ANNUAL REPORT
OF
HIGHWAY DIVISION
HIGHWAY RESEARCH AND DEVELOPMENT
IN IOWA

SEPTEMBER 2003

Iowa Department of Transportation

ANNUAL REPORT
OF
HIGHWAY DIVISION
HIGHWAY RESEARCH AND DEVELOPMENT IN IOWA

FOR THE
FISCAL YEAR ENDING JUNE 30, 2003

OFFICE OF MATERIALS
(515) 239-1447

HIGHWAY DIVISION
IOWA DEPARTMENT OF TRANSPORTATION
AMES, IOWA 50010

SEPTEMBER 2003

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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, 2003; it is also a report on projects completed during the fiscal year beginning July 1, 2002, and ending June 30, 2003. 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, 2003 is listed in Table I.

The Research Board held eight regular meetings during the period of July 1, 2002 to June 30, 2003. Suggestions for research and development were reviewed at these meetings and recommendations were made by the Board.

TABLE I
2002-2003 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	12-31-05	Robert Younie Construction Engineer Iowa DOT - Dist. 1 1020 S. 4th Street Ames, IA 50010 (515) 239-1542
Lyle Brehm Tama County Engineer 1002 E. 5th Street Tama, IA 52339-2216 (641) 484-3341 SS# 086	12-31-05 District 1	Dennis Short Hamilton County Engineer 2300 Superior Street Webster City, IA 50595-3197 (515) 832-9520 SS# 040
Robert Ettema Chair, Dept. of Civil & Env. Engineering The University of Iowa 4105 Seamans Center Iowa City, IA 52242 (319) 384-0596		-
Todd Fonkert Bremer County Engineer 1995 Euclid Avenue Waverly, IA 50677 (319) 352-4302 SS# 009	12-31-04 District 2	Andrew Smith Hancock County Engineer 855 State Street P.O. Box 70 Garner, IA 50438 (641) 923-2243 SS# 041
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. Engineering Iowa State University 390 Town Engineering Building 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 District 3	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 District 6	Clark Schloz Jackson County Engineer 201 W. Platt Maquoketa, IA 52060 (563) 652-4782 SS# 049
Jeff Krist Project Manager Public Works Department 209 Pearl Street Council Bluffs, IA 51503 (712) 328-4635	12-31-03	Richard Fosse City Engineer 410 E. Washington Iowa City, IA 52246-5717 (319) 356-5143
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
Charles Marker Cass County Engineer 5 W. 7th Street Atlantic, IA 50022 (712) 243-2442 SS# 015	12-31-05 District 4	John Rasmussen Montgomery County Engineer 406 W. 4th Street P.O. Box 95 Red Oak, IA 51566 (712) 623-5197 SS# 069
Mark Nahra Delaware County Engineer 2139 Highway 38 P.O. Box 68 Delaware, IA 52036 (563) 927-3505 SS# 028		-
Greg Parker City Streets Director 2101 6th Street S.W. Cedar Rapids, IA 52404 (319) 286-5826	12-31-05	John Joiner Civil Engineer 515 Clark Avenue P.O. Box 811 Ames, IA 50010 (515) 239-5165
John Selmer District Engineer Iowa Department of Transportation District 4 63200 White Pole Rd. P.O. Box 406 Atlantic, IA 50022 (712) 243-3355	12-31-04	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 District 5	Roger Schletzbaum Marion County Engineer 402 Willetts Drive Knoxville, IA 50138 (641) 828-2225 SS# 063

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, 2003. Total expenditure was $1,650,250.18.

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-four counties during fiscal year 2003 as part of the Annual Traffic Count Program. This activity consisted of 261 portable recorder classification counts, 4,145 portable recorder volume counts and 47 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 2003 financial summary is:

Beginning Balance 7-1-02		$2,303,858.63
Receipts		
State Road Use Tax Fund (1½% of receipts)	$1,132,875.46	
Federal Aid Secondary (1½% of receipts)	0.00	
Research Income	1,163.67	
Sub-Total		$1,134,039.13
Total Funds Available		$3,437,897.76
Obligation for Expenditures		
Obligated for Contract Research	605,097.01	
Non-Contract Engineering Studies	95,933.56	
Total Expenditures		701,030.57
BALANCE 6-30-03		$2,736,867.19

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 2003 financial summary is:

Beginning Balance (7-1-02)	$ 146,871
FY03 Street Research Funding	200,000
Total Funds Available for Street Research	$346,871

Obligated for Expenditure

HR-296	$ 45,000
TR-459	29,775
TR-474	1,499
TR-480	8,000
TR-481	6,000
TR-482	5,000
TR-483	7,289
TR-484	23,950
TR-485	3,876
TR-487	6,250
TR-488	4,500
TR-490	6,476
TR-491	10,000
TR-492	25,360
TR-493	9,821
TR-495	7,500
TR-497	2,998
TR-499	3,000

Total obligated for Expenditure	$206,294	
Ending Unobligated Balance 6-30-03		$140,577

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 FY03 was $694,901.52 and the estimate for FY04 is $750,000.

PROJECTS INITIATED DURING FY 2003

The new projects initiated during FY 2003 were:

TR-480, "Investigation of the Long Term Effects of Concentrated Salt Solutions on Portland Cement Concrete"
TR-481, "Identification of the Best Practices for the Design, Construction, and Repair of Bridge Approach Sections"
TR-482, "Determination of the Optimum Base Characteristics for Pavements"
TR-483, "Evaluation of Hot Mix Asphalt Moisture Sensitivity Using the Nottingham Asphalt Test Equipment"
TR-484, "Materials and Mix Optimization Procedures for PCC Pavements"
TR-485, "Erosion Control for Highway Applications - Phase II: Development and Implementation of a Web-Based Expert System for Erosion and Sediment Control Measures"
TR-486, "Development of Abutment Design Standards for Local Bridge Designs"
TR-487, "Development of Object Oriented Specifications for IADOT and Urban Standards"
TR-488, "Economics of Using Calcium Chloride vs. Sodium Chloride for Deicing/Anti-icing"
TR-489, "Innovative Solutions for Slope Stability Reinforcement and Characterization in Iowa Soils"
TR-490, "Stringless Portland Cement Concrete Paving"
TR-491, "Development of Winter Performance Measures for Highway Winter Maintenance Operations"
TR-492, "Embankment Quality Phase IV - Application to Unsuitable Soils"
TR-493, "Performance Evaluation of Steel Bridges: Phase II"
TR-494, "Statistical Analysis of Highway Needs Condition Data: Manual vs. Automated"
TR-495, "Field Evaluation of Compaction Monitoring Technology"
TR-497, "Manual of Iowa Drainage Law"
TR-498, "Field Testing of Railroad Flat Car Bridges"
TR-499, "Effectiveness of Electrochemical Chloride Extraction for the Iowa Avenue Pedestrian Bridge"
TR-500, "Evaluation of the Compensatory Wetland Mitigation Program in Iowa"

20 projects

Table II

FINANCIAL SUMMARY OF RESEARCH AND DEVELOPMENT PROJECT EXPENDITURES

July 1, 2002 to June 30, 2003

(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)	10,000.00	49,216.69	32,925.66	92,142.35
370	10,000	Pipe Rehabilitation With Polyethylene Pipe Liners				
375	22,400	Transportation Research Board Education for County Engineers		1,920.36		1,920.36
391	163,741	Optimal Usage of De-Icing Chemicals When Scraping Ice				
394	672,152	Transportation Program Management System	9,319.91			9,319.91
399	299,932	Field Testing of Integral Abutments	129.52			129.52
412	65,000	Development of a Computer Controlled Underbody Plow				
414	50,000	Superpave Mix Designs for Low Volume Roads				
419	30,000	Education on Urban Corridor Issues	1,703.49			1,703.49
420	98,478	Field Evaluation of Alternative Load Transfer Device Locations in Low Traffic Volume		19,089.26	79.05	19,168.31
422	14,000	Pretreatment for Reduction of Asphalt Absorption in Porous Aggregate				
424	178,358	Steel Diaphragms in Prestressed Concrete Girder Bridges		31,219.25		31,219.25
427	26,200	Evaluation of High-Slump Concrete for Bridge Deck Overlays				
428	294,760	Effective Structural Concrete Repair	5,856.26	6,204.23		12,060.49
429	195,060	Evaluation of Appropriate Maintenance Repair and Rehabilitation Methods for Iowa				
432	183,903	Ultrathin Portland Cement Concrete Overlay Extended Evaluation	171.99	5,337.81	152.48	5,662.28
434	30,420	Use of Abrasives in Winter Maintenance	304.20	2,433.60	304.20	3,042.00
435	117,030	Thin Maintenance Surfaces - Phase II	6,436.52	5,266.32		11,702.84
436	158,028	Retrofit Methods for Distortion Cracking Problems in Plate Girder Bridges	5,202.51	11,546.56	5,955.16	22,704.23
438	142,903	Integral Abutment Bridge With Precast Concrete Piles	12,145.58	11,754.56		23,900.14
444	187,620	Demonstration Project Using Railroad Flatcars for Low Volume Road Bridges		35,110.32		35,110.32
445	176,876	Development of Bridge Load Testing Process for Load Evaluation		18,673.57	4,256.00	22,929.57
446	214,150	Technology Transfer of "As Built Preliminary Surveys" by Total Station GPS, Video Logging & Laser	1,198.99	9,339.99		10,538.98
449	58,135	Determination and Evaluation of Alternative Methods for Managing and Controlling Highway Related Dust		5,702.64		5,702.64
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		13,273.33		13,273.33
452	48,865	Alternative Solutions to Meet the Service Needs of Low Volume Bridges in Iowa		11,767.52		11,767.52
456	107,800	Measuring Main-Channel Slopes for Major Rivers in Iowa		50,800.00		50,800.00
457	73,997	Development of a Manual Crack Quantification and an Automatic Crack Measurement System				
458	151,920	Field Testing of Abrasive Delivery Systems in Winter Maintenance	4,423.95	20,019.05	341.82	24,784.82
459	67,133	Reuse of Lime Sludge From Water Softening	107.29		1,952.05	2,059.34
460	87,924	Living Snow Fences	17,300.45	37,490.87		54,791.32
461	70,000	Soil Stabilization of Non-Uniform Subgrade Soils	14,670.42	22,702.84	2,183.09	39,556.35
462	61,560	Manual for Roadside Control of Trees and Brush	1,747.80	16,749.39	6,153.25	24,650.44
463	99,804	Field Performance Study of Past Iowa Pavement Research: A Look Back	12,906.94	44,751.65	9,000.00	66,658.59
464	30,000	Erosion Control for Highway Applications - A Critical Review of Published Literature	7,009.89	12,000.00	2,869.86	21,879.75
466	47,049	Evaluation of Unbonded Ultrathin Whitetopping of Brick Streets			518.35	518.35
467	190,890	Investigation of the Modified Beam-in-Slab Bridge System		99,610.17		99,610.17
468	10,000	Technology Transfer Program for the Iowa Highway Research Board (IHRB)	2,863.23	630.00		3,493.23
469	139,832	Reduction of Concrete Deterioration by Ettringite Using Crystal Growth Inhibition Techniques-Part II-Field Evaluation of Inhibitor Effectiveness	59,931.60			59,931.60
470	59,272	Development of a Method to Determine Pavement Damage Due to Detours and Haul Roads	19,516.95	20,575.19		40,092.14

Project	Total Funds Committed	Project Title	Primary Road Research Fund Expenditures	Secondary Road Research Fund Expenditures	Street Research Fund Expenditures	Total Expenditures
471	100,000	Evaluation of Using Non-Corrosive Deicing Materials and Corrosion Reducing Treatments for Deicing Salts	49,531.86	24,876.29	779.75	75,187.90
472	80,000	Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipment	28,113.26	1,450.27		29,563.53
473	178,197	Rehabilitation of Concrete Pavements Utilizing Rubblization and Crack and Seat Methods	46,854.70	31,178.08		78,032.78
474	129,671	Development of a Mix Design Process for Cold-In-Place Rehabilitation Using Foamed Asphalt	63,793.42	24,246.63	34,101.31	122,141.36
476	69,375	PCVAL: A Computer Program for Valley Stage-Discharge Curves and Bridge Backwater Calculations	22,592.25	24,840.00	8,673.75	56,106.00
477	29,635	Total Cost of Transportation Analysis - Phase II (HR-388 - Phase I)		3,816.35		3,816.35
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.)	16,422.32			16,422.32
479	96,828	Investigation Into Improved Pavement Curing Materials and Techniques: Part II (Phase III)	56,524.34	6,965.00	2,322.41	65,811.75
480	80,000	Investigation of the Long Term Effects of Concentrated Salt Solutions on Portland Cement Concrete	36,000.00	36,000.00	8,000.00	80,000.00
481	120,000	Identification of the Best Practices for the Design, Construction, and Repair of Bridge Approach Sections	27,487.23	3,538.44		31,025.67
482	100,000	Determination of the Optimum Base Characteristics for Pavements	35,186.36			35,186.36
483	145,775	Evaluation of Hot Mix Asphalt Moisture Sensitivity Using the Nottingham Asphalt Test Equipment	44,175.22			44,175.22
484	159,666	Materials and Mix Optimization Procedures for PCC Pavements	11,824.35			11,824.35
485	38,757	Erosion Control for Highway Applications - Phase II: Development and Implementation of a Web-Based Expert System for Erosion and Sediment Control Measures	15,858.79	11,074.47	2,136.31	29,069.57
486	99,265	Development of Abutment Design Standards for Local Bridge Designs		15,438.28		15,438.28
487	124,999	Development of Object Oriented Specifications for IADOT and Urban Standards	29,539.31	2,822.46		32,361.77
488	90,000	Economics of Using Calcium Chloride vs. Sodium Chloride for Deicing/Anti-icing	6,903.88			6,903.88
489	198,462	Innovative Solutions for Slope Stability Reinforcement and Characterization in Iowa Soils	1,644.34	1,716.62		3,360.96
490	129,519	Stringless Portland Cement Concrete Paving				
491	100,000	Development of Winter Performance Measures for Highway Winter Maintenance Operations				
492	169,067	Embankment Quality Phase IV - Application to Unsuitable Soils				
493	196,421	Performance Evaluation of Steel Bridges: Phase II				
494	17,405	Statistical Analysis of Highway Needs Condition Data: Manual vs. Automated		13,175.10		13,175.10
495	75,000	Field Evaluation of Compaction Monitoring Technology				
497	59,965	Manual of Iowa Drainage Law				
498	121,096	Field Testing of Railroad Flat Car Bridges				
499	30,000	Effectiveness of Electrochemical Chloride Extraction for the Iowa Avenue Pedestrian Bridge				
500	6,802	Evaluation of the Compensatory Wetland Mitigation Program in Iowa				
1027	70,000	Secondary Road Research Coordinator		68,321.00		68,321.00
1080	29,997	Synthesis of Dowel Bar Research	7,414.96			7,414.96
1081	25,000	Development of In-Situ Detection Methods for Material Related Distress (MRD) in Concrete	2,087.44			2,087.44
		Contract Research Subtotal	694,901.52	832,644.16	122,704.50	1,650,250.18
SPR-PR-PL-1(33)		FY2003 Planning & Research Program (Transportation Inventory Engineering Studies)		95,933.56		95,933.56
		Non-contract Engineering Studies Subtotal		95,933.56		95,933.56
		Grand Total of Expenditures	694,901.52	928,577.72	122,704.50	1,746,183.74

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, 2003

Research Board Funding: $100,000 per year

Funding Source: 36 percent Federal funds, 16 percent State Safety funds, 22% other sources and 26 percent State - 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 six newsletters per year
2. conducting at least 10 training courses/workshops 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.

Reports: Final Report, April 2003

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. 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 gives 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 2003, a total of 18 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-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 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 September 30, 2003

Research Board Funding: $672,152

Funding Source: 100 percent State - 25 percent Primary funds, 70.7 percent Secondary funds, and 4.3 percent 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 final system and report from the research are being completed and will be presented to the IHRB at its September 26, 2003 meeting.

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-399

Project Title: Field Testing of Integral Abutments

Agency: Iowa State University

Principal Investigator: Robert Abendroth

Research Period: February 1, 1997 to April 30, 2003

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.

A final report is being completed and is expected to be presented to the IHRB in the fall of 2003.

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-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, 2003

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-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.

Reports: Final Report, March 2003

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.

Reports: Construction Report, December 1999

Implementation: If an optimized dowel placement regimen can be demonstrated, counties will be more inclined to use dowels in their paving projects.

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 October 31, 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: The finite-element analyses were completed for prototype, prestressed concrete (PC), girder bridges that were subjected to horizontal-impact forces. These forces represented the effect of an over-height-vehicle impact on the bottom flange of a PC girder. To confirm the accuracy of the finite-element models, calibrations were performed using the experimentally-determined displacement and strain results from a laboratory test of an approximately, one-half-scale, single-span, bridge model. This calibration process confirmed the finite-element, mesh sizes and the types of special, finite elements that were used in the bridge superstructures for the prototype bridges. The final report for the research project is nearing completion.

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. Several additional bridge decks have been overlaid with this method successfully since these first projects. 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 FRP as a protective barrier to chloride penetration. Each of the five sites studied had wraps and a protective topcoat installed last fall (2002). Samples of concrete were gathered from each of these five sites in June 2003. The analysis of the samples indicated that there was no change in chloride levels after the first winter season.

In the laboratory, all five FRP wraps have been installed on a concrete slab. These wraps were installed in three layers so that there are sections on the slab that have one, two and three layers of the FRP wraps. In addition to the five wraps, both topcoats utilized as a protective UV cover were also installed. The slab was then flooded with a three percent salt solution for a ninety-day cycle. After the completion of a cycle, the slab was drained, samples were obtained and the slab was patched so it could be flooded again. To-date, two 90 day cycles have been completed. All five wraps and the two topcoats have successfully kept the chloride level below the corrosion threshold. However, the topcoats and one of the carbon wraps have displayed a small increase in the amount of chlorides that have penetrated through to the slab.

A report summarizing the work to date is currently being prepared. Also, a synopsis of the installation procedures used for each of the FRP wraps has been created for use by maintenance personnel. The synopsis will be included as an appendix to the final report.

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 April 30, 2003

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.

Reports: Final Report and Manual, May 2003

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-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 Portland Cement Association (PCA) and American Concrete Paving Association (ACPA).

Progress: Monitoring of the site continues.

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-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, March 2001

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.

Reports: Final Report, January 2003

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 January 31, 2003

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.

Reports: Final Report, January 2003

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-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 September 30, 2003

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: A nine month, no cost, time extension was approved for this project. Work continued on the analysis of the experimentally measured data that was obtained during the field monitoring of the Tama County Bridge.

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-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: July 10, 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.

Reports: Final Report, February 2003

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 February 28, 2003

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.

Reports: Final Report, April 2003

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: Final Report, September 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-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.

Reports: Final Report, June 2002

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: $80,000

Funding Source: 50 percent Institute for Safe, Quiet, and Durable Highways funds, 25 percent Indiana DOT funds, 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: Research on this project was delayed by contractual issues between Purdue University and the Iowa DOT. The schedule for completion of the project will be revised after confirming with the panel next quarter. A review of possible technologies to polish and test the mixture samples is nearly complete. Late last year NCAT received a promising Japanese device, which may be lent to the project, but software problems delayed its use. The PI visited NCAT for another project at the end of October 2002 and saw the devices, which look very good. A report and request for extension will be reviewed by the research team next quarter prior to distribution to the SAC.

Reports: Quarterly Report, April - June 2003

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.

Reports: Final Report, 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 and Terry J. Wipf

Research Period: March 1, 2001 to October 31, 2003

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.

Except for minimal response (only 26 responses were received) to the questionnaire that was sent to all Iowa County Engineers, the project is essentially completed. Upon the suggestion of S. DeVries of the Iowa County Engineers Association Service Bureau (ICEASB), the research team is mailing the questionnaire to those county engineers that haven't responded. The ICEASB has had good experience with obtaining responses to mailed questionnaires after a poor response to an initially e-mailed copy of the questionnaire.

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-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 funds 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: The project is in final stages of completion. A final report is being completed and is expected to be presented to the IHRB in the fall of 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 December 31, 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 have been assigned to the proper pavement manage sections for re-analysis. The revised analysis required additional time. A final report is due in fall 2003

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, 2004

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 pieces for this project are all in place and functional now. The major challenge is coordinating the pieces so that after or during a storm it is possible for both truck and test vehicle to meet up and conduct their measurements in such a way as not to create a hazardous situation for the public. The lack of a good winter season the past two years has not helped in this regard.

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 in Road Construction

Agency: Iowa State University

Principal Investigator: J(Hans) van Leeuwen

Research Period: August 15, 2001 to December 31, 2004

Research Board Funding: $67,133

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: The work is continuing after delays resulting from not being able to find a suitable graduate research assistant.

Reports: Interim Progress Report, August 2003

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: $87,924

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

Objective: (1) 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.
(2) 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.
(3) 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: Two winters of testing have provided some interesting results. The living corn test, conducted just north of Tipton, has indicated that between 6 and 12 rows of corn, adjacent to the right of way (i.e. right at the edge of the farmer's field) have proven to be very effective snow fences over the last two winters. However, these have not been normal winters. The corn snow fences store a great deal of snow with the rows of corn, in contrast to a more traditional snow fence where almost all storage is downwind of the fence.

On the basis of these results, it seems that living snow fences can be placed much closer to the road (or the right of way) than traditional fences, but in the absence of a more normal winter, considerable care is needed in interpreting these results.

The project calls for a third winter of testing, which it is to be hoped will be "more normal" than the previous two winters. Ideally, a living corn fence will be placed in a similar area north of Tipton, with both six and twelve rows of corn. In addition, further observations of the switch grass living fence will be made in Pocahontas.

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 November 30, 2004

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: A 12-month extension was given by the IHRB. Laboratory testing has focused on determination of shear strength parameter values for soil/fly ash combinations tested in triaxial compression and determination of soil mineralogy from thermo gravimetric analysis (TGA).

Reports: Quarterly Report, April 2003

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.

Reports: Final Report, October 2002

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 September 30, 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: All test sections from the selected pavement research projects funded through the Iowa Highway Research Board were evaluated. To validate the findings from the original studies, digital images were captured from all the remaining test sections. The deflections were measured and cores were taken from several test sections. Currently, images are being manually analyzed from the computer screen. The cores were tested for shear strength of the bonding area. The core test and image analysis results are being compared with the previous findings.

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.

Reports: Final Report, 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: The construction report was completed and given to the IHRB at the April 2003 meeting. Monitoring of the site continues.

Reports: Construction Report, August 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 and Terry J. Wipf

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: Five specimens were constructed and tested to investigate the behavior of the proposed Modified Beam in Slab Bridge (MBISB) system. Four single bay specimens were constructed and tested last year to evaluate the strength of the formwork and the MBISB system. A fifth specimen, a model bridge consisting of 3 bays was constructed in the ISU Structures Laboratory to investigate the load distribution characteristics and ultimate strength of the MBISB design. Service level load tests on this model were completed in September 2002. The specimen was then subjected to an ultimate flexural loading causing permanent deformations in the longitudinal members. Data gathered from testing the laboratory specimens aided in the design of the second demonstration bridge.

The first MBISB demonstration bridge was designed and constructed in Tama County during the fall of 2001 and then opened to traffic. The bridge was field tested in July 2003, to quantify the behavior of the structure.

The second demonstration bridge, also in Tama County, has been constructed and field tested. The structure utilizes 6 rolled W-sections in the MBISB system. The deck was placed on November 7, 2002 and opened to traffic.

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, 2002 to November 30, 2003

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: Three sets of cores from highways constructed in 1997 and in 1992 are being used. For each highway location, three sets of cores were obtained near the margins of the highway panel and three sets of cores were taken from the center of the panel. Samples of the cores used in the study were derived from two-inch thick slices from the top and the bottom of the core. These samples were subsequently divided into two sets so that chemical applications could be made on a weekly basis to one set and on a monthly basis to the other set. All of these samples were placed on the roof of the Science building. Further testing will be done this year.

Reports: Progress Report, May 2003

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 September 30, 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: A six-month, no cost extension was granted.

Developed two approaches to determine damage: the condition based approach and the traffic based approach (MN DOT).

Reports: Quarterly Progress Report, April 2003

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: Five different test types have been proposed to date. For each test, a written protocol is being developed. The liquid deicing chemicals tested to date in this project are sodium chloride, calcium chloride, calcium magnesium acetate (CMA), potassium acetate (KA), 20% ice ban - 80% salt brine mixture, caliber M-1000 and mineral brine. At present, it is not anticipated that any additional chemicals will be tested under this project.

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 Equipment

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 literature review is now complete, and the lab and field test programs are being set up and will be completed by the end of the forth-coming winter season.

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 "draft" design program is complete, awaiting calibration at the end of the project. A significant database of "theoretical" pavement is being compiled for both PCC and HMA overlaid PCC pavement structures. This is needed in later analysis. A method for rapid determination of subgrade properties under PCC pavement has been developed and checked. Details and histories of existing rubblized pavements have been obtained from the Office of Special Investigations.

Reports: Quarterly Progress Report, April 2003

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 December 31, 2003

Research Board Funding: $129,671

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: Phase I of this project is competed, and an interim report was presented to the IHRB at its June 2003 meeting. An extension of $29,988 was approved by the IHRB at its April 25, 2003 meeting to conduct Phase II of the project.

Reports: Interim Report, June 2003

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-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 September 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: The software was completed by June 30, 2003. It is undergoing testing and the user manual is in preparation. A final report and the software and manual will be presented to the IHRB in the fall of 2003.

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 September 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.

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: The Total-cost-of-transportation model has been rebuilt, using 2002 physical and financial data. Subsequently, the analyses of optimal service levels, county road service adequacy, and prediction of future needs were redone. The model's results have also been used to develop a provisional method for computing county Road Use Tax allocation factors, and this information was presented to the Secondary Road Fund Distribution Advisory Committee for evaluation. Individual county and road segment service ratings are now being developed to complete the project. The final report will be presented to the IHRB at its September 2003 meeting.

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 funds 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: Phase III contract field data collection work began after May 1, 2003 and will continue through August 31, 2006. The following dates for completion of each of the data collection items in this phase are established at this time:

1. Deflection testing to be done biannually and completed by May 31, 2006.
2. Visual distress surveys to be done biannually and compiled by May 31, 2006.
3. Joint faulting and joint opening testing to be done biannually and completed by May 31, 2006.
4. Longitudinal profiling testing to be conducted biannually and completed by May 31, 2006.
5. Coring of selected pavement locations to determine bond between layers will be done in year 3 and 5 of the contract and be completed by May 31, 2006.

Reports: Quarterly Report, April 2003

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 April 30, 2003

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.

Reports: Final Report, March 2003

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: TR-480

Project Title: Investigation of the Long Term Effects of Concentrated Salt Solutions on Portland Cement Concrete

Agency: Michigan Technological University

Principal Investigator: Lawrence L. Sutter (Dave Huft, Project Manager, South Dakota DOT)

Research Period: July 15, 2002 to July 14, 2004

Research Board Funding: $80,000

Funding Source: Multi-state pooled funds coordinated by South Dakota Department of Transportation - 86.7 percent other sources, 13.3 percent State - 45 percent Primary funds, 45 percent Secondary funds, and 10 percent Street funds

Objective: The objectives of this project are 1) to determine the long-term effects of concentrated solutions of magnesium, sodium and calcium chloride as well as CMA or other alternative liquid deicers on durable Portland cement concrete, 2) to estimate the potential for reduction in performance and service life for pavements (jointed plain, reinforced and continuously reinforced) and structures subjected to various concentrated deicing brines.

Progress:
- Progress on the literature review continues. Although the researchers are still reviewing papers, a partial draft has been started and is being refined.
- A summary of the maintenance practices survey is near completion and will be completed within the next reporting cycle. It should be noted that survey responses are still coming in.
- Pavement core samples from sites in Idaho were received and cataloged.
- Core samples from Iowa, Colorado, and south Dakota have been sectioned and hardened air contents have been determined in accordance with ASTM C457.
- Most of the 2760 required 2" x 4" cylinder mortar specimens have been prepared.
- The final cylinders are scheduled to be completed August 15, 2003.
- The research team has spent considerable effort working out the logistics of testing the large number of specimens required for Phase I and this study.
- The guidance of the technical panel in establishing the required solutions strengths for testing is requested.

Reports: Quarterly Report, September 2003

Implementation: The results of this research may be used to aid in the decision-making processes, with respect to the continued use of concentrated liquid deicers, while minimizing any potential damage to concrete pavements and structures.

Project Number: TR-481

Project Title: Identification of the Best Practices for the Design, Construction, and Repair of Bridge Approach Sections.

Agency: Iowa State University

Principal Investigator: David J. White and Sri Sritharan

Research Period: August 15, 2002 to August 14, 2004

Research Board Funding: $120,000

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

Objective: 1) Identify state-of-the-art practices for design, construction, and maintenance of bridge approaches to reduce the bridge approach settlement problem. 2) Document several bridge approach sites where poor performance has been observed. 3) Develop practical threshold limits at the interface between the bridge approach and embankment to be used for determination of when corrective maintenance/repair is required. 4) Investigate and continue current monitoring of project case histories. 5) Conduct simple pilot tests for which more rigorous compaction specifications and the application of pre-cambering of the bridge approach is used. 5) Recommend design, construction and maintenance alternatives.

Progress: 1) Literature review and first draft summarizing the information from the literature have been completed. 2) Fourteen bridge sites in and around Des Moines and Ames have been inspected. 3) A bridge at Highway 65 over South Skunk River has been selected for a detailed site investigation.

Reports: None

Implementation: Because the proposed research is specific to Iowa conditions, results will be implemented by county, city, and state highway agencies and contractors statewide as follows:

- It is expected that maintenance personnel will adopt the newly established threshold criteria indicating needed repair/maintenance of bridge approaches.
- Bridge and earthwork contractors will improve quality construction to reduce the occurrence of the bump based on final recommendations.
- Field personnel will implement QM-E end-result quality assurance testing to ensure proper compaction of bridge embankment fills.
- Office of Soil Design will consider various ground improvement methods in areas where soft foundation conditions exist.
- Office of Bridge Design and Office of Soil Design will consider alternative design approaches the design of new bridges.

Project Number: TR-482

Project Title: Determination of the Optimum Base Characteristics for Pavements

Agency: Iowa State University

Principal Investigator: David J. White and Charles Jahren

Research Period: August 15, 2002 to February 14, 2004

Research Board Funding: $100,000

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

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

- Identify the optimal range for both in-place stability and in-place permeability of granular base course material in Iowa;
- Develop reliable field QC tests to determine the in-place stability and permeability of granular base course materials;
- Develop end-result specification for the acceptance of granular bases based on these findings; and
- Identify alternative construction practices for the placement of permeable granular base layers in areas which have narrow or no shoulders for use as a haul road.

Progress: Laboratory investigations are being conducted on six aggregate materials including crushed aggregate (limestone and gravel materials) and recycled concrete, collected from several sources in Iowa. Laboratory experiments including gradation analysis, air permeability test, constant head permeability test, DCP test, clegg hammer test, stiffness using Geo-gauge are being conducted. A database of aggregate specifications followed by different states DOTs has been established.

Reports: Quarterly Progress Report, April 2003

Implementation: The proposed research is specific to Iowa, highway agencies and contractors statewide will implement results. However, final recommendations could be implemented at the regional/national level. Results will be communicated to practicing engineers and contractors through local/regional/national presentations and dissemination.

Project Number: TR-483

Project Title: Evaluation of Hot Mix Asphalt Moisture Sensitivity Using the Nottingham Asphalt Test Equipment

Agency: Iowa State University

Principal Investigator: Brian Coree

Research Period: August 1, 2002 to January 31, 2005

Research Board Funding: $145,775

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

Objective: This research will develop one or more test protocols using the superpave gyratory compactor and the Nottingham Asphalt Tester with which more reliable, or robust, determinations may be obtained of the likelihood of moisture damage in hot mix asphalt mixtures. These protocols will include and specifically address sample preparation, sample conditioning and testing, and recommendations as to critical acceptance criteria. Field validation and implementation plans will be recommended.

Progress: A significant literature review is complete. Components of the proposed research have been checked and calibrated, e.g. the definition and measurement of saturation in sample preparation. A pilot study with trial mixtures has been undertaken. Actual sample testing will proceed in summer.

Reports: Quarter Progress Report, April 2003

Implementation: 1) DOT specification for each aggregate type and source that identifies the material as a stripper or a non-stripper; and 2) Revised DOT specification substituting the recommended method/protocol in place of the current AASHTO T-283 procedure. Revision of the current specification to allow the use of 150 mm samples in the AASHTO T-283 procedure.

Project Number: TR-484

Project Title: Materials and Mix Optimization Procedures for PCC Pavements

Agency: Iowa State University

Principal Investigator: Scott Schlorholtz, Kejin Wang and Dale Harrington

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

Research Board Funding: $159,666

Funding Source: 49 percent Federal funds and 51 percent State - 50 percent Primary funds, 35 percent Secondary funds, and 15 percent Street funds

Objective: The ultimate goal of this research project is to provide contractors and engineers with a set of guidelines that simplify and specify the process of producing affordable and durable PCC pavements. The guidelines will provide details on optimization of concrete mixing procedures when supplementary cementitious materials and other admixtures are used to modify the properties of concrete. The scope of this project is limited to materials commonly used by the Iowa DOT.

The specific objectives of the project include:

- Define the characteristics of a "good" concrete mix while still in the plastic state.
- To investigate effects of the key parameters of concrete mixing on fresh concrete properties.
- Develop guidelines for proper optimization of materials and mixing method/time

Progress: Tasks 1 through 4 of the work plan have been completed. They include a literature survey on mixing procedures and their influence on concrete performance. The selection of materials, laboratory studies and contractors was discussed with the Iowa DOT. A vibrating slope apparatus (VSA) was loaned from the FHWA and testing has begun. A moisture sensor availability study was done. A review panel for the project is nearly finalized.

Reports: Quarterly, April 2003

Implementation: Implementation of the project results will be conducted through an implementation module structured for practicing engineers, technicians, quality assurance/quality control personnel, contractor superintendents, trade persons, and producers. Development of user guides and training sessions will be at the joint discretion of the Principal Investigator and PCC Center Advisory Board and Iowa Highway Research Board. In addition, the results will be incorporated for national distribution into the deliverables of the larger "Material and Construction Optimization for Concrete Pavements" program.

Project Number: TR-485

Project Title: Erosion Control for Highway Applications - Phase II: Development and Implementation of a Web-Based Expert System for Erosion and Sediment Control Measures

Agency: The University of Iowa

Principal Investigator: Marian Muste

Research Period: August 26, 2002 to September 30, 2003

Research Board Funding: $38,757

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

Objective: The objectives of Phase II of this project are to substantially enhance the expert-system's (ES) knowledge database, transition the current PC version to a web-based platform, and disseminate the developed computer application to Iowa Department of Transportation (Iowa DOT) users. Enhancement of the ES entails the following additions:

- the extensive in-house erosion and sedimentation control methods (ESCM) expertise developed by the Iowa DOT
- calculation engines for estimation of sediment yield or water runoff
- the components related to the Storm Water Pollution Prevention Plan (SWPPP) and other pertinent permitting requirements (e.g., state, local)

Progress: The objectives have been completed and the final report and program will be presented to the IHRB in the fall of 2003.

Reports: None

Implementation: The ES is aimed at practically assisting state, city, and county engineers to select, design, construct, inspect, and maintain erosion and sediment control measures. The web-version of the ES will enable additional user categories, (e.g., associate general contractors, design engineers, consultant engineers) to make use of the expertise assembled in the ES. Training sessions for various groups of users will be prepared by the developers of the ES aided by ESCM experts from Iowa DOT and elsewhere.

Project Number: TR-486

Project Title: Development of Abutment Design Standards for Local Bridge Designs

Agency: Iowa State University

Principal Investigator: F. Wayne Klaiber, David J. White, and Terry J. Wipf

Research Period: December 1, 2002 to August 31, 2003

Research Board Funding: $99,265

Funding Source: 100 percent State - 100 percent Secondary funds

Objective: The objective of the proposed project is to prepare a series of abutment designs that complement previously developed replacement superstructures. Although various systems will be reviewed, as a minimum the following will be reviewed in detail (and where appropriate, designs and construction drawings developed): a simple concrete abutment, the sheet pile backwall, and a timber backwall design.

Progress: A literature review and information search has been completed.

A valuable source of information has been the Iowa County Engineers. On June 10, 2003, a survey was sent to the county engineers to gather information on substructures used by various Iowa counties. Of the 99 counties, 42 have returned the completed survey.

At this time load calculations have also been completed. This includes dead loads for the different substructure systems. Also, the longitudinal loads such as wind loads on the structure and live load, longitudinal force (braking force), and lateral dead and live load earth pressures have been determined.

The Iowa DOT Bridge Design Manual (BDM) is being used as a guideline to determine the lateral and axial capacity of the abutment piles. However, the simple span bridge abutments being considered for this project do not qualify as standard stub abutments according to the BDM since they have much higher backwalls and do not utilize battered piles. For this reason, the assumptions made by the BDM are currently being investigated to determine if they are applicable for these abutment systems.

Reports: None

Implementation: The bridge abutments used by many counties do not qualify as standard stub abutments according to the BDM. As a result, we do not have standards that county engineers can use to help design these abutments. This research will help develop those standards.

Project Number: TR-487

Project Title: Development of Object Oriented Specifications for IADOT and Urban Standards

Agency: Iowa State University

Principal Investigator: Edward Jaselskis and Russell Walters

Research Period: October 1, 2002 to May 31, 2004

Research Board Funding: $124,999

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

Objective: The purpose of this research project is to perform a Phase I study to pilot test this idea and assess its impact on the design and construction of transportation projects. It is anticipated that some specifications (Iowa DOT and urban) will be included in an object-oriented format to demonstrate the concept. The research team plans to build off the current work related to the Electronic Reference Library since this is already in a useable format for this pilot project. In a sense, the end product will be a graphical or visual front end system for the ERL. One possible acronym is the Visual Electronic Reference Library (VERL). Full-scale development and maintenance issues will be addressed as part of the project. Workshops will be provided to obtain information on the usefulness of this idea.

Progress: Thus far, OO-CAD (Object Oriented Computer Aided Design) specification demonstration has been developed. A focus group approach will be used to obtain feedback on this idea. Also there is current review of the urban and Iowa DOT specifications and exploration of database options to work in concert with the graphical software.

Reports: Quarterly Progress Report, April 2003

Implementation: It will be easier for designers, field personnel, contractors, suppliers, and manufacturers to find the specifications relevant for a specific portion of the design. This should improve the efficiency of preparing the design documents and interpreting them in the field. It will also help DOT in maintaining a cutting-edge presence in information technologies since this may be a new paradigm in which projects will be constructed in the future.

Project Number: TR-488

Project Title: Economics of Using Calcium Chloride vs. Sodium Chloride for Deicing/Anti-icing

Agency: The University of Iowa

Principal Investigator: Wilfrid A. Nixon

Research Period: February 1, 2003 to July 31, 2004

Research Board Funding: $90,000

Funding Source: 100 percent State - 70 percent Primary funds, 25 percent Secondary funds, and 5 percent Street funds

Objective: The objective of this project is to determine what mixture of calcium chloride and sodium chloride is best applied to the road surface under winter weather conditions, to provide the best possible level of service to the public, in the most economical way possible. As part of this, economic factors, as well as ice melting capability will be considered, and operational impacts will be a major factor of consideration.

Progress: Studies are focusing on the relative performance of the two chemicals and mixtures of the two brines. The aim is to suggest the most cost effective mixture as a function of temperature. Experiments to find this are underway, and a suitable algorithm is being developed.

Reports: None

Implementation: The result of this study will be presented at an appropriate meeting in Iowa, after completion of the project. The report will also be made available via e-mail to all subscribers to the Snow and Ice mailing list, and will be placed on the SICOP web site (www.sicop.net).

Project Number: TR-489

Project Title: Innovative Solutions for Slope Stability Reinforcement and Characterization in Iowa Soils

Agency: Iowa State University

Principal Investigator: David J. White

Research Period: March 1, 2003 to September 1, 2005

Research Board Funding: $198,462

Funding Source: 100 percent State - 25 percent Primary funds and 75 percent Secondary funds

Objective: The objectives of this research are as follows:

- Identify state-of-the-art practices for design, construction and maintenance of earth slopes to reduce slope instability problems on new embankments and backslope cuts. Develop recommendations specific to Iowa site conditions.
- Document several failure sties (5-10) where failures have been observed in order to better understand conditions that lead to instability in Iowa.
- Show the validity of and develop appropriate test procedures (i.e. I.M.s) for determining shear strength parameters using the Borehole Shear Test (BST).
- Investigate and conduct simple pilot tests to evaluate various remediation techniques.
- Recommend design, construction and remediation alternatives for Iowa soil conditions to ensure slop stability of new embankment till and shallow backslopes.

Progress: In April and May, the research team visited a large landslide on B57 along the Des Moines River near Madrid. Following the initial field reconnaissance, air photos have been collected and examined to better understand the failure geometry. A topography laser scanning company from Florida has been contacted to discuss a field trail at this site. In June, the research team collected soil profile information near Sioux City, Iowa in loess for lab characterization, including shear strength parameters.

Reports: Quarterly Progress Report, July 2003

Implementation: A summary sheet will be created and a PowerPoint presentation will be made at appropriate local/regional conferences to help in design, construction and maintenance operations.

Project Number: TR-490

Project Title: Stringless Portland Cement Concrete Paving

Agency: Iowa State University

Principal Investigator: James K. Cable and Edward Jaselskis

Research Period: December 1, 2002 to December 31, 2003

Research Board Funding: $129,519

Funding Source: 7 percent outside sources and 93 percent State - 45 percent Primary funds, 50 percent Secondary funds, and 5 percent Street funds

Objective: Evaluation of the use of robotic total station control to guide the Trimmer, Slipform Paver and Cure Cart in the alignment and depth control of the final Portland cement concrete pavement. The research will compare the results to the design depths, quantities, alignment, profile and smoothness obtained by other means in similar projects in Washington County.

Progress: An agreement to do the research was signed on July 1, 2003.

Reports: None

Implementation: This method can revolutionize the paving in state, county and city paving in areas of limited right of way. It has the potential to eliminate human error in conventional ground surveys and slipform paver control staking. This relates to application in up to 10,000 miles of county road pavements in Iowa alone. It also relates to providing faster construction of concrete pavements with less effort and funds being expended in alignment control and more in the product being placed. It could also have a positive impact on pavement smoothness, and relieving urban construction area congestion.

Implementation steps would include:
1. Presentations at ICPA and ACPA state conferences and workshops
2. Presentations at APWA and ICEA conferences
3. Publication in PCC and CTRE publications

Project Number: TR-491

Project Title: Development of Winter Performance Measures for Maintenance Operations

Agency: The University of Iowa

Principal Investigator: Wilfrid A. Nixon

Research Period: July 1, 2003 to June 30, 2005

Research Board Funding: $100,000

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

Objective: The objective of this project is to create a method for measuring performance levels of winter maintenance operations during winter storms. The method must consider the severity of the storm, and must be able to measure the outcomes of the winter maintenance actions in such a way as to cumulatively assess the performance of those actions.

Progress: A contract was executed between the Iowa DOT and The University of Iowa on June 11, 2003 to perform this research.

Reports: None

Implementation: The results 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. The final report will be made available in pdf format on a web site.

Project Number: TR-492

Project Title: Embankment Quality Phase IV - Application to Unsuitable Soils

Agency: Iowa State University

Principal Investigator: David J. White

Research Period: May 15, 2003 to November 15, 2005

Research Board Funding: $169,067

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

Objective: Embankment Quality Phase IV research is to continue development and refinement of the Quality Management - Earthwork program (QM-E program), but with effort focused specifically on "unsuitable" soils. This phase will provide additional *Grading Certification Level I* training of contractor and field personnel on two separate pilot projects - preferably one in western Iowa and one in southern Iowa. The outcomes of this phase will be 1) final recommendations for QM-E implementation; 2) a proposed Iowa DOT developmental specification; and 3) improved data management tools for contractor quality control (QC) and Iowa DOT quality assurance (QA).

Progress: Project was initiated in May 2003.

Reports: None

Implementation: The results of this research and pilot studies will be used as a basis for developing statewide specification changes for improved roadway embankments.

Project Number: TR-493

Project Title: Performance Evaluation of Steel Bridges: Phase II

Agency: Iowa State University

Principal Investigator: Terry J. Wipf

Research Period: May 1, 2003 to April 30, 2006

Research Board Funding: $196,421

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

Objective: There are two primary objectives to the proposed research: first, to study the performance of bridges with suspect or untested design details; and second, to develop a low-cost system for use by secondary road bridge owners to easily monitor the conditions of infrastructure.

Progress: A contract was executed with Iowa State University to perform this research in March 2003.

Reports: None

Implementation: The product of this research will be a better understanding of two types of primary road bridges and the development of a low-cost monitoring system for secondary road bridges. With the behavior information for the primary road bridge, the bridge owner will likely gain confidence in the performance of two bridge types. Also, secondary road bridge owners will have a low-cost system for monitoring bridges for specific behaviors or events.

Project Number: TR-494

Project Title: Statistical Analysis of Highway Needs Condition Data: Manual vs. Automated

Agency: Iowa State University

Principal Investigator: Omar Smadi

Research Period: March 1, 2003 to September 30, 2003

Research Board Funding: $17,405

Funding Source: 100 percent State - 100 percent Secondary funds

Objective: The object of this project is to conduct a statistical analysis to examine the differences and/or similarities of the condition data collected manually and in an automated fashion. This information will help the advisory committee responsible for finding alternatives to the current highway needs process to make an informed decision whether HWYNEEDS should be converted to a PC platform and modified to be used by the counties to distribute the counties' share of the RUTF.

Progress: As of June 30th, all of the tasks related to the statistical analysis had been completed. Staff support to the advisory committee has been provided to investigate the possibility of distributing RUTF among the counties based on a regression equation that considers condition.

Reports: None

Implementation: The results will be reported to the project advisory committee. The committee will use the information in developing a recommendation for future Road Use Tax Fund distribution methods for Iowa counties.

Project Number: TR-495

Project Title: Field Evaluation of Compaction Monitoring Technology

Agency: Iowa State University

Principal Investigator: E. Thomas Cackler

Research Period: May 15, 2003 to February 28, 2004

Research Board Funding: $75,000

Funding Source: 40 percent other sources and 60 percent State - 80 percent Primary funds, 10 percent Secondary funds, and 10 percent Street funds

Objective: The projects objectives are as follows:

1. Evaluate compaction-monitoring technology under actual field conditions for a wide range of soil, aggregate, and asphaltic concrete materials available in Iowa.
2. Identify needed refinements to the technology and communication systems and make appropriate modifications.
3. Develop model QC/QA guidelines using this technology.
4. Identify the technologies potential benefit to contractors and project owners.

Progress: Project initiated in May 2003.

Reports: None

Implementation: The project will result in advances in real-time compaction monitoring technology, which will provide contractors and project owners improved job site safety, faster construction, and greater cost savings. The motoring public will also benefit from reductions in travel delays and disruption. The project will contribute significantly to the American Association of State Highway and Transportation Officials (AASHTO) Subcommittee on Construction's priorities of research into rapid, real-time testing.

Project deliverables include:

- Field validation of compaction monitoring technology on earthwork and asphalt paving applications.
- Identification of the technology's potential benefits to contractors and project owners.
- Model QC/QA guidelines to be used with the technology.

Project Number: TR-497

Project Title: Manual of Iowa Drainage Law

Agency: Iowa State University

Principal Investigator: Stephen J. Andrle

Research Period: July 1, 2003 to March 31, 2004

Research Board Funding: $59,965

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

Objective: The objective of this project is to develop a manual that clearly and completely describes drainage laws that are applicable to the entire state of Iowa and those specific to Iowa's drainage districts. The manual will provide a comprehensive reference for Iowa engineers, landowners, drainage district commissioners, county drainage clerks, county supervisors and other officials, contractors, and other interested people of drainage laws and general legal principles of drainage as well as potential impacts on construction and maintenance of drainage improvements.

Progress: The project was initiated July 1, 2003.

Reports: None

Implementation: Iowa counties, cities, and the Iowa DOT will be able to apply the research results and products to improve efficiency, procedures, and communications. Affected landowners and interested others will also benefit from having access to the information in the manual. The manual will serve to answer questions, reduce confusion, and facilitate mutually beneficial, rather than adversarial relationships between parties affected by drainage issues and transportation projects.

Project Number: TR-498

Project Title: Field Testing of Railroad Flat Car (RRFC) Bridges

Agency: Iowa State University

Principal Investigator: F. Wayne Klaiber
Writing
Research Period: June 1, 2003 to September 30, 2004

Research Board Funding: $121,096

Funding Source: 100 percent State - 100 percent Secondary funds

Objective: The primary objective of this proposed research is to obtain more data on the structural behavior of additional RRFC bridges. To date only two RRFC demonstration bridges have been constructed and tested. Numerous other variables need to be investigated. Refinement of the design methodology presented in TR-444 is needed as well as the development of a load rating process for these types of bridges.

Progress: A contract has been executed between the Iowa DOT and Iowa State University to conduct the research.

Reports: None

Implementation: The primary value of the proposed research is to provide counties with a bridge superstructure alternative that is relatively inexpensive and easy to install. Results of this investigation will expand the current level of knowledge in the area of using RRFC for LVR bridges and will improve the design methodology previously developed in TR-444. The rating methodology developed in this investigation will make it possible for county engineers and consultants to rate these types of bridges.

Project Number: TR-499

Project Title: Effectiveness of Electrochemical Chloride Extraction (ECE) for the Iowa Avenue Pedestrian Bridge

Agency: NNW, Inc.

Principal Investigator: Steven Jacobsen and Hosin "David" Lee (The University of Iowa)

Research Period: July 15, 2003 to January 31, 2004

Research Board Funding: $30,000

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

Objective: This research effort is expected to provide local engineers and contractors with a better understanding of the ECE process as it applies to bridge decks. It is hoped that research will show that the ECE process is an effective method to prolong the useful life of bridge decks and thus provide a replacement cost savings to the Iowa people.

Progress: An agreement was signed July 25, 2003 to conduct the research.

Reports: None

Implementation: The research findings are expected to determine the short-term and long-term effectiveness and justification for the ECE process for various depths or thicknesses of slabs. If the ECE proves effective, it would extend the life of bridges, thereby reducing the costs for bridge replacement.

Construction specifications would be written to include testing of the deck concrete and extraction when required.

The results of this investigation will be available on-line. Area engineers and contractors would also be invited to view the ECE process during the extraction.

Project Number: TR-500

Project Title: Evaluation of the Compensatory Wetland Mitigation Program in Iowa

Agency: Iowa Department of Transportation

Principal Investigator: Kelly Poole

Research Period: July 24, 2003 to July 31, 2004

Research Board Funding: $6,802

Funding Source: 100 percent State - 100 percent Primary funds

Objective: This research will focus on characterizing wetland mitigation projects at a minimum of 24 randomly selected sites. The research objectives are to

1) determine if project areas meet the definition of a jurisdictional wetland, and
2) determine degree of compliance with requirements specified in Clean Water Act Section 404 permits.

Progress: The project was initiated July 24, 2003.

Reports: None

Implementation: The results of this study will form the basis of more detailed biological, chemical and physical investigations of selected mitigation sites. In addition, the results of this work will provide a means for evaluating restoration and construction techniques and provide valuable information toward improving the DOT's compensatory wetland mitigation efforts as we respond to an increasing number of non-compliance inquiries. The results of this work will be integrated with the results of additional studies which will be submitted for publication in a peer-reviewed journal.

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.

Project Number: HR-1080

Project Title: Synthesis of Dowel Bar Research

Agency: Iowa State University

Principal Investigator: Max Porter

Research Period: July 1, 2001 to August 15, 2002

Research Board Funding: $29,997

Funding Source: 100 percent State - 100 percent Primary funds

Objective: The objective of the study was to investigate the latest completed and on-going research from across the nation to locate the gaps and duplications in recent dowel bar research.

Reports: Final Report, August 2002

Implementation: The results of this synthesis will guide the nation's research program concerning the use of alternative materials and shapes for pavement dowel bars.

Project Number: HR-1081

Project Title: Development of In-Situ Detection Methods for Material Related Distress (MRD) in Concrete Pavements, Phase II Extension

Agency: Iowa State University

Principal Investigator: Scott Schlorholtz and Kejin Wang

Research Period: January 1, 2003 to December 31, 2003

Research Board Funding: $25,000

Funding Source: 100 percent State - 100 percent Primary funds

Objective: The research is designed to evaluate and develop methods to detect and quantify material related distress in PCC pavements by completing the following:

1. Identify current techniques (preferably nondestructive) that can be used to identify the condition of the aggregates and the cement paste throughout the depth of the Portland cement pavement at any given time in the life of the pavement.
2. Identify the gaps in the current NDT methods for identification of MRD.
3. Evaluate the most promising MRD methods identified in the Phase I effort.

Progress: Ground penetrating radar (GPR) technique was selected for a preliminary round of "proof-of-concept" trails. The Mandli pavement profile scanner (PPS) system was also selevted for use in the preliminary round of "proof-of-concept" trails; however, technical problems delayed the use of that system until Phase 2 of the project.

GPR surveys were carried out over a variety of Portland cement concrete pavements using two different systems. Surveys conducted with both sets of equipment have produced test results capable of identifying subsurface distress in two of the three sites that were investigated. Both systems failed to detect distress in a single pavement that exhibited extensive cracking. The initial positive results presented here indicate that a more thorough study (incorporating refinements to the system, data collection and analysis) is needed.

Reports: None

Implementation: The results of the previous Iowa research and development efforts and the evaluation of the MRD methods should be communicated to the general highway industry through newsletters, electronic media and workshops for the ICPA, ICEA, and APWA members.

The method developed for distress identification should be demonstrated through workshops in various parts of the state for consultants, state and local government persons to view.