Durable, Cost Effective Pavement Marking Materials – Phase I

Agency: Iowa State University

Principal Investigator: Gary B. Thomas

Research Period: January 1, 2001 to June 30, 2001

Research Board Funding: $43,640

Funding Source: 100 percent State – 50 percent Primary funds, 25 percent Secondary funds and 25 percent Street funds

Objective: The objective of this research is to evaluate the durability, performance, and placement procedure of pavement marking materials.

Reports: Final Report, June 2001

Implementation: The result of this phase of the project will be used to develop an appropriate method of getting durable and cost effective Pavement Marking Materials.

Project Number: TR-455

Project Title: Handbook of Simplified Practice for Traffic Studies

Agency: Iowa State University

Principal Investigator: Stephen J. Andrle

Research Period: March 1, 2001 to September 30, 2002

Research Board Funding: $37,400

Funding Source: 100 percent State – 20 percent Primary funds, 60 percent Secondary funds and 20 percent Street funds

Objective: There are two primary objectives for this project. The first objective is to develop a manual of traffic studies that is convenient for Iowa jurisdictions to use in assessing traffic issues. The second objective of the project is to develop a series of boilerplate scopes of work that local jurisdictions can use to hire outside consulting firms to perform traffic studies.

Progress: The project advisory committee met. Draft handbook was reviewed and the suggestions are being implemented.

Reports: None

Implementation: One of the main objectives of this project is to make the task of performing traffic studies less cumbersome for local jurisdictions. By providing boilerplate scopes of work, simplified procedures, and a manual that includes only the most commonly used studies, it is anticipated that local jurisdictions can and will be better prepared to perform the needed studies.

Project Number: TR-456

Project Title: Measuring Main-Channel Slopes for Major Rivers in Iowa

Agency: United States Geological Survey

Principal Investigator: David Eash

Research Period: April 18, 2001 to September 30, 2003

Research Board Funding: $107,800

Funding Source: 50 percent Federal and 50 percent State (50 percent Primary funds and 50 percent Secondary funds)

Objective: To measure Main Channel Slope (MCS) using GIS along major rivers in Iowa, plot graphs of those measurements, and compare them to manual measurements to determine if adjustments are necessary.

Progress: Main channels were digitized for approximately 145 major rivers in Iowa that have drainage areas greater than 100 square miles and are located in Hydrology Regions 2 and 3. Stream sites located approximately every 5 miles along each of these river reaches were digitized and main-channel slopes (10-85 percent slopes) were calculated for each of these stream sites using the Basinsoft program.

Best-fit curves have been developed for approximately 120 of the 145 graphs that will be included in the report. Earlier this summer graphs and tables were sent to Dave Claman, Iowa DOT Office of Bridges and Structures, for review. First draft of the report will be completed by about January 2003.

Reports: Progress Report, September 2002

Implementation: The results of this project will enable engineers, managers, and planners to estimate flood-frequency discharges with greater efficiency and predictive accuracy.

Project Number: TR-457

Project Title: Development of a Manual Crack Quantification and an Automated Crack Measurement System

Agency: The University of Iowa

Principal Investigator: Hosin "David" Lee

Research Period: April 1, 2001 to April 30, 2003

Research Board Funding: $73,997

Funding Source: 100 percent State – 60 percent Primary funds and 40 percent Secondary funds

Objective: To develop two software packages: one to verify the outputs of Roadware Inc. against Iowa DOT procedures; and the second to automatically process pavement crack data objectively and consistently.

Progress: A draft final report was submitted in May 2002. During the course of the review, it became apparent that the images provided for analysis did not correspond to the pavement management system output. The images are currently being assigned to the proper pavement manage sections for analysis. The revised analysis will require 6-12 months additional time.

Reports: Draft Final, May 2002

Implementation: The software packages will offer improved accuracy and consistency over the current labor-intensive manual system at a lower cost. This system will be implemented in Iowa DOT and selected cities and counties.

Project Number: TR-458

Project Title: Field Testing of Abrasive Delivery Systems in Winter Maintenance

Agency: The University of Iowa

Principal Investigator: Wilfrid A. Nixon

Research Period: May 1, 2001 to April 30, 2003

Research Board Funding: $151,920

Funding Source: 100 percent State – 30 percent Primary funds, 60 percent Secondary funds, and 10 percent Street funds

Objective: The objective of this project is to conduct a series of experiments aimed at improving the ability of abrasives to increase friction on snow and ice covered roads. Two novel delivery methods will be tested and compared with existing delivery methods, using a friction measuring device. It is expected that friction increases due to abrasives will diminish more slowly with the two delivery methods than with existing delivery methods.

Progress: The aim of this research is to develop the best method of placing abrasives on a road so that they remain in place and give a friction enhancement for as long as possible. The location for the field test has been determined and a DOT truck has been provided for the project and equipped with suitable delivery devices. Winter of 2001-2002 was too mild to provide any useful data. A one-year no cost extension will be requested to allow two years of data to be collected.

Reports: None

Implementation: Maintaining roads in winter, in Iowa is difficult. The safely of the driving public is paramount. If one of these novel abrasive delivery methods proves more effective than conventional methods and is cost effective, then winter maintenance will be more easily performed and the driving public will be safer.

Project Number: TR-459

Project Title: Reuse of Lime Sludge From Water Softening

Agency: Iowa State University

Principal Investigator: J(Hans) van Leeuwen

Research Period: August 15, 2001 to August 31, 2002

Research Board Funding: $27,433

Funding Source: 52 percent Outside Sources and 48 percent State (25 percent Primary funds and 75 percent Street funds)

Objective: The objectives are as follows:

1. Lime sludge in mixture with fly ash, soils and aggregate is to be tested for its suitability to prepare subbase for road construction.
2. Evaluate the use of lime sludge for fill and embankments as an admixture with other fill materials and fly ash.
3. Calcium Carbonate is one of the feedstocks in cement manufacture and much larger quantities of this are required than produced in water treatment. The objective here is to determine if the sludge can be trucked economically to Mason City of Buffalo, Iowa to be used in cement production.
4. Many power plants are already using calcium carbonate for sulfur dioxide removal. The present source of CaCo3 is limestone. Here the objective is to find means of preparing lime sludge to replace some of the limestone in powerplants.
5. Some waste water treatment plants need to add calcium hydroxide, to compensate for reductions in alkalinity due to nitrification in the plant or due to the use of chemicals for phosphate removal. The objective of the research would be to find ways to substitute lime sludge for these purposes.

Progress: So far, there have been five aspects that have been investigated to some deeper extent for this project.

1. Can make excellent fill material for bridge approaches and embankments from lime sludge, fly ash and bottom ash, low density and high strength.
2. It is possible to use lime sludge in cement production.
3. Lime sludge holds promise in power plants for SO2 capture.
4. Did not work for dust control. It should be studied in greater detail.
5. Did not improve soil strength in higher dosages. Effect of lime sludge on soil with cement and/or fly ash at low dosages should be studied further.

Reports: Interim Progress Report, August 2002

Implementation: The potential value of the lime sludge in Iowa is around 1 million dollars, against present disposal costs of also around 1 million dollars, so this could mean some value adding and business opportunities. Iowa is not the only state with this problem and the technologies developed can be used more widely.

Project Number: TR-460

Project Title: Living Snow Fences

Agency: The University of Iowa

Principal Investigator: Wilfrid A. Nixon

Research Period: September 1, 2001 to April 30, 2004

Research Board Funding: $89,971.00

Funding Source: 100 percent State – 50 percent Primary funds and 50 percent Secondary funds

Objective: The project has a number of objectives. First is to determine the optimal configuration of corn rows and switch grass to "catch" drifting snow. Other living snow fences may also be studied during this part of the study, and direct comparison with artificial (i.e. wooden or plastic) snow fences will be made.

The second objective, is to create a living snow fence design guide which parallels the snow fence guide developed under SHRP. This will indicate how to configure living snow fences for given levels of snow fall and wind fetch.

A third objective is to develop suitable marketing stools to "sell" living snow fences as a desirable option to landowners. This will include attempting to develop an appropriate cost tool to be used in providing compensation to landowners.

Progress: Work during the first winter of the project (2001-02 winter) made a comparative study of different snow fence types along a stretch of highway north of Tipton, Iowa. Six different fence configurations were used, three being standing corn rows, and three being lath fences. Given the relatively low snowfall of the winter, all six fences performed well, but it was noticeable that the corn rows stored snow between the rows of corn, rather than downwind of all the rows. Should this hold true in winters with heavier snowfall, it would be an extremely useful finding. To test this hypothesis, another set of corn row configurations will be tested in a nearby location this winter (2002-03). However, in this case, the corn rows will be at the edge of the field. If these configurations still store snow effectively without causing drifting across the road, it will be much easier to convince farmers to participate in the standing corn fence program, because leaving corn standing at the edge of the field is much easier than leaving rows in the center of a field.

Reports: None

Implementation: The results of this study will be presented at an appropriate meeting in Iowa, after completion of the project. The report and the design guide would also be made available via e-mail to all subscribers to the snow and ice mailing list, and would be placed on the SICOP web site.

Project Number: TR-461

Project Title: Soil Stabilization of Non-Uniform Subgrade Soils

Agency: Iowa State University - CTRE

Principal Investigator: David J. White

Research Period: July 1, 2001 to June 30, 2003

Research Board Funding: $70,000

Funding Source: 61 percent Outside Sources and 39 percent State (60 percent Primary funds, 35 percent Secondary funds and 5 percent Street funds)

Objective: To determine what types of ash are available, which type works best for site conditions and soil types, what is the proper mix design and construction process, and what are the benefits.

Progress:

1. Extensive laboratory analysis is ongoing to measure engineering properties of fly ash/soil mixtures (i.e. unconfined compressive strength, CBR, stiffness, durability, etc.)

2. Ten fly ashes were collected from around the state and tested for initial and final set times and mixed with soil to measure the influence of compaction delay on strength and density.

3. Field DCP and GeoGauge tests were performed to measure strength and uniformity at three projects, i.e. cold-in-place recycled asphalt mixed with soil and fly ash at ISU, reclaimed hydrated fly ash as base material in Eddyville, and pavement removal in Jasper Co. at Hwy 330.

4. Specifications were developed for use of reclaimed conditioned fly ash (CFA) and reclaimed hydrated fly ash (HRA) as a subgrade material.

Reports: Quarterly Report, July 2002

Implementation: The results of this research will allow highway agencies and contractors statewide to provide a more uniform subgrade for highways

Project Number: TR-462

Project Title: Manual for Roadside Control of Trees and Brush

Agency: University of Northern Iowa

Principal Investigator: Kirk Henderson

Research Period: September 1, 2001 to October 31, 2002

Research Board Funding: $61,560

Funding Source: 100 percent State - 30 percent Primary funds, 50 percent Secondary funds and 20 percent Street funds

Objective: To develop a manual that describes best practices for the control and removal or roadside tree and brush debris.

Progress: The final manual for Roadside Control of Trees and Brush is complete and will be presented to the Research Board this fall.

Reports: None

Implementation: Administrators and maintenance crews alike need to be involved in the policy writing process. Several regional training sessions would be necessary to train county supervisors, county engineers, roadside managers, operations managers, weed commissioners and maintenance personnel from each county.

Project Number: TR-463

Project Title: Field Performance Study of Past Iowa Pavement Research: A Look Back

Agency: The University of Iowa

Principal Investigator: Hosin "David" Lee

Research Period: August 24, 2001 to February 28, 2003

Research Board Funding: $99,804

Funding Source: 100 percent State – 40 percent Primary funds, 50 percent Secondary funds and 10 percent Street funds

Objective: The objective of this project is to take a comprehensive look back at selected Iowa Highway Research Board projects to evaluate their performance over a period that is more representative of their expected service life.

Progress: A study group of 15 tentative projects has been selected from the past pavement research projects funded through Iowa Highway Research Board. An extensive review on two project sites was done which involved the fast-track concrete pavement and foamed asphalt base stabilization. To validate the findings from the original studies, current field data was collected, which include visual crack survey, deflection measurement, and cores. The cores were tested for their indirect tensile strengths. The indirect tensile strengths were then compared against the deflection measurements.

Reports: Preliminary, March 2002

Implementation: The results of this study will also provide a better understanding of pavement performance and the factors that influence performance. Validated findings of the past pavement research is being summarized. The new findings will provide a measure of the impact that the pavement research program has made on pavement design, construction and material selection.

Project Number: TR-464

Project Title: Erosion Control for Highway Applications – A Critical Review of Published Literature

Agency: The University of Iowa

Principal Investigator: Marian Muste

Research Period: December 1, 2001 to July 31, 2002

Research Board Funding: $30,000

Funding Source: 100 percent State – 50 percent Primary funds, 40 percent State funds and 10 percent Street funds

Objective: Phase I: Conduct a literature review and compile a synthesis of current practice short- and long-term erosion control methods utilized in highway applications.

Phase II: Expand on research objectives required to considerably improve mitigation methods with emphasis on transitioning from short- to long-term erosion control following construction.

Progress: A comprehensive literature review was done. Particularly useful information was obtained from state DOTs and from Iowa County Engineers. A contemporary, computer-based expert system for use by highway engineers was developed to provide guidance on erosion and sediment control methods.

Reports: Final, Phase I, May 2002

Implementation: The use of the newly developed literature will help in selecting means to minimize the impact of construction and maintenance operations and mitigating sediments and erosion concerns resulting in not only better roads, but a better environment.

Project Number: TR-466

Project Title: Evaluation of Unbonded Ultrathin Whitetopping of BrickStreets

Agency: Iowa State University

Principal Investigator: James K. Cable

Research Period: July 1, 2001 to June 30, 2006

Research Board Funding: $47,049

Funding Source: 100 percent State – 25 percent Primary funds, 10 percent Secondary funds and 65 percent Street funds

Objective: Demonstrate the ability to design and place an unbonded PCC overlay on an existing base of ACC and brick, and evaluate the performance of the 3" PCC overlay to that of the 3" ACC overlay in the short- and long-term.

Progress:
- Construction was done in 2001.
- Monitoring of the site continues.
- Construction report is in progress.

Reports: Quarterly Report, April 2002

Implementation: Information gathered from the 3 reporting periods will be distributed to city administrators and the highway industry through the following:

1. Use of the CTRE newsletters and Portland Cement Concrete Center publications.
2. Presentations at the APWA Iowa Chapter annual meetings.
3. Technology abstracts in the Midwest Concrete Consortium Web Page.
4. Distribution of the project reports by the Iowa Highway Research Board to public entities and consultants.

Project Number: TR-467

Project Title: Investigation of the Modified Beam-in-Slab Bridge System

Agency: Iowa State University

Principal Investigator: F. Wayne Klaiber

Research Period: December 1, 2001 to November 30, 2003

Research Board Funding: $190,890

Funding Source: 100 percent State - 100 percent Secondary funds

Objective: The primary objective of this research is to do additional laboratory work on the alternate shear connector and to assist in designing and constructing two demonstration bridges which will use the modified beam-in-slab (MBIS) system. Both bridges will be instrumented for measurement of strains and deflections at critical locations and load tested after construction is complete. Periodically they will be inspected and re-tested. The bridge design and construction will be documented (photographs, videotape, etc.) for use by other interested counties.

Progress: **Laboratory work:** A total of five laboratory specimens have been constructed; four have been tested to date. Two single bay specimens, 8 ft wide and 2 ft long, were constructed to test the applicability of two formwork specimens; both formwork systems met the goals of the research team. Two single bay specimens, 8 ft wide and 15 ft long, were constructed to investigate the strength of the MBIS system. The specimens were tested at service levels and at ultimate load to obtain the behavior of the system under simulated wheel loads. The fifth specimen was a three bay, 20 ft wide, 31 ft long bridge constructed in the ISU Structures Laboratory. This model bridge was constructed to investigate the load distribution characteristics and ultimate strength of the MBIS system. Service load testing of this specimen has been completed; the ultimate load test of this specimen will be performed during the fall of 2002.

Demonstration bridges (Tama County): The first demonstration bridge was constructed during the fall of 2001. Theoretical results indicate the bridge can carry Iowa legal loads. The structure is currently in service and will be field load tested in the fall of 2002.

The second demonstration bridge is in the final design phase. Construction of the bridge will be completed in late fall 2002. Construction of the demonstration bridge is being fully documented to assist others with the construction of future MBIS structures. The completed structure will be instrumented and tested once the concrete has cured; it will be re-tested during the summer of 2003.

Reports: None

Implementation: The value of the research is to provide strength and behavior information on the MBIS bridge system which can be used to replace deficient bridges in a cost effective manner. The main advantages of the MBIS bridge system over the Benton County system are that less materials are required, composite action is obtained, and longer spans are possible. In addition, the methodology developed will assist engineers with the design of this type of bridge. Construction of these bridges will be documented to assist others in the construction of additional MBIS bridge systems.

Project Number: TR-468

Project Title: Technology Transfer Program for the Iowa Highway Research Board

Agency: Iowa Department of Transportation

Principal Investigator: Mark Dunn

Research Period: December 1, 2001 to November 30, 2002

Research Board Funding: $10,000

Funding Source: 100 percent State - 40 percent Primary funds, 50 percent Secondary funds, and 10 percent Street funds

Objective: The objective of this project is to provide improved research technology transfer and information distribution to the Iowa Highway Research Board and to transportation professionals in Iowa. Through electronic distribution of information, a wider audience can be obtained with reduced publication and distribution cost.

This project will also provide resources to cover facility costs for small workshops related to IHRB research when it would be beneficial to transfer technology.

Progress: Shortly after the start of this project, the Iowa DOT purchased equipment to mass produce CDs quickly. CD duplication and reproduction costs expected to be paid through this project were paid through the DOT Reproduction Office's budget. No outside services were required.

Two literature searches were performed by CTRE at Iowa State University in support of the IHRB's prioritization process. This project also covered meeting costs for the IHRB's meeting at field sites in Buchanan County.

Reports: None

Project Number: TR-469

Project Title: Reduction of Concrete Deterioration by Ettringite Using Crystal Growth Inhibition Techniques - Part II- Field Evaluation of Inhibitor Effectiveness

Agency: Iowa State University

Principal Investigator: Paul G. Spry

Research Period: March 1, 2002 to February 29, 2004

Research Board Funding: $139,832

Funding Source: 100 percent State - 80 percent Primary funds, 10 percent Secondary funds, and 10 percent Street funds

Objective: The purposed research project objective is to determine whether periodic application of inhibitor chemicals to highway concrete under field conditions will prevent or reduce ettringite formation.

Progress: The contract for this research was executed in March 2002.

Reports: None

Implementation: The result from this research will probably prove to be a highly cost-effective method of reducing secondary mineral damage to existing highways. This will provide a specific guideline for application method of inhibitor chemicals to highways, including details of inhibitor concentration and rate of application.

Project Number: TR-470

Project Title: Development of a Method to Determine Pavement Damage Due to Detours and Haul Roads

Agency: Iowa State University

Principal Investigator: Omar Smadi

Research Period: April 1, 2002 to March 31, 2003

Research Board Funding: $59,272

Funding Source: 100 percent State - 50 percent Primary funds, 45 percent Secondary funds and 5 percent Street funds

Objective: The object of this project is to develop an objective method for determining pavement damage on secondary highways and municipal streets resulting from additional traffic loading on detours and haul roads used temporarily by the Iowa DOT.

Progress: 1. A literature review of the current process of detour and haul roads at the Iowa DOT has been completed. Several contracts with DOT, City, and County staff have been made. The results are summarized and will be included in the final report. Also, examples of recent detour and haul roads compensation agreements were requested and individuals from the DOT district offices and local agencies were contacted.

2. A survey of the surrounding state practices in terms of detour and haul roads have been completed. A phone survey was conducted with staff from the following states:
   - Minnesota
   - Nebraska
   - South Dakota
   - Kansas
   - Missouri
   - Illinois
   - Wisconsin

Reports: None

Implementation: At the end of the project, a set of guidelines and procedures for a new process of developing detour and haul roads compensation will be presented. If approved, the Iowa DOT, cities, and counties involved in such activities, will us the newly developed methodology to determine their compensation.

Project Number: TR-471

Project Title: Evaluation of Using Non-Corrosive Deicing Materials and Corrosion Reducing Treatments for Deicing Salts

Agency: The University of Iowa

Principal Investigator: Wilfrid A. Nixon

Research Period: May 1, 2002 to April 30, 2004

Research Board Funding: $100,000

Funding Source: 100 percent State - 60 percent Primary funds, 35 percent Secondary funds, and 5 percent Street funds

Objective: To develop a series of tests that will allow the evaluation of existing and future deicing chemicals respective to their effectiveness at removing snow and ice, and their impact on the highway infrastructure and surrounding environment.

Progress: The progress has been made in determining tests to perform on concrete and related materials and also on identifying specific tests to conduct on ice melting and penetration capabilities.

Reports: Annual Report

Implementation: The results from this study will be presented at an appropriate meeting in Iowa, after completion of the project. The report would also be made available via e-mail to subscribers to the snow and ice mailing list.

Project Number: TR-472

Project Title: Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipement

Agency: The University of Iowa

Principal Investigator: Wilfrid A. Nixon

Research Period: May 1, 2002 to October 31, 2003

Research Board Funding: $80,000

Funding Source: 100 percent State - 60 percent Primary funds, 35 percent Secondary funds, and 5 percent Street funds

Objective: The research project attempts to find methods that can effectively and economically reduce corrosion on maintenance vehicles, especially when liquid deicing chemicals are being used.

Progress: The project will examine both products and procedures that have been shown to minimize corrosion, and after testing, will determine which ones operate best. Researcher has gathered significant information and suitable progress is being made.

Reports: Progress Report

Implementation: The result of this study will be presented at an appropriate meeting in Iowa, after completion of the project. The report would also be made available via e-mail to all subscribers to the snow and ice mailing list.

Project Number: TR-473

Project Title: Rehabilitation of Concrete Pavements Utilizing Rubblization and Crack and Seat Methods

Agency: Iowa State University

Principal Investigator: Brian Coree

Research Period: January 1, 2002 to December 31, 2004

Research Board Funding: $178,197

Funding Source: 100 percent State - 65 percent Primary funds and 35 percent Secondary funds

Objective: The objective of this project is to study the effects of PCC rubblization and crack-and-seat operations of the HMA overlay thickness necessary to achieve the desired design life. To design HMA overlay on fractured slabs, it is necessary for the design to specifically avoid, or control, the primary distress, i.e., reflective cracking. This is the function of the slab fracturing process in combination with a sufficient thickness of HMA overlay to control the strains at the bottom of the HMA layer, which are a function of the constitution of the entire pavement structure, more especially the subgrade. In order to achieve this objective, four sub-objectives will need to be addressed: 1) to determine the structural value of PCC slabs fractured by either method, 2) to examine design, construction and performance records of existing overlaid fractured PCC pavements to estimate the effects of subgrade, fractured slab thickness and structural value, and overlay thickness on performance (or life), and 3) to establish a structural and fatigue model and 4) to validate or calibrate the model using in-service pavement performance histories and the instrumented pavements on IA 141. Ultimately, provide a research report and implementable design guidelines to the Iowa DOT.

Progress: The development and testing of the initial computer model has been very successful and a comprehensive model has been developed that addresses a three-layer system (HMA overlay + Rubblized PCC + Subgrade) that is responsive to seasonal environmental impacts (monthly). It is this model that will be "calibrated" using field measurements and PMIS data of selected Iowa HMA overlaid rubblized PCC pavements.

Reports: None

Implementation: Responsibility for implementation rests primarily within the DOT. The PI will assist in any way necessary to this end and will provide implementable design guidelines to the Iowa DOT.

Project Number: TR-474

Project Title: Development of a Mix Design Process for Cold-In-Place Rehabilitation Using Foamed Asphalt

Agency: The University of Iowa

Principal Investigator: Hosin "David" Lee

Research Period: May 1, 2002 to January 31, 2003

Research Board Funding: $99,683

Funding Source: 100 percent State - 60 percent Primary funds, 35 percent Secondary funds, and 5 percent Street funds

Objective: The main objective is to develop a new mix design process for cold-in-place rehabilitation (CIPR) using foamed asphalt. The research will 1) review past research efforts on foamed asphalt, 2) evaluate the current practices of CIPR with emulsion, and 3) determine mix design parameters for CIPR with foamed asphalt, and 4) develop a lab procedure.

Progress: A comprehensive review of past research efforts, has been performed. To establish a baseline, the research efforts were directed towards the evaluation of current practices with foamed asphalt and emulsion for CIPR. A significant effort has been made to examine several design variables to determine what parameters should be part of the design process. The steering committee meeting took place on campus of The University of Iowa with members participating from Iowa DOT, Delaware county, and industry. The foamed asphalt laboratory equipment has been ordered.

Reports: None

Implementation: The implementation outlook for the proposed project is very realistic, given a number of planned construction projects of CIPR pavements using foamed asphalt in Iowa. The results of this study shall provide a better understanding of the CIPR process using foamed asphalt. A new design method for the CIPR using foamed asphalt is expected to come out of the proposed study for implementation. Completion of the research by the winter of 2002/2003 will allow engineers to apply the mix design procedure on pilot projects during the 2003 construction season.

Project Number: TR-475

Project Title: Synthesis of Best Practices for Increasing Protection and Visibility of Highway Maintenance Vehicles

Agency: Iowa State University

Principal Investigator: Ali Kamyab

Research Period: March 1, 2002 to October 31, 2002

Research Board Funding: $25,000

Funding Source: 100 percent State - 40 percent Primary funds, 40 percent Secondary funds, and 20 percent Street funds

Objective: The object of this research project is to examine practices in enhancing visibility of highway maintenance vehicles involved in moving operations such as snow removal and shoulder operations, crack sealing, and pothole patching.

Progress: The final report will be presented to the Iowa Highway Research Board at the September meeting.

Reports: Quarterly Reports.

Implementation: The findings of this research will enable the maintenance staff to assess the applicability and impact of each method to their use and budget.

Project Number: TR-476

Project Title: A Computer Program for Valley Stage-Discharge Curves and Bridge Backwater Calculations

Agency: Digital Control, Inc.

Principal Investigator: LaDon Jones

Research Period: July 1, 2002 to June 30, 2003

Research Board Funding: $69,375

Funding Source: 100 percent State – 40 percent Primary funds, 40 percent Secondary funds and 20 percent Street funds

Objective: This project will produce integrated, user friendly, personal computer software that will estimate stage-discharge curves for valley cross-sections and perform bridge backwater calculations. The software will be written in Visual Basic 6.0 and will be a complete stand alone program that will run on computers using Microsoft Windows 95, 98, NT, 2000 or XP.

Progress: A contract for this research was executed in June 2002.

Reports: None

Implementation: The PC program will be utilized by city and county engineers, the Iowa DOT staff and consultants for the design of culverts and bridges along the State's primary and secondary road system.

Project Number: TR-477

Project Title: Total Cost of Transportation Analysis - Phase II

Agency: Iowa County Engineers Association Service Bureau

Principal Investigator: Steve DeVries

Research Period: July 1, 2002 to April 30, 2003

Research Board Funding: $29,635

Funding Source: 100 percent State – 100 percent Secondary funds

Objective: To use the transportation costs based analysis tools developed in HR-388 to prepare an accurate, current study of Iowa's county road system - using 2002 data. Once up-to-date physical and cost models have been set up, the data will be used to investigate system adequacy, operating cost needs, capital upgrade needs, and costs versus revenues. The analysis will be done on three levels: system wide, single county, and specific road segment. Results of the project will be reported to the Iowa County Engineers Association and the Needs Study replacement committee as background information to support their efforts in finding a replacement for the Quadrennial Needs Study based RUTF allocation system.

TR-477 will also devote time to more thoroughly research and determine average annual speeds of travel on various types of roads, refine the estimates of capital upgrade costs, review whether or not recent year expenditures have been enough to maintain system quality at a steady state, recheck human resource / travel time costs, and re-estimate accident costs.

Progress: A contract for this research was executed in June 2002.

Reports: None

Implementation: The results of this research effort will be employed to support efforts, by ICEA and the Needs Study Replacement Committee, to devise a new way of allocating the FM and Local Secondary portions of the state Road Use Tax Fund among the counties. It may also be used to evaluate and then demonstrate the adequacy of the county road network and establish how much ought to be spent on it each year.

Project Number: TR-478

Project Title: Evaluation of Composite Pavement Unbonded Overlays (Installation and Maintenance of Weigh In Motion Detection System on Iowa Highway 13 in Delaware County)

Agency: Iowa State University

Principal Investigator: James K. Cable

Research Period: June 1, 2002 to June 30, 2006

Research Board Funding: $49,520

Funding Source: 80 percent Federal and 20 percent State (100 percent Primary funds) This funding is provided as the required state matching funds for the FHWA project.

Objective:

1. The first is the site section and installation of the WIM site on Iowa Highway 13 north of Manchester, Iowa, by Dr. Jim Cable and representatives of the Office of Transportation Data Systems under the supervision of Mr. Phil Meraz.

2. The second objective is the successful operation and maintenance of this system by Mr. Meraz' staff to provide truck data to Dr. Cable throughout the life of the research contract.

Progress: Equipment is being prepared for a July/August 2002 installation date. Data collection is scheduled to begin immediately after equipment installation.

Reports: Quarterly Report, April 2002

Implementation: Information collected from the WIM site will be used to provide truck traffic data to Dr. Cable throughout the life of the research contract.

Project Number: TR-479

Project Title: Investigation into Improved Pavement Curing Materials and Techniques: Part II (Phase III)

Agency: Iowa State University

Principal Investigator: James K. Cable

Research Period: June 1, 2002 to September 30, 2002

Research Board Funding: $96,828

Funding Source: 100 percent State - 60 percent Primary funds, 30 percent Secondary funds and 10 percent Street funds

Objective: The objectives of Phase I and II of this research were the following:

1. Identification and evaluation of alternative curing materials and techniques that meet the goals of the Iowa DOT to improve the moisture retention in newly placed PCCP. The techniques should be compatible with current construction techniques.

2. Evaluation of application methods for each alternative-curing compound.

3. Develop a suitable evaluation method for measuring the effectiveness of the compound on the pavement at construction time.

The objective of Phase III is the field evaluation of the products and application rates identified in Phases I and II as having promise to meet the original objectives.

Progress: A field site has been selected and construction arrangements have been made with the contractor for applying the materials. Construction is anticipated in July 2002.

Reports: None

Implementation: The results of this research can be used to provide an alternative set of materials to be used in the curing of pavements at all government levels to enhance the performance of concrete pavements. It has a benefit to HYPERPAVE activities at a national level to validate models that in turn result in improved concrete pavements across the nation.

It is proposed that the results be implemented through presentations and abstract distributions.

Project Number: HR-1027

Project Title: Secondary Road Research Coordinator

Agency: Iowa Department of Transportation, Highway Division

Principal Investigator: Ed Engle

Research Period: March 1980 to present

Research Board Funding: $70,000.00/yr. (covers salary and state share of costs for FICA, IPERS, health insurance, vehicle costs and expenses)

Funding Source: 100 percent State – 100 percent Secondary funds

Objective: To maintain research liaison with all county engineers and solicit new, innovative and progressive ideas; to actively promote secondary research for solutions to problems and ideas that will improve quality and reduce costs.

Progress: Ed Engle continues to visit with many county engineers to discuss problems being encountered by the secondary road departments and to discuss present research projects during the year. At present, there are approximately 18 active research projects that involve counties, including secondary projects with consultants. The coordinator assists these counties with special testing, evaluation, and writing of construction and final reports necessary to the research. He has also been keeping county engineers updated on the changes in the Iowa Highway Research Board (IHRB) operating procedures.

Reports: None

Implementation: There are many problems that are unique to the secondary road system in Iowa. These problems are usually common to several counties. Coordination between counties is necessary for understanding the problem and formulating solutions. Proper documentation and dissemination of reports allows for timely technology transfer between the counties.