ANNUAL REPORT
OF
HIGHWAY DIVISION
HIGHWAY RESEARCH AND DEVELOPMENT
IN IOWA

DECEMBER 2004

Attachment 6 to
FY 2004 Annual Report -
Research, Intelligent Transportation Systems, and
Technology Transfer Activities

Iowa Department of Transportation

IHRB
IOWA HIGHWAY
RESEARCH BOARD

ANNUAL REPORT
OF
HIGHWAY DIVISION
HIGHWAY RESEARCH AND DEVELOPMENT
IN IOWA

FOR THE
FISCAL YEAR ENDING JUNE 30, 2004

RESEARCH AND TECHNOLOGY BUREAU
(515) 239-1447
www.dot.state.ia.us/materials/research/research_home

HIGHWAY DIVISION
IOWA DEPARTMENT OF TRANSPORTATION
AMES, IOWA 50010

DECEMBER 2004

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LIST OF ACRONYMS

AASHTO - American Association of State Highway and Transportation Officials
AC - Asphalt Cement
ACC - Asphalt Cement Concrete
ACPA - American Concrete Paving Association
APWA - American Public Works Association
BMP - Best Management Practice
BST - Borehole Shear Test
CIPR - Cold In-Place Recycling
CTRE - Center for Transportation Research and Education
DOT - Department of Transportation
FHWA - Federal Highway Administration
FRP - Fiber Reinforced Polymer
FWD - Falling Weight Deflectometer
GFRP - Glass Fiber Reinforced Polymer
GIS - Geographic Information System
GPS - Global Positioning System
HMA - Hot Mix Asphalt
IHRB - Iowa Highway Research Board
ICPA - Iowa Concrete Paving Association
ICEA - Iowa County Engineers Association
ISU - Iowa State University
LVR - Low Volume Road
NCHRP - National Cooperative Highway. Research Program
NDT - Non-Destructive Testing
PC - Prestressed Concrete
PCA - Portland Cement Association
PCC - Portland Cement Concrete
PI - Principal Investigator
QA - Quality Assurance
QC - Quality Control
QM-E - Quality Management - Earthwork
RAP - Recycled Asphalt Pavements
RC - Reinforced Concrete
SHRP - Strategic Highway Research Program
SUDAS - Statewide Urban Designs and Specifications
TAC - Technical Advisory Committee
TRB - Transportation Research Board
U of I - The University of Iowa
WIM - Weigh in Motion

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, 2004; it is also a report on projects completed during the fiscal year beginning July 1, 2003, and ending June 30, 2004. Detailed information on each of the research and development projects mentioned in this report is available in the Research and Technology Bureau 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 Iowa 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 for a three-year term. The membership of the Research Board as of June 30, 2004, is listed in Table I.

The Research Board held seven regular meetings during the period of July 1, 2003, to June 30, 2004. Suggestions for research and development were reviewed at these meetings and recommendations were made by the Board.

TABLE I
2003-2004 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 - District 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	Danny Waid Howard County Engineer 137 N. Elm Street Cresco, IA 52136 (563) 547-2620 SS# 045
Roger Gould Process Management Engineer Iowa DOT - Engineering Bureau 800 Lincoln Way Ames, IA 50010 (515) 239-1834	12-31-06	James Berger Director of Materials Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1843
Lowell Greimann Dept of Civil, Const. & Env. Engr. Iowa State University 390 Town Engineering Bld. Ames, IA 50011 (515) 294-5586		-
Jon Ites Buena Vista County Engineer 215 E. 5th Street P.O. Box 368 Storm Lake, IA 50588 (712) 749-2540 SS# 011	12-31-06 District 3	Steve Camp Pocahontas County Engineer 99 Court Square, Suite 4 Pocahontas, IA 50574-1629 (712) 335-3252 SS #076

Larry Jesse Director of Local Systems Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1291	12-31-06	Ahmad Abu-Hawash Chief Structural Engineer Iowa DOT - Bridges and Structures 800 Lincoln Way Ames, IA 50010 (515) 239-1393
Jeff Krist Project Manager Public Works Department 209 Pearl Street Council Bluffs, IA 51503 (712) 328-4635	12-31-06	Richard Fosse City Engineer 410 E. Washington Iowa City, IA 52246-5717 (319) 356-5143
Charles Marker Cass County Engineer 5 W. 7th Street Atlantic, IA 50022 (712) 243-2442 SS# 015	12-31-05 District 4	John Rasmussen Pottawattamie County Engineer 223 South 6th Street Council Bluffs, IA 51501 (712) 328-5608 SS# 078
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
Clark Schloz Jackson County Engineer 201 W. Platt Maquoketa, IA 52060 (563) 652-4782 SS# 049	12-31-06 District 6	Steve Gannon Linn County Engineer 1888 County Home Road Marion, IA 52302-9753 (319) 892-6400 SS# 057
John Selmer District Engineer Iowa DOT - District 4 63200 White Pole Rd. P.O. Box 406 Atlantic, IA 50022 (712) 243-3355	12-31-04	Glen Miller Construction Engineer Iowa DOT - 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 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, 2004. Total expenditure was $1,930,473.09.

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 Research and Technology Bureau, Operations 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 Research and Technology Bureau, Operations 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 0.055 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.

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 25 counties during fiscal year 2004 as part of the Annual Traffic Count Program. This activity consisted of 290 portable recorder classification counts, 5,200 portable recorder volume counts and 53 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 90 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 2004 financial summary is:

Beginning Balance 7-1-03		$2,736,867.19
Receipts		
State Road Use Tax Fund (1½% of receipts)	$1,159,198.96	
Federal Aid Secondary (1½% of receipts)	0.00	
Research Income	0.00	
Sub-Total		$1,159,198.96
Total Funds Available		$3,896,066.15
Obligation for Expenditures		
Obligated for Contract Research	1,291,773.25	
Non-Contract Engineering Studies	0.00	
Total Expenditures		1,291,773.25
BALANCE 6-30-04		$2,604,293.15

STREET RESEARCH FUND

The Street Research Fund was established in 1989 under Section 312.3A of the Iowa Code. Each year $200,000 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 2004 financial summary is:

Beginning Balance (7-1-03)	$ 140,577
FY04 Street Research Funding	200,000
Total Funds Available for Street Research	$340,577
Total obligated for Expenditure	$318,765
Ending Unobligated Balance 6-30-04	$21,812

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. The amount expended for contract research from the Primary Road Research Fund for FY04 was $871,347.15 and the estimate for FY05 is $750,000.

PROJECTS INITIATED DURING FY 2004

The new projects initiated during FY 2004 were:

TR-496, "Development of Standard Plans for the Design of Single Span Pretensioned, Prestressed Concrete Beam Bridges with Concrete Abutments"
TR-501, "Optimization and Management of Materials in Earthwork Construction"
TR-502, "Evaluation of Long Term Field Performance of Cold In-Place Recycled Roads"
TR-503, "Utility Cut Repair Techniques - Investigation of Improved Utility Cut Repair Techniques to Reduce Settlement in Repaired Areas"
TR-504, "Extensions to the Iowa Culvert Hydraulics Software - The Design of Energy Dissipators"
TR-505, "Improving PCC Mix Consistency & Production by Mixing Improvements"
TR-506, "Determination and Evaluation of Alternate Methods for Managing and Controlling Highway-Related Dust, Phase II - Demonstration Project"
TR-507, "Thin Maintenance Surfaces Phase III - Municipal Streets and Low-Volume Rural Roads"
TR-508, "Design Guide and Construction Specifications for NPDES Site Runoff Control"
TR-509, "AASHTO 2002 Pavement Design Guide Implementation Plan - Phases I and II"
TR-510, "Laboratory Study of Structural Behavior of Alternative Dowel Bars"
TR-511, "Design and Construction Procedures for Concrete Overlay and Widening of Existing Pavements"
TR-512, "Measuring Pavement Profile at the Slipform Paver"
TR-513, "Decision Support Model for Assessing Archaeological Survey Needs for Bridge Replacement Projects in Iowa"
TR-514, "Development of a Manual of Practice for Roadway Maintenance Workers"
TR-515, "A Guide for Monitoring and Protecting Bridge Waterways Against Scour"
TR-516, "Measurement of Seasonal Changes and Spatial Variation in Pavement Subgrade Support Properties - A Link to Pavement Performance"
TR-517, "Guidelines for Safety Treatment of Roadside Culverts"
TR-518, "Monitoring Wind-Induced Vibrations/Stresses in a High Mast Lighting Tower"
TR-519, "Developing Flood-Frequency Discharge Estimation Methods for Small Drainage Basins in Iowa"
TR-520, "Evaluation of Dowel Bar Retrofits for Local Road Pavements"

21 projects

Table II

FINANCIAL SUMMARY OF RESEARCH AND DEVELOPMENT PROJECT EXPENDITURES

July 1, 2003 to June 30, 2004

(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	100,000/year	ISU Local Technical Assistance Program (LTAP)	10,000.00	11,603.67	45,000.00	66,603.67
375	22,400	Transportation Research Board Education for Co. Engineers				
394	672,152	Transportation Program Management System	16,652.00	47,222.38	2,839.91	66,714.29
399	299,932	Field Testing of Integral Abutments				
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	1,179.64	150.00	1,500.00	2,829.64
420	98,478	Field Evaluation of Alternative Load Transfer Device Locations in Low Traffic Volume		26,552.79	15,459.52	42,012.31
422	14,000	Pretreatment for Reduction of Asphalt Absorption in Aggregate				
424	178,358	Steel Diaphragms in Prestressed Concrete Girder Bridges	4,168.32	6,266.43	1,007.87	11,442.62
427	26,200	Evaluation of High-Slump Concrete for Bridge Deck Overlays	1,027.06	770.30	770.30	2,567.66
428	294,760	Effective Structural Concrete Repair	4,695.91	1,519.75		6,215.66
429	195,060	Evaluation of Appropriate Maintenance Repair and Rehabilitation Methods for Iowa	8,777.65	8,765.02	1,928.12	19,470.79
432	183,903	Ultrathin PCC Overlay Extended Evaluation	22,874.78	9,036.44	990.16	32,901.38
438	142,903	Integral Abutment Bridge With Precast Concrete Piles	560.32	5,486.83	5,078.25	11,125.40
450	80,000	Identification of Laboratory Techniques to Optimize Superpave HMA Surface Friction Characteristics				
452	48,865	Solutions to Meet the Service Needs of Low Volume Bridges		4,886.45		4,886.45
456	107,800	Measuring Main-Channel Slopes for Major Rivers in Iowa	10,900.00	3,100.00		14,000.00
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 Maint.		13,503.43		13,503.43
459	67,133	Reuse of Lime Sludge From Water Softening	8,677.56		20,898.83	29,576.39
460	87,924	Living Snow Fences				
461	70,000	Soil Stabilization of Non-Uniform Subgrade Soils	2,278.17	1,797.16	1,316.91	5,392.24
463	99,804	Field Performance Study of Past Iowa Pavement Research				
466	47,049	Evaluation of Unbonded Ultrathin Whitetopping of Brick Streets	668.60	267.40	1,738.20	2,674.20
467	190,890	Investigation of the Modified Beam-in-Slab Bridge System		42,737.33		42,737.33
468	10,000	Technology Transfer Program for the IHRB		224.00		224.00
469	139,832	Reduction of Concrete Deterioration by Ettringite Using Crystal Growth Inhibition Techniques-Part II-Field Evaluation	38,408.05	10,968.56	12,424.23	61,800.84
470	59,272	Development of a Method to Determine Pavement Damage Due to Detours and Haul Roads	1,752.82	5,771.05	2,555.12	10,078.99
471	100,000	Evaluation of Using Non-Corrosive Deicing Materials and Corrosion Reducing Treatments for Deicing Salts		6,623.72	3,720.25	10,343.97
472	80,000	Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipment	9,921.31	14,571.73		24,493.04
473	178,197	Rehabilitation of Concrete Pavements Utilizing Rubblization and Crack and Seat Methods	8,360.30	63,496.71		71,857.01
474	228,469	Development of a Mix Design Process for Cold-In-Place Rehabilitation Using Foamed Asphalt	40,154.43	16,114.23	3,421.53	59,690.19
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		2,500.22		2,500.22
478	49,520	Evaluation of Composite Pavement Unbonded Overlays				
480	80,000	Long Term Effects of Concentrated Salt Solutions on PCC				
481	120,000	Identification of the Best Practices for the Design, Construction, and Repair of Bridge Approach Sections	20,526.80	36,661.08		57,187.88
482	100,000	Determination of the Optimum Base Characteristics for Pvmts.	29,813.64	30,000.00	5,000.00	64,813.64
483	145,775	Evaluation of Hot Mix Asphalt Moisture Sensitivity Using the Nottingham Asphalt Test Equipment	37,651.63	5,996.54		43,648.17
484	159,666	Materials and Mix Optimization Procedures for PCC Pavements	66,252.08	27,603.38	2,138.59	95,994.05
485	38,757	Development and Implementation of a Web-Based Expert System for Erosion and Sediment Control Measures		374.11		374.11

Project	Total Funds Committed	Project Title	Primary Road Research Fund Expenditures	Secondary Road Research Fund Expenditures	Street Research Fund Expenditures	Total Expenditures
486	99,265	Development of Abutment Design Standards for Local Bridge Designs		72,090.34		72,090.34
487	124,999	Development of Object Oriented Specifications for IADOT and Urban Standards	24,917.84	57,125.53	6,016.85	88,060.22
488	90,000	Economics of Using Calcium Chloride vs. Sodium Chloride for Deicing/Anti-icing	49,129.85			49,129.85
489	198,462	Innovative Solutions for Slope Stability Reinforcement and Characterization in Iowa Soils	39,378.55	62,354.12		101,732.67
490	129,519	Stringless Portland Cement Concrete Paving	38,980.57	38,278.85		77,259.42
491	100,000	Development of Winter Performance Measures for Highway Winter Maintenance Operations	30,056.74			30,056.74
492	169,067	Embankment Quality Phase IV - Application to Unsuitable Soils	64,782.71			64,782.71
493	196,421	Performance Evaluation of Steel Bridges: Phase II	7,661.17			7,661.17
494	17,405	Statistical Analysis of Highway Needs Condition Data: Manual vs. Automated		3,996.15		3,996.15
495	75,000	Field Evaluation of Compaction Monitoring Technology	55,913.93			55,913.93
496	179,250	Development of Standard Plans for the Design of Single Span Pretensioned, Prestressed Concrete Beam Bridges with Concrete Abutments		27,397.79		27,397.79
497	59,965	Manual of Iowa Drainage Law	11,430.83	27,891.57		39,322.40
498	121,096	Field Testing of Railroad Flat Car Bridges		51,102.13		51,102.13
499	30,000	Effectiveness of Electrochemical Chloride Extraction for the Iowa Avenue Pedestrian Bridge	17,491.78			17,491.78
500	6,802	Evaluation of the Compensatory Wetland Mitigation Program	2,000.00			2,000.00
501	175,000	Optimization & Management of Materials in Earthwork Construction	17,263.08	6,191.60		23,454.68
502	145,216	Evaluation of Long Term Field Performance of Cold In-Place Recycled Roads	27,161.45	2,298.36		29,459.81
503	119,412	Utility Cut Repair Techniques	24,943.66		6,075.03	31,018.69
504	40,000	Extensions to the Iowa Culvert Hydraulics Software - The Design of Energy Dissipators	6,818.40			6,818.40
505	164,764	Improving PCC Mix Consistency & Production by Mixing Improvements	17,559.62		4,245.02	21,804.64
506	107,070	Determination and Evaluation of Alternate Methods for Managing and Controlling Highway-Related Dust, Phase II		21,526.09		21,526.09
507	86,373	Thin Maintenance Surfaces Phase III - Municipal Streets and Low-Volume Rural Roads	13,176.85	10,597.61	1,495.31	25,269.77
508	207,800	Design Guide and Construction Specifications for NPDES Site Runoff Control	15,800.58	2,637.81	8,485.92	26,924.31
509	75,003	AASHTO 2002 Pavement Design Guide Implementation Plan	15,866.56			15,866.56
510	57,992	Lab Study of Structural Behavior of Alternative Dowel Bars	13,137.28			13,137.28
511	101,578	Design and Construction Procedures for Concrete Overlay and Widening of Existing Pavements	2,504.72			2,504.72
512	75,000	Measuring Pavement Profile at the Slipform Paver	1,081.36	812.79		1,894.15
513	50,000	Decision Support Model for Assessing Archaeological Survey Needs for Bridge Replacement Projects in Iowa		1,775.48		1,775.48
514	64,991	Development of a Manual of Practice for Roadway Main. Wrkrs.		482.05		482.05
515	80,816	A Guide for Monitoring and Protecting Bridge Waterways Against Scour		5,922.85		5,922.85
516	40,000	Measurement of Seasonal Changes and Spatial Variation in Pavement Subgrade Support Properties				
517	24,995	Guidelines for Safety Treatment of Roadside Culverts				
518	80,819	Monitoring Wind-Induced Vibrations/Stresses in a High Mast Lighting Tower				
519	78,000	Developing Flood-Frequency Discharge Estimation Methods for Small Drainage Basins in Iowa				
520	146,708	Evaluation of Dowel Bar Retrofits for Local Road Pavements				
1027		Secondary Road Research Coordinator		74,454.44		74,454.44
1081	25,000	Development of In-Situ Detection Methods for Material Related Distress (MRD) in Concrete	6,396.30			6,396.30
		Contract Research Total	871,347.15	896,346.27	162,779.67	1,930,473.09

HR-296

Agency:
Iowa State University

Principal Investigator:
Duane Smith

Research Period:
October 1, 1986 to December 31, 2004

Research Board Funding:
$100,000 per year

Funding Source:
35.9% Federal funds, 15.4% 402 Safety funds, 14.4% ISU/Midwest Transportation Center funds, 8.7% Workshop income funds and 25.6% State - 10% Primary funds, 45% Secondary funds and 45% Street funds

promote research - encourage implementation - distribute research data

Iowa State University Local Technical Assistance Program (LTAP)

Objective: The objective of this project is to help Iowa's local governments keep up with growing demands on local roads, streets, bridges, and public transportation. The center provides technical and management assistance to Iowa's local transportation officials through a variety of programs.

Progress: The major tasks are the following:

- publishing at least six *Technology News* newsletters per year,
- conducting at least 10 training courses/workshops per year,
- distribute publications,
- provide service and information to users, and
- 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.

HR-375

Agency:
Iowa Department of Transportation, Highway Division

Principal Investigator:
Edward J. Engle

Research Period:
November 1, 1994, on-going

Research Board Funding:
$22,400

Funding Source:
100% State - 100% Secondary funds

Transportation Research Board Education for County Engineers

Objective: The objective of the project is to send two county engineers annually to the TRB Annual Meeting in Washington, D.C., for research education. County engineers selected are generally those starting their term as regular members of the 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 2004, a total of 18 county engineers were sent to TRB.

Reports: None

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

HR-394

Agency:
Iowa County Engineers Association Service Bureau

Principal Investigator:
Steve DeVries

Research Period:
August 1, 1996 to September 30, 2003

Research Board Funding:
$672,152

Funding Source:
100% State - 25% Primary funds, 70.7% Secondary funds and 4.3% Street funds

Transportation Program Management System, Phase I-IV

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

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

Reports: Final Report, September 2003

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 real-time project status at any time.

HR-399

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% State -
50% Primary funds,
35% Secondary funds
and 15% 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 do the following:

- Evaluate the state-of-the-art of integral abutment design.
- 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 2004.

Reports: Interim Report, August 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.

TR-412

Agency:
The University of Iowa

Principal Investigator:
Wilfrid A. Nixon

Research Period:
August 1, 1997 to December 31, 2004

Research Board Funding:
$65,000

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

Development of a Computer Controlled Underbody Plow

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 methodology required that first the force signature of an underbody plow scraping ice be studied. The forces indicate when the underbody plow is successfully scraping ice and also when it is not. In the latter case, the blade will likely ride along the top of the ice surface and not remove any significant amount of ice.

Optimal performance results when the ratio of vertical scraping force to horizontal scraping force lies within a certain range. Under normal operating conditions, the underbody plow blade angle must be set and continuously adjusted to achieve this operating range.

The approach chosen was to use a combination of fuzzy logic and neural network algorithms such that an appropriate measure of control was developed for the system. An algorithm has been developed that meets the system requirements and tested electronically. The project scope specifically excluded field testing this system; thus, any field implementation would require further study.

The final report of this project is being written and should be completed by December 31, 2004.

Reports: None

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.

TR-414

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

Principal Investigator:
Edward J. Engle and respective County Engineers

Research Period:
July 1, 1997 to December 31, 2004

Research Board Funding:
$50,000

Funding Source:
100% State -
100% Secondary funds

Gyratory mix design process

Superpave Mix Designs for Low Volume Roads

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

Progress: All of the eight final projects are completed. Regular distress and performance surveys have been performed. The draft final report is nearing completion and will be presented to the Board in fall of 2004.

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 be an attractive alternative for counties statewide. This is especially true as state ACC projects are shifted to 100% Superpave.

TR-419

Agency:
Snyder and Associates, Inc.

Principal Investigator:
Todd J. Happel

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

Research Board Funding:
$30,000

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

Education on Urban Corridor Issues Through Computer Animation

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.

TR-420

Agency:
Iowa State University

Principal Investigator:
James K. Cable

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

Research Board Funding:
$98,478

Funding Source:
100% State - 80% Secondary funds and 20% Street funds

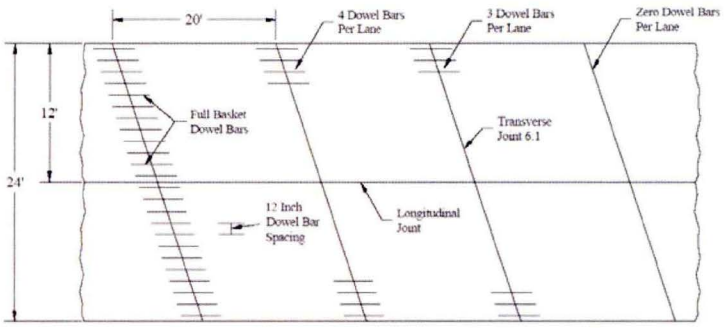
Alternative dowel basket locations can provide material and construction savings.

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

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.

Reports: Final Report, February 2004

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



Typical Dowel Bar Placement

TR-422

Agency:
Iowa Department of Transportation and Louisa County

Principal Investigator:
Edward J. Engle and John Hinrichsen

Research Period:
August 1998 to April 2005

Research Board Funding:
$14,000

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

Pretreatment for Reduction of Asphalt Absorption in Porous Aggregate

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

Progress: The paving project was completed in the summer of 1998. Evaluations of the pavement have been performed in conjunction with another research project (TR-414). 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.

TR-424

Agency:
Iowa State University

Principal Investigator:
Robert Abendroth and Fouad S. Fanous

Research Period:
January 1, 1999 to April 30, 2004

Research Board Funding:
$178,358

Funding Source:
100% State -
65% Primary funds,
25% Secondary funds
and 10% Street funds

Steel Diaphragms in Prestressed Concrete Girder Bridges

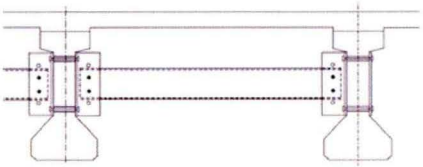
Objective: The objectives of the research are the following:

- Evaluate the state-of-the-art regarding the role of intermediate diaphragms in distributing lateral loads throughout PC girder bridge structures.
- Investigate the static and dynamic-load response characteristics of different types and configurations of intermediate diaphragms in PC girder bridges.
- 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.

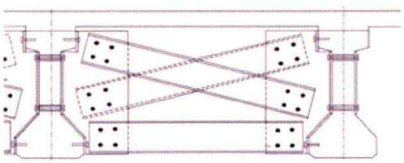
Reports: Final Report, September 2004

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 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.

Reinforced Concrete Diaphragm



Steel Channel Diaphragm



Steel X-Brace Diaphragm

TR-427

Agency:
Iowa Department of Transportation and Buchanan County

Principal Investigator:
Edward J. Engle

Research Period:
December 21, 1998 to April 30, 2005

Research Board Funding:
$26,200

Funding Source:
100% State -
40% Primary funds, 30% Secondary funds and 30% Street funds

The concrete could be delivered from local ready mix suppliers and placed in large quantities with standard equipment.

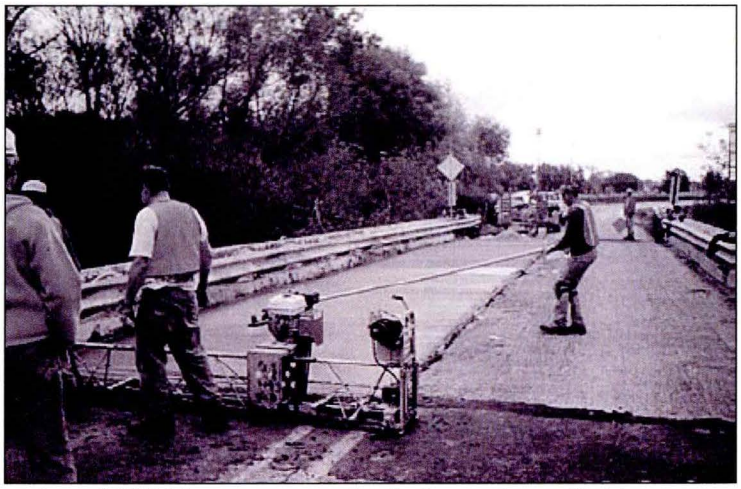
Evaluation of High-Slump Concrete for Bridge Deck Overlays

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. Several additional bridge decks have been overlaid with this method successfully since these first projects. A final report will be prepared by December 2005.

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.



PCC Placement on the Independence Bridge

TR-428

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

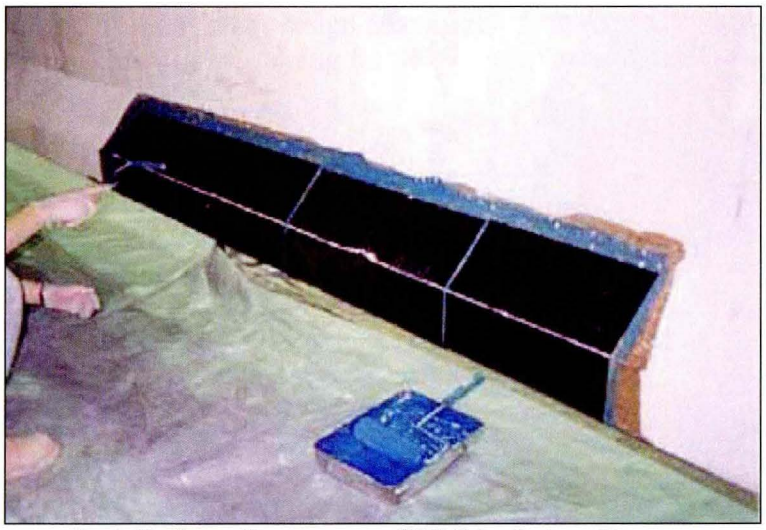
Funding Source:
100% State -
45% Primary funds,
45% Secondary funds
and 10% Street funds

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

Progress: A final report summarizing the work to date was presented. Also, a synopsis of the installation procedures used for each of the FRP wraps has been created for use by maintenance personnel. The synopsis is included as an appendix to the final report. A revised final report will be prepared in 2008 to reflect the service life of the documented repairs.

Reports: Final Report, April 2004

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.



Installation of transverse CFRP jacket on Beam

TR-429

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% State -
45% Primary funds,
45% Secondary funds
and 10% Street funds

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

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.

Jacketing of Deteriorated Timber Piles

TR-432

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% State -
50% Primary funds, 45% Secondary funds and 5% Street funds

Ultrathin PCC Overlay Extended Evaluation

Objective: The objectives of the project are as follows: 1) Evaluate conventional methods of slab removal and surface preparation for removal and replacement areas, 2) Evaluate the condition of the asphalt concrete surface under removal and replacement areas, 3) Evaluate the cost/benefit of polypropylene fiber addition to the concrete, 4) Evaluate the performance of the rehabilitated sections, and 5) Validate the existing ultrathin whitetopping design procedures of the PCA and ACPA for application in Iowa.

Progress: Data collection in the form of FWD, coring and distress surveys have been completed and are under analysis at this time. A draft report is being prepared for delivery.

Reports: Construction Report, July 2000 and 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

TR-438

Agency:
Iowa State University

Principal Investigator:
Robert Abendroth

Research Period:
July 1, 1999 to June 30, 2004

Research Board Funding:
$142,903

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

An Integral Abutment Bridge With Precast Concrete Piles

Objective: The research objectives are the following:

- 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.
- 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.
- Establish the longitudinal displacement versus temperature behavior for the abutments of the Tama County Bridge.

Progress: Final analysis is being performed on the data and a final report will be delivered in the fall of 2004.

Reports: None

Implementation: The results obtained from this research will provide bridge design engineers with a better understanding of the behavior of the PCC abutment piles in the Tama County integral-abutment bridge. Engineers with the Office of Bridges and Structures 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.

TR-450

Agency:
Purdue University and sub-contract with Iowa State University

Principal Investigator:
Rebecca S. McDaniel (Purdue University) and Brian Coree (Iowa State University)

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

Research Board Funding:
$80,000 (Purdue University - $23,674; Iowa State University - $56,326)

Funding Source:
Pooled funds coordinated by North Central Superpave Center at Purdue University - 50% Institute for Safe, Quiet, and Durable Highways funds, 25% Indiana DOT funds and 25% State - 100% Primary funds

Identification of Laboratory Techniques to Optimize Superpave HMA Surface Friction Characteristics

Objective: The main purpose of this research is to evaluate various blends of aggregates to optimize the combination of micro- and macro-texture 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: The dynamic friction tester and circular texture meter were received in March. The Purdue machine shop completed fabrication of a laboratory polisher for accelerating the polishing of slabs of hot mix. Sources of aggregates for testing are being determined in consultation with members of the TAC and the Co-PI at ISU. Aggregate selection and sampling is in progress. A graduate student has been selected to work on the project.

Reports: None

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

TR-452

Agency:
Iowa State University

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

Research Period:
March 1, 2001 to July 31, 2004

Research Board Funding:
$48,865

Funding Source:
100% State - 100% Secondary funds

There are approximately 22,000 bridges on Iowa's Secondary Road System.

Alternative Solutions to Meet the Service Needs of Low Volume Bridges In Iowa

Objective: The objective of this phase of the project is to develop a reference document to address common problems in 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.

Reports: Final Report, September 2004

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.

TR-456

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% Federal funds and 50% State - 50% Primary funds, 50% Secondary funds

Measuring Main-Channel Slopes for Major Rivers in Iowa

Objective: To measure main channel slope using GIS along major rivers in Iowa, plot graphs of those measurements, and compare them to manual measurements to determine if adjustments are necessary.

Reports: Final Report, October 2003

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

TR-457

Agency:
The University of Iowa

Principal Investigator:
Hosin "David" Lee

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

Research Board Funding:
$73,997

Funding Source:
100% State - 60% Primary funds and 40% Secondary funds

Development of a Manual Crack Quantification and an Automated Crack Measurement System

Objective: To develop software to verify the outputs pavement management data against Iowa DOT procedures and 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 2004.

Reports: Draft Final, May 2004

Implementation: The software package 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.

TR-458

Agency:
The University of Iowa

Principal Investigator:
Wilfrid A. Nixon

Research Period:
May 1, 2001 to April 30, 2005

Research Board Funding:
$151,920

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

Field Testing of Abrasive Delivery Systems in Winter Maintenance

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. Last winter significant coordination difficulties were encountered but these have been addressed and it is hoped that good tests will be conducted this coming winter. Completion of the project together with the final report is anticipated in June 2005.

Reports: None

Implementation: Maintaining roads in winter in Iowa is difficult. The safety 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.

TR-459

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% outside sources and 48% State - 25% Primary funds and 75% Street funds

Reuse of Lime Sludge from Water Softening in Road Construction

Objective: The objectives are as follows:

- Lime sludge in mixture with fly ash, soils and aggregate is to be tested for its suitability to prepare subbase for road construction.
- Evaluate the use of lime sludge for fill and embankments as an admixture with other fill materials and fly ash.
- Calcium Carbonate (CaCO3) 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 from Buffalo, Iowa to be used in cement production.
- 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 power plants.
- 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 graduate assistant on this project continues the work on developing other uses of lime sludge. Lime sludge has a low permeability and lends itself for use as a barrier material in landfills. Measuring permeability using a flexible wall permeameter will be done this semester. As well, leaching tests will be done to find whether any heavy metals escape from the coal combustion ashes in the mix. Another new application will include developing a better dewatering lagoon for water treatment plants without significant capital costs.

Reports: None

Implementation: The potential value of the lime sludge in Iowa is around $1 million, against present disposal costs of also around $1 million, 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.

TR-460

Living Snow Fences

Agency:
The University of Iowa

Principal Investigator:
Wilfrid A. Nixon

Research Period:
September 1, 2001 to July 31, 2004

Research Board Funding:
$87,924

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

12 rows of corn provide the best alternative to the traditional snow fence in terms of performance and cost effectiveness.

Objective: The following are the main objectives:

- 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.
- 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.
- Develop suitable marketing tools 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: Three 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 three 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.

In recent tests, 12 rows performed better at catching snow particles and offering wind protection than 6 rows. Conclusion - 12 rows of corn provide the best alternative to the traditional snow fence in terms of performance and cost effectiveness.

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 will also be made available via e-mail to all subscribers to the snow and ice mailing list, and would be placed on the Snow and Ice Cooperative Program and Iowa DOT Web sites.

TR-461

Agency:
Iowa State University

Principal Investigator:
David J. White

Research Period:
July 1, 2001 to November 30, 2004

Research Board Funding:
$70,000

Funding Source:
61.1% outside sources and 38.9% State - 60% Primary funds, 35% Secondary funds and 5% Street funds

Soil Stabilization of Non-Uniform Subgrade Soils

Objective: 1) Evaluate the influence of subgrade uniformity on pavement performance. 2) Determine how the addition of various raw fly ashes can bring about uniform subgrade support. 3) Develop an Ash Stabilization Guide as a resource for Iowa designers and contractors.

Progress: Freeze-thaw and wet-dry durability test data were compiled for the stabilized limestone screenings project. Results show that the cement kiln dust stabilized limestone screenings are not feasible as a construction material due to poor freeze-thaw durability. Statistical analysis of the finite element modeling results for the subgrade uniformity study shows that a link exists between subgrade non-uniformity and pavement fatigue resistance. As subgrade non-uniformity increases, pavement performance decreases.

Reports: None

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

TR-463

Agency:
The University of Iowa

Principal Investigator:
Hosin "David" Lee

Research Period:
August 24, 2001 to March 31, 2004

Research Board Funding:
$99,804

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

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

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: Draft Final, May 2004

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.

TR-466

Agency:
Iowa State University and City of Oskaloosa

Principal Investigator:
James K. Cable

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

Research Board Funding:
$47,049 (Iowa State University - $20,307; City of Oskaloosa - $26,742)

Funding Source:
100% State - 25% Primary funds, 10% Secondary funds and 65% Street funds

Evaluation of Unbonded Ultrathin Whitetopping of Brick Streets

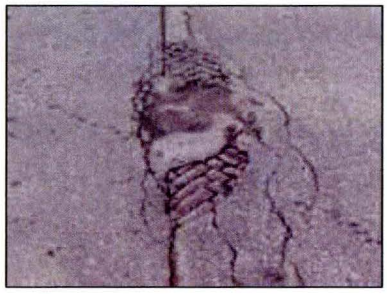
Objective: Demonstrate the ability to design and place an unbonded PCC overlay on an existing base of ACC and brick, and evaluate the performance of the 3" PCC overlay to that of the 3" ACC overlay in the short- and long-term.

Progress: The construction report was completed and presented to the IHRB. Monitoring of the site continues, including deflection and distress surveys.

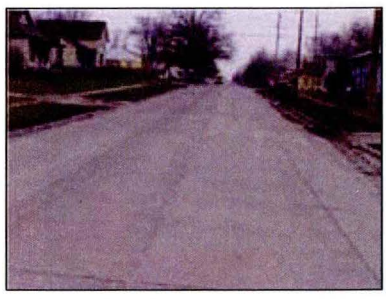
Reports: Construction Report, August 2002

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

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



Asphalt Surface with Exposed Brick



Completed Jointing Pattern

TR-467

Agency:
Iowa State University

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

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

Research Board Funding:
$190,890

Funding Source:
100% State - 100% Secondary funds

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.

Investigation of the Modified Beam-in-Slab (MBIS) Bridge System

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 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 MBIS bridge system. Four single bay specimens were constructed and tested in 2001 to evaluate the strength of the formwork and the MBIS bridge system. A fifth specimen, a model bridge, was constructed in the ISU Structures Laboratory to investigate the load distribution characteristics and ultimate strength of the MBIS bridge design. Data gathered from testing the laboratory specimens aided in the design of the second demonstration bridge.

The first MBIS bridge 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 six rolled W-sections in the MBIS bridge system. The deck was placed on November 7, 2002, and opened to traffic.

A final report will be presented to the Board in the fall 2004.

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 material is 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.

TR-468

Agency:
Iowa Department of Transportation

Principal Investigator:
Mark J. Dunn

Research Period:
December 1, 2001, on-going

Research Board Funding:
$10,000

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

Technology Transfer Program for the Iowa Highway Research Board

Objective: The objective of this project is to provide improved research technology transfer and information distribution to the IHRB 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: This project covers meeting costs for the IHRB's annual traveling meeting at field sites in Iowa. No other technology transfer activities required funding for FY 03-04.

Reports: None

TR-469

Agency:
Iowa State University

Principal Investigator:
Paul G. Spry and Robert D. Cody

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

Research Board Funding:
$139,832

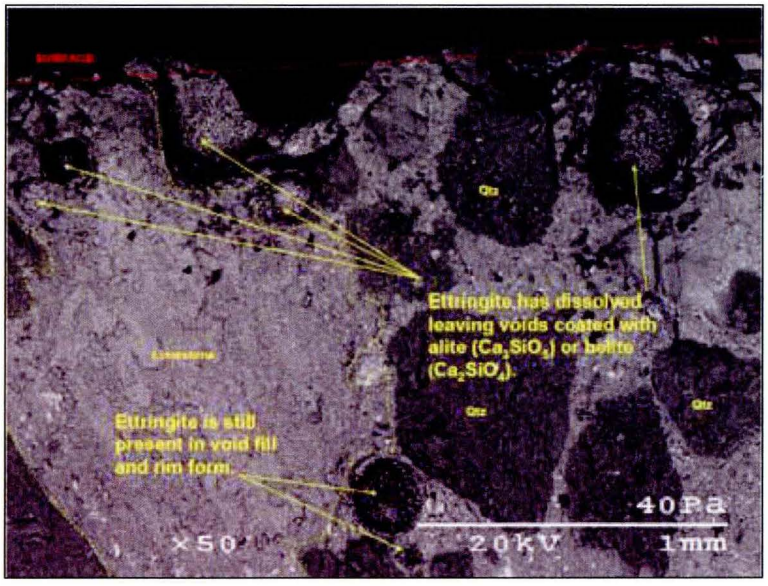
Funding Source:
100% State -
80% Primary funds,
10% Secondary funds
and 10% Street funds

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

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

Reports: Final Report, July 2004

Implementation: The result of 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.



TR-470

Agency:
Iowa State University

Principal Investigator:
Omar Smadi

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

Research Board Funding:
$59,272

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

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

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 draft final report was submitted in June 2004 and will be presented in the fall of 2004

Reports: Draft Final Report, June 2004

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 use the newly developed methodology to determine their compensation.

TR-471

Agency:
The University of Iowa and sub-contract with Iowa State University

Principal Investigator:
Wilfrid A. Nixon (The University of Iowa) and Kejin Wang (Iowa State University

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

Research Board Funding:
$100,000 (The University of Iowa - $92,000; Iowa State University - $8,000)

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

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

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

Progress: The following tests were performed with liquid deicing chemicals:

- Ice melting test
- Freezing point test
- Ice penetration test
- Viscosity test
- Specific gravity test

The results of these tests will be presented in the final report.

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 subscribers on the snow and ice mailing list.

TR-472

Agency:
The University of Iowa

Principal Investigator:
Wilfrid A. Nixon

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

Research Board Funding:
$80,000

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

Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipment

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 Pacific Northwest Snowfighters testing was used to determine the corrosivity of a variety of different chemicals on steel and aluminum. The corrosivity will be related to the corrosion of distilled water, and will be reported as a millimeters per year of corrosion when final results are presented. The final report is being prepared and should be completed by March 31, 2005.

Reports: None

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 on the snow and ice mailing list.

TR-473

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% State - 35% Primary funds and 65% 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), 3) to establish a structural and fatigue model, and 4) to validate/calibrate the model using in-service pavement performance histories and the instrumented pavements on IA 141. Ultimately, this project will provide a research report and implementable design guidelines to the Iowa DOT.

Progress: A mechanistically-based design method for HMA overlays over rubblized and cracked and seated PCC pavements has been developed. The method has been partially validated using the field results from the instrumented sections of IA 141 near Grimes, Iowa. A report is in its final stages of preparation, and will include a computer program which will allow the designer to estimate the required thickness of HMA overlay for various levels of performance.

Reports: None

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

TR-474

Development of a Mix Design Process for Cold In-Place Rehabilitation Using Foamed Asphalt- Phases I and II

Agency:
The University of Iowa

Principal Investigator:
Hosin "David" Lee

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

Research Board Funding:
$228,469

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

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

Progress: RAPs were collected from six different sources across the state of Iowa, 1500 lbs. from each construction site. The collected RAP materials were sieved into stockpiles of five different sizes. The steering committee meeting took place on campus of The University of Iowa with members participating from Iowa DOT, Delaware County, and industry. The simple performance testing equipment has been ordered.

Reports: None

Implementation: The implementation outlook for the proposed project is very realistic, given a number of planned construction projects of CIPR pavements using foamed asphalt in Iowa. The results of this study will 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 study for implementation.

TR-476

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% State -
40% Primary funds,
40% Secondary funds
and 20% Street funds

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

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.

Reports: Final Report, October 2003

Implementation: The computer 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.

TR-477

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% State - 100% 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.

Reports: Final Report, September 2003

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 Farm-to-Market 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.

TR-478

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% Federal funds and 20% State - 100% Primary funds - This funding is provided as the required state matching funds for the FHWA project.

Evaluation of Composite Pavement Unbonded Overlays

(Installation and Maintenance of Weigh in Motion (WIM) Detection System on Iowa Highway 13 in Delaware County)

Objective: The IHRB is providing funding as a cost-share of $50,000 (out of a total project cost of $230,000). The purpose of this funding is to provide for placement and maintenance of a WIM system in support of the research project, Evaluation of Composite Pavement Unbonded Overlays.

Progress: The WIM system was installed in July 2002. The Iowa DOT continues to provide WIM data and maintain the system.

Reports: Construction 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 project.

TR-480

Agency:
Michigan Technological University

Principal Investigator:
Lawrence L. Sutter

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% other sources and 13.3% State - 45% Primary funds, 45% Secondary funds and 10% Street funds

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

Objective: The objectives of this project are:

- Determine the long-term effects of concentrated solutions of magnesium, sodium and calcium chloride as well as calcium magnesium acetate or other alternative liquid deicers on durable Portland cement concrete
- 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: The literature review continues as additional information becomes available. There is not a consensus in the literature on some key aspects of the study requiring the research team to continue to search for reliable and widely accepted sources of information.

- Work has continued on preparing thin sections from the field core samples for petrographic analysis, and slab specimens for determination of chloride ion ingress.
- The majority of the effort for this reporting period was in finalizing the Phase I laboratory experiments involving exposure of mortar specimens to various deicer solutions. Preliminary results to date are presented.
- Petrographic analysis is being employed in an attempt to understand the various types of deterioration that has occurred.

Reports: Progress Report, April 2004

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.

TR-481

Agency:
Iowa State University

Principal Investigator:
David J. White

Research Period:
August 15, 2002 to December 31, 2004

Research Board Funding:
$120,000

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

Identification of the Best Practices for the Design, Construction, and Repair of Bridge Approach Sections

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. 6) Recommend design, construction and maintenance alternatives.

Progress: 1) Literature review and first draft summarizing the information from the literature have been completed. 2) Multiple 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. 4) A lab scale abutment drainage model has been developed.

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: 1) It is expected that maintenance personnel will adopt the newly established threshold criteria indicating needed repair/maintenance of bridge approaches. 2) Bridge and earthwork contractors will improve quality construction to reduce the occurrence of the bump based on final recommendations. 3) Field personnel will implement QM-E end-result quality assurance testing to ensure proper compaction of bridge embankment fills. 4) Office of Soil Design will consider various ground improvement methods in areas where soft foundation conditions exist. 5) Office of Bridge Design and Office of Soil Design will consider alternative design approaches the design of new bridges.

TR-482

Agency:
Iowa State University

Principal Investigator:
David J. White

Research Period:
August 15, 2002 to May 31, 2004

Research Board Funding:
$100,000

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

Determination of the Optimum Base Characteristics for Pavements

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: A Final report was presented and approved by the IHRB in May 2004

Reports: Final Report, May 2004

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.

TR-483

Agency:
Iowa State University

Principal Investigator:
Brian J. Coree

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

Research Board Funding:
$145,775

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

Evaluation of Hot Mix Asphalt Moisture Sensitivity Using the Nottingham Asphalt Test (NAT) Equipment

Objective: This research will develop one or more test protocols using the superpave gyratory compactor and the NAT 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: Asphalt mixtures of varying moisture sensitivities have been fabricated and tested using the proposed protocol: dynamic testing in the NAT. The results are somewhat disappointing and are no better than might be obtained from the existing AASHTO-T-283 protocol. An examination of the results led to further sub-study that studied the distribution of air voids in the samples and the effects of such distribution on the test results. It is clear that some samples are damaged by the process of sample preparation and this damage masks the damage due to the effect of moisture. This observation applies to both the proposed protocol and the existing AASHTO-T-283 procedures. A final report and recommendations are in final preparation.

Reports: None

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.

TR-484

Agency:
Iowa State University

Principal Investigator:
Scott Schlorholtz

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

Research Board Funding:
$159,666

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

Materials and Mix Optimization Procedures for PCC Pavements

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.
- 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:

- Chemical testing for uniformity of Portland Cement, blended cement and slag samples obtained from the Iowa DOT is being conducted. To date, over 70 samples have been analyzed for DOT.
- Experiments that study how premature stiffening is influenced by cementitious material composition, mixing procedure and temperature are being conducted.
- Potential field projects have been identified for 2004.

Reports: None

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.

TR-485

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% State -
50% Primary funds,
40% Secondary funds
and 10% Street funds

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

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 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 and other pertinent permitting requirements (e.g. state, local).

Progress: The objectives have been completed and the final report and program are currently under review. Final presentation will be done in the fall of 2004.

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.

TR-486

Agency:
Iowa State University

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

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

Research Board Funding:
$99,265

Funding Source:
100% State - 100% Secondary funds

Development of Abutment Design Standards for Local Bridge Designs

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.

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 returned the completed survey.

Load calculations have also been completed. These included dead loads for the different substructure systems; longitudinal loads such as wind loads on the structure and live load, longitudinal force (braking force), and lateral dead and live load earth pressures.

The project has been completed and a final report will be submitted to the Board in the fall of 2004.

Reports: None

Implementation: The bridge abutments used by many counties do not qualify as standard stub abutments according to the Bridge Design Manual. 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.

TR-487

Agency:
Iowa State University

Principal Investigator:
Edward J. Jaselskis

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

Research Board Funding:
$124,999

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

Development of Object-Oriented Specifications for Iowa DOT and Urban Standards

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 (ERL) 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: A draft final report was submitted in April 2004 and is currently being reviewed. Final presentation will be complete in fall of 2004.

Reports: Draft Final Report, April 2004

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.

TR-488

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% State -
70% Primary funds, 25% Secondary funds and 5% Street funds

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

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: In addition to the freeze point curves for various mixes of the two brines, ice melting capacity tests and specific gravity tests have also been run. Results from the latter indicate they will be very helpful in ensuring proper mixing of the two brines, while the former will give a clear measure of the appropriate quantities of the mix to use, and thus feed directly into the cost-benefit analysis. The final report will be completed by the end of March 2005.

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 Snow and Ice Cooperative Program Web site (www.sicop.net).

TR-489

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% State - 25% Primary funds and 75% Secondary funds

Innovative Solutions for Slope Stability Reinforcement and Characterization in Iowa Soils

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 sites (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. Instructional Memorandums) for determining shear strength parameters using the BST.
- Investigate and conduct simple pilot tests to evaluate various remediation techniques.
- Recommend design, construction and remediation alternatives for Iowa soil conditions to ensure slope stability of new embankment till and shallow backslopes.

Progress: Pile load tests were conducted in a manner similar to large-scale direct shear tests. The 14 load tests suggest the influence of soil type, pile size, and pile spacing on the stabilization potential for micropiles. The test data is being analyzed to determine whether load transfer of pile subject to lateral soil movement is predicted with existing analytical models and software of laterally loaded piles. The prediction of pile behavior is a principal objective in demonstrating the stability of pile-stabilized slopes. A number of field trips have been made and more than 10 slope failures have been identified. Preliminary investigations, including soil characterization on a few slides, have been carried out.

Reports: None

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.

TR-490

Agency:
Iowa State University

Principal Investigator:
James K. Cable and Edward J. Jaselskis

Research Period:
December 1, 2002 to February 28, 2004

Research Board Funding:
$129,519

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

Stringless Portland Cement Concrete Paving

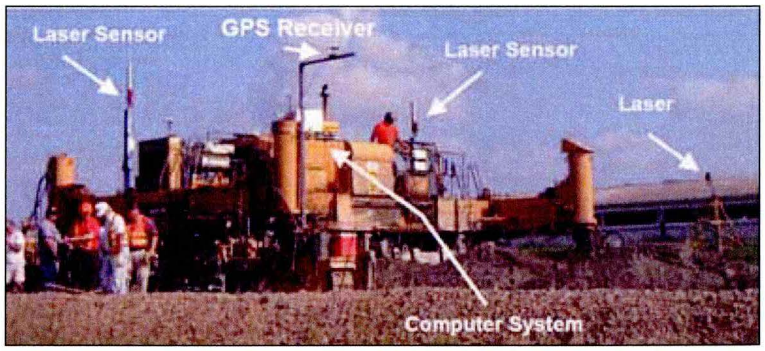
Objective: Evaluation of the use of robotic total station control to guide the Trimmer, Slipform Paver and Cure Cart in the alignment and depth control of the final Portland cement concrete pavement. The research will compare the results to the design depths, quantities, alignment, profile and smoothness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

Reports: Final Report, February 2004

Implementation: This method can revolutionize paving in state, county and city 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:

- Presentations at ICPA and ACPA state conferences and workshops.
- Presentations at APWA and ICEA conferences.
- Publication in PCC Center and CTRE publications.



Slipform Paving Machine with GPS Guidance Equipment Attached

TR-491

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% State -
80% Primary funds,
10% Secondary funds
and 10% Street funds

Development of Winter Performance Measures for Maintenance Operations

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: The literature review has been completed and will be updated through the life of the project as new papers are published. Potential storm classification schemes are being evaluated and a storm severity index has been developed.

The remainder of the project will be examining performances and costs for winter maintenance with the different winter storm scenarios.

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.

TR-492

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% State -
70% Primary funds,
15% Secondary funds
and 15% Street funds

Embankment Quality Phase IV - Application to Unsuitable Soils

Objective: Embankment Quality Phase IV research is to continue development and refinement of the 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: Progress was slowed due to the delay in identification of suitable construction projects for this work. Lab testing and field dynamic cone penetrometer testing has been started. Pilot project selection has begun.

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.

TR-493

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% State -
75% Primary funds,
20% Secondary funds
and 5% Street funds

Performance Evaluation of Steel Bridges - Phase II

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. Development of a monitoring plan is 25% complete.

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.

TR-494

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% State - 100% 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 Windows-based environment and modified to be used by the counties to distribute the counties' share of the Road Use Tax Fund.

Reports: Final Report, September 2003

Implementation: The results have been 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.

TR-495

Agency:
Iowa State University

Principal Investigator:
E. Thomas Cackler, David J. White and Edward J. Jaselskis

Research Period:
May 15, 2003 to August 31, 2004

Research Board Funding:
$75,000

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

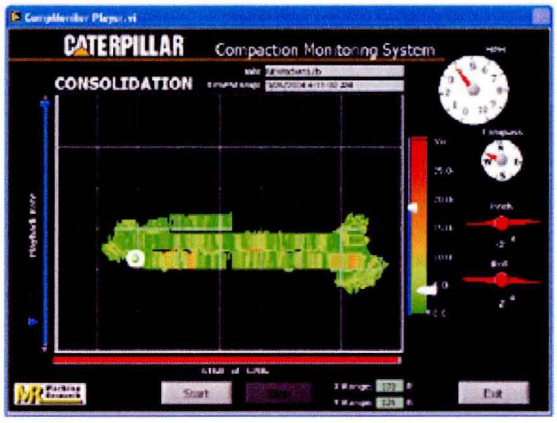
Field Evaluation of Compaction Monitoring Technology

Objective: The project's objectives are as follows:

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

Reports: Final Report, September 2004

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 AASHTO Subcommittee on Construction's priorities of research into rapid, real-time testing.



Monitor output for machine energy

TR-496

Development of Standard Plans for the Design of Single Span Pretensioned, Prestressed Concrete Beam Bridges with Concrete Abutments

Agency:
Stanley Consultants, Inc.

Principal Investigator:
Larry Badtram

Research Period:
April 1, 2004 to January 31, 2005

Research Board Funding:
$179,250

Funding Source:
100% State - 100% Secondary funds

Objective: The objective of this project is to perform an engineering study to update the existing H24S and H30S bridge standards and to create a new standard (H24IS and H30IS) utilizing concrete abutments.

Progress: This project is approximately 20% complete. CADD drawings are being developed and the structural design of the abutments is underway.

Reports: None

Implementation: All drawing files will be included in Microstation format for the final submittal for both standard series. Upon final review and approval, the detail sheets will be made available in Microstation format on the Iowa DOT Web page.

Counties are currently paying approximately $5,000 to $8,000 per bridge for consultant designs of concrete abutments. The cost of developing these standards will be recouped after being used approximately 23-36 times. Cost savings would then be available for use in other parts of the roadway network.

TR-497

Manual of Iowa Drainage Law

Agency:
Iowa State University

Principal Investigator:
Stephen J. Andrle

Research Period:
July 1, 2003 to February 28, 2005

Research Board Funding:
$59,965

Funding Source:
100% State -
20% Primary funds,
75% Secondary funds
and 5% 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: Draft chapters of the manual have been produced. The project advisory committee will review and comment on the material. The legal review is nearly complete. A final report is expected in fall 2004.

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 others who are interested 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.

TR-498

Field Testing of Railroad Flat Car (RRFC) Bridges

Agency:
Iowa State University

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

Research Period:
June 1, 2003 to March 31, 2005

Research Board Funding:
$121,096

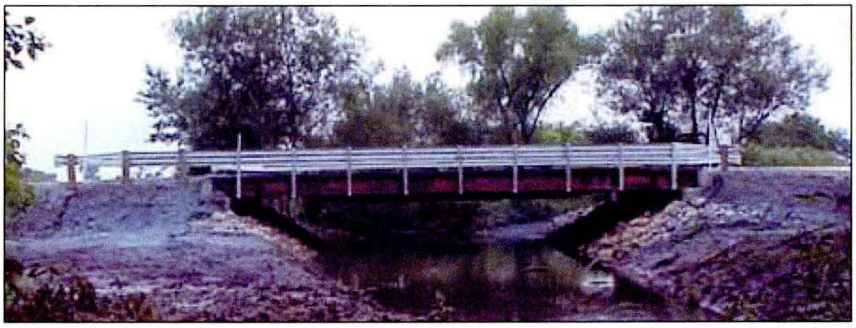
Funding Source:
100% State - 100% Secondary funds

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: The research has been completed and a final report is being written.

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.



Finished Buchanan County RRFC Bridge

TR-499

Agency:
NNW, Inc. and sub-contract with The University of Iowa

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

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

Research Board Funding:
$30,000 (NNW, Inc. - $20,000; The University of Iowa - $10,000)

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

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

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 people of Iowa.

Progress: The research is complete; the final report will be presented to the Board in the fall of 2004.

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.

TR-500

Agency:
Iowa Department of Transportation

Principal Investigator:
Kelly Poole and Scott Marler

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

Research Board Funding:
$6,802

Funding Source:
100% State -
100% Primary funds

Evaluation of the Compensatory Wetland Mitigation Program in Iowa

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

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

Progress: The project final report is being written and will be presented in the fall of 2004.

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.

TR-501

Agency:
Iowa State University

Principal Investigator:
Radhey S. Sharma

Research Period:
January 1, 2004 to December 31, 2005

Research Board Funding:
$175,000

Funding Source:
100% State -
45% Primary funds,
45% Secondary funds
and 10% Street funds

Optimization and Management of Materials in Earthwork Construction

Objective: The following are the objectives for this project:

- Through a forensic study of recent geotechnical problems and failures in Iowa, identify the impact of not doing material management and optimization.
- Determine appropriate parameter values to use in optimizing geotechnical system performance and material placement (i.e. shear strength, volumetric stability) in particular geotechnical applications, including subgrades, retaining structures, embankments, box culverts, and foundations.
- Develop guidelines (i.e. flow chart) for selection, mixing, stabilization and/or ground improvement of materials that provide desired engineering properties to obtain optimal performance for the various applications.
- Provide recommendations for Phase II pilot studies and development of design tools/software.

Progress: The project has just started. Literature review (task 1) and forensic investigation (task 2) are underway. A major part of literature review has been completed and two site visits have been completed to analyze the problems related to earthwork optimization.

Reports: None

Implementation: In addition to the written report, a summary sheet will be created, and presentations will be made at appropriate local and regional conferences. The observations and conclusions from this study will provide recommendations for better management and optimization of on-site and select earth materials through the use of new ground improvement technologies. State, county, and local transportation agencies and contractors can implement the recommendations for improved geotechnical construction.

TR-502

Agency:
Iowa State University and The University of Iowa

Principal Investigator:
Charles Jahren and Hosin "David" Lee

Research Period:
November 1, 2003 to April 30, 2005

Research Board Funding:
$145,216 (Iowa State University - $97,941; The University of Iowa - $47,275)

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

Evaluation of Long Term Field Performance of Cold In-Place Recycled Roads

Objective: The objectives of this research project are to develop an understanding of the following:

- How the engineering properties of CIPR material, the environment, traffic and subgrade conditions influence the performance of the CIPR pavement.
- How the engineering properties of CIPR material change over time.
- How the mix design and the construction methods influence the engineering properties of CIPR materials.
- A rational mix design method and construction quality control system that is generally accepted in Iowa.

Progress: ISU passed inventory information to The U of I to conduct pavement distress surveys.

Reports: None

Implementation: The result of this study will allow transportation officials to make decisions with regard to cold in-place asphalt recycling with more confidence that those decisions will result in actual improvements in road performance. As road performance improves, road users will have more satisfaction with pavement condition and tax payers will obtain more cost effectiveness from transportation network investments.

TR-503

Agency:
Iowa State University

Principal Investigator:
Vernon R. Schaefer

Research Period:
October 1, 2003 to December 31, 2004

Research Board Funding:
$119,412

Funding Source:
100% State -
25% Primary funds,
25% Secondary funds
and 50% Street funds

Utility Cut Repair Techniques - Investigation of Improved Utility Cut Repair Techniques to Reduce Settlement in Repaired Areas

Objective:

- To identify pavement patching techniques that are cost effective and durable. Pavement patch techniques will be examined on existing urban streets and rural highways. Good and poor pavement utility repair techniques will be identified.
- Research and identify trench subsurface principles that minimize utility trench settlement or bridging of the trench in cold weather.
- Develop a best practices utility repair techniques manual for state and local jurisdictions, which is a synthesis of known field practices and/or documented research. A section of the manual will contain recommended requirements that can be used by jurisdictions in their utility permit process.

Progress: The research team is documenting the literature and practices obtained from several states and Iowa cities (Cedar Rapids, Ames, Council Bluffs, Sioux City, Des Moines, Mason City, Waterloo, Dubuque, Bettendorf, and Davenport). The research team met with Ames City Street Maintenance Supervisors, Dave Cole and Dale Weber, on April 2, 2004, and obtained samples of backfill material used in trenches. This material will be tested in the laboratory.

Reports: None

Implementation: The observations and conclusions from this study will provide recommendations on effective utility cut repairs. State, county, and city transportation agencies/jurisdictions can implement the recommendations for utility cut repairs. It is anticipated that the best practices manual will be incorporated as a chapter in the Statewide Urban Design Manual and the specification recommendations will be included in the Statewide Urban Specifications Manual.

TR-504

Agency:
Digital Control, Inc.

Principal Investigator:
LaDon Jones

Research Period:
November 1, 2003 to December 31, 2004

Research Board Funding:
$40,000

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

Extensions to the Iowa Culvert Hydraulics Software - The Design of Energy Dissipators

Objective: The main objective is the addition of energy dissipator design to the Iowa Culvert Hydraulics software. The updated software will be known as the Iowa Culvert Hydraulics Software, Version 2.0. The updated version will be completely backward compatible with the current version. That is, the user can access files created from the current version in the new version without any loss of information.

In addition, while the software is being upgraded, we propose to also add an additional design discharge estimation method, update the user manual, and add an on-line version of the user manual.

Progress: A contract has been executed between the Iowa DOT and Digital Control, Inc. to conduct the research. The final report and software are expected to be presented to the Board in December 2004.

Reports: None

Implementation: The Iowa DOT and counties can use the updated software to assist in the design of energy dissipators for culvert outlets. The Iowa DOT handled the copying and distribution of the current version of the Iowa Culvert Hydraulics Software, and we propose to continue with this arrangement.

TR-505

Agency:
Iowa State University

Principal Investigator:
Vernon R. Schaefer

Research Period:
October 1, 2003 to September 30, 2005

Research Board Funding:
$164,764

Funding Source:
50% Federal funds and 50% State - 70% Primary funds, 15% Secondary funds and 15% Street funds

Improving PCC Mix Consistency and Production by Mixing Improvements

Objective: To find optimal mixing procedures for production of a homogeneous and workable mixture and quality concrete using a two-stage mixing operation.

Specific Objectives:

- To achieve optimal mixing energy and time for a homogeneous cementitious material.
- To characterize the homogeneity and flow property of the pastes.
- To investigate effective methods for coating aggregate particles with cement slurry.
- To study the effect of the two-stage mixing procedure on concrete properties.
- To improve production rates.

Progress: The literature review is mostly complete. Laboratory tests are ongoing investigating optimal cement mixing regimens.

Reports: None

Implementation: The Iowa DOT will use this two-stage mixing operation in demonstration projects. This is intended to lead to development of a new specification for the process.

TR-506

Determination and Evaluation of Alternate Methods for Managing and Controlling Highway-Related Dust, Phase II - Demonstration Project

Agency:
Iowa State University

Principal Investigator:
Vernon R. Schaefer and Robert A. Lohnes

Research Period:
October 1, 2003 to March 31, 2005

Research Board Funding:
$107,070

Funding Source:
100% State - 100% Secondary funds

Objective: The objective of the proposed study is to evaluate the effectiveness of two dust control additives that have been used but subjected to limited systematic studies. The two suppressants are: ground asphalt shingles and soap stock (a soybean oil by-product). These materials will be compared with untreated sections, as well as lignin and calcium chloride that are currently widely used as dust palliatives.

Progress: Dust measurement equipment has been purchased. The test locations in Story County have been selected and a test protocol developed. A wet spring delayed application of treatments until late May and continued rain hampered data collection. Initial measurements were completed in early July.

Reports: None

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

TR-507

Agency:
Iowa State University

Principal Investigator:
Charles Jahren

Research Period:
November 1, 2003 to December 31, 2005

Research Board Funding:
$86,373

Funding Source:
100% State -
20% Primary funds,
20% Secondary funds
and 60% Street funds

Thin Maintenance Surfaces - Phase III - Municipal Streets and Low Volume Rural Roads

Objective: The objective of the proposed project is to fully develop a thin maintenance surface technology transfer program specifically for municipal and secondary road personnel. The program will be developed to fit the specific needs of the following groups:

- Municipal and county engineers
- Consulting engineers and contractors involved in secondary road and street maintenance
- Secondary road and street superintendents
- Officials involved in street maintenance for small municipalities

Progress: The literature review is mostly complete. Test locations have been selected. Work has begun to develop technology transfer material.

Reports: None

Implementation: The technology transfer program will be based on the findings from Phase I and II of this research program. Researchers will work with a focus group of the target audience to develop effective material.

TR-508

Agency:
Iowa State University

Principal Investigator:
Dale Harrington

Research Period:
December 1, 2003 to November 30, 2005

Research Board Funding:
$207,800

Funding Source:
100% State - 33.3% Primary funds, 33.4% Secondary funds and 33.3% Street funds

Design Guide and Construction Specifications for NPDES Site Runoff Control

Objective: Update and publish a revised erosion control section in the SUDAS Urban Design Standards and Urban Standard Specifications in order to provide additional tools for designers and contractors to meet the requirements of National Pollution Discharge Elimination System (NPDES) Phase II Stormwater Regulations. Issue addenda to the two SUDAS manuals and place the contents of the erosion and sedimentation control on the Web. Assist Iowa DOT to upgrade its design standards and specifications for Iowa DOT's and counties' rural projects.

Progress: A draft outline and format for the erosion and sediment control chapter has been developed. Interim BMP design standards are being developed. This will serve as the main source for information until the manual is completed.

Reports: None

Implementation: Will provide Iowa Municipal Separate Storm Sewer Systems entities and design engineers a reference and design handbook for selection and implementation of water quality based BMP for stormwater management. The design procedures and specifications should facilitate the adoption of water quality based stormwater management by Iowa communities.

TR-509

Agency:
Iowa State University

Principal Investigator:
Brian J. Coree

Research Period:
November 1, 2003 to January 31, 2005

Research Board Funding:
$75,003

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

AASHTO 2002 Pavement Guide Implementation Plan - Phases I and II

Objective: The objective is to formalize a process leading to an approved implementation plan by July 2004.

Progress: As of April 2004, the Guide Software has not been released by NCHRP. The researchers were granted a no-cost extension to September 30, 2004.

Reports: None

Implementation: The benefits that may accrue from this project include the following:

- A detailed analysis of the Design Guide by knowledgeable faculty and Iowa DOT staff.
- An examination of the data-readiness of Iowa DOT for implementation.
- A sensitivity study to identify those factors of specific importance to implementation in Iowa.
- A phased approach to implementation over four years, with which the background, the basics, the testing and use of the new guide can be developed in an orderly fashion.
- A training schedule for DOT and non-DOT users.

TR-510

Agency:
Iowa State University

Principal Investigator:
Max Porter

Research Period:
February 1, 2004 to October 31, 2005

Research Board Funding:
$57,992

Funding Source:
56.2% Federal funds, 11.2% other sources and 32.6% State - 80% Primary funds and 20% Secondary funds

Laboratory Study of Structural Behavior of Alternative Dowel Bars

Objective: The objective of this research is to determine an improved test procedure to replace the AASHTO T253 procedure and the corresponding analysis to incorporate the modulus of dowel support based upon structural laboratory tests.

Progress: A total of 18 concrete specimens have been cast (using 1/8 - and ½ inch gap) with three dowel types: elliptical steel, circular steel and elliptical GFRP. Three specimens included strain gages. Specimens are ready to be tested. Models are being developed using finite element analysis for the AASHTO T253-76 test setup and using the stiffness matrix method for a beam on elastic foundation.

Reports: None

Implementation: Implementation is to be done via recommendations to the following:

- State DOTs for improved dowel bar design
- AASHTO for an improved test procedure to replace the current T253
- FHWA for improved dowel bar design.

TR-511

Agency:
Iowa State University

Principal Investigator:
James K. Cable

Research Period:
February 1, 2004 to September 30, 2005

Research Board Funding:
$101,578

Funding Source:
52.8% Federal funds, 2.6% State In-kind and 44.6% State - 45% Primary funds, 50% Secondary funds and 5% Street funds

Design and Construction Procedures for Concrete Overlay and Widening of Existing Pavements

Objective: The objectives of this research are as follows:

- Conduct a structural analysis of the overlay and widening unit contributions to stress reductions and extended pavement life of the composite pavement.
- Develop construction guidelines for construction of thin concrete overlays and widening units and a catalog of designs employed.
- Develop overlay design procedures for the thin PCC overlays and widening units.
- Validate the structural and design procedure with field load tests and strain measures for the various pavement layers of the existing pavements.

Progress: Planning for installation of temperature probes and strain gages at some 18 locations in the pavement has been completed. Installation and monitoring will begin in summer 2004. The data will be used to develop and calibrate the design model.

Reports: None

Implementation: The results will be implemented in several ways:

- Presentation of the design manual with city, county, state, and national groups during their annual meetings or through special workshops.
- Development of demonstration projects with specific county, city and state engineers in selected Iowa highway districts to illustrate the process.

TR-512

Agency:
Iowa State University

Principal Investigator:
James K. Cable

Research Period:
February 1, 2004 to December 31, 2004

Research Board Funding:
$75,000

Funding Source:
20% Federal funds, 46.5% other sources and 33.5% State - 45% Primary funds, 45% Secondary funds and 10% Street funds

Measuring Pavement Profile at the Slipform Paver

Objective: This research is directed at evaluation of equipment and methods to measure profile being produced at the slip-form paver and by each of the various pieces of paving equipment and processes used from the deposit of the pavement concrete to the completion of the curing operation.

Progress: The test sections have been designed and a project selected for the testing. Testing will be performed in July and August 2004 on U.S. 30 near Le Grand, Iowa.

Reports: None

Implementation: The results of this research (guidelines and draft specifications) relating to smoothness will first be introduced at national, state and local pavement meetings to discuss the proposed specifications, equipment and goals of proposed changes in paving processes.

Secondly, a series of demonstration projects using different paving train equipment models and makes with the profiling equipment to compare the results to conventional measurements and processes would be developed for state and local projects.

TR-513

Agency:
The University of Iowa - Office of the State Archaeologist

Principal Investigator:
Joe Alan Artz

Research Period:
April 1, 2004 to March 31, 2005

Research Board Funding:
$50,000

Funding Source:
100% State - 45% Primary funds and 55% Secondary funds

Decision Support Model for Assessing Archaeological Survey Needs for Bridge Replacement Projects in Iowa

Objective: The Decision Support Model will leverage Iowa DOT's 30-year investment in archaeological survey to create a tool for evaluating the archaeological potential of bridge replacement projects. The following objectives will be achieved:

- Evaluate data from previous archaeological surveys of bridge replacements with regard to their ability to detect buried archaeological sites.
- Identify critical variables that influence the presence, preservation, and relative age of cultural deposits in a proposed bridge replacement's Area of Potential Effect.
- Develop a Decision Support Model that allows project planners and their archaeological consultants to apply the critical variables in evaluating the archaeological potential of proposed bridge replacement projects.
- Develop a handbook in pdf format containing guidance and best practices for using the Decision Support Model
- Develop recommendations for further research to improve, test, and extend the Decision Support Model.

Progress: As a framework for evaluating survey data and modeling archaeological potential, a GIS was developed. A total of 1,870 reports on Phase I archaeological survey projects that included a bridge were examined to identify the extent and methodology of subsurface testing. For each report, data on testing methodology, numbers of tests, and depth of testing were compiled in an Access database. Only tests conducted in areas mapped as alluvial soils were considered in compiling data.

Reports: None

Implementation: The Decision Support Model will be used at the local level by city, county, and district engineers, at the state level by State Historical Preservation Office and Iowa DOT, and by archaeological and engineering/ environmental consultants at the individual project level. Self-training will be provided to some extent by the User's Manual, but some amount of hands-on, instructor-led training may also be needed.

TR-514

Agency:
Iowa State University

Principal Investigator:
Duane Smith

Research Period:
May 1, 2004 to April 30, 2005

Research Board Funding:
$64,991

Funding Source:
100% State - 100% Secondary funds

Development of a Manual of Practice for Roadway Maintenance Workers

Objective: The objective of this project is to prepare a maintenance practices manual for county road workers and supervisors for use as a training and reference tool. The manual will be topical with each maintenance activity covered in a short chapter that will offer concise information targeted to equipment operators (backhoe operators and truck drivers) and other workers who actually perform the maintenance work. Ideally, the chapters would form the backbone for a "tool box talk" safety and training program.

Progress: The steering committee has been selected and planning meetings are scheduled. Handbooks have been gathered and categorized.

Reports: None

Implementation: Presentations to introduce and explain the handbook will be made to county engineers and transportation professionals at conferences and workshops. The manual will be highlighted in Iowa's Local Technical Assistance Program (LTAP) publication, *Tech News*, and technical articles will be developed incorporating the research findings. It is anticipated a one-day workshop on the manual will most likely be developed, and will be provided for maintenance workers at many locations around the state over the next several years through the Iowa LTAP.

TR-515

Agency:
The University of Iowa

Principal Investigator:
Robert Ettema and Thanos Papanicolaou

Research Period:
April 1, 2004 to March 31, 2005

Research Board Funding:
$80,816

Funding Source:
100% State - 40% Primary funds, 55% Secondary funds and 5% Street funds

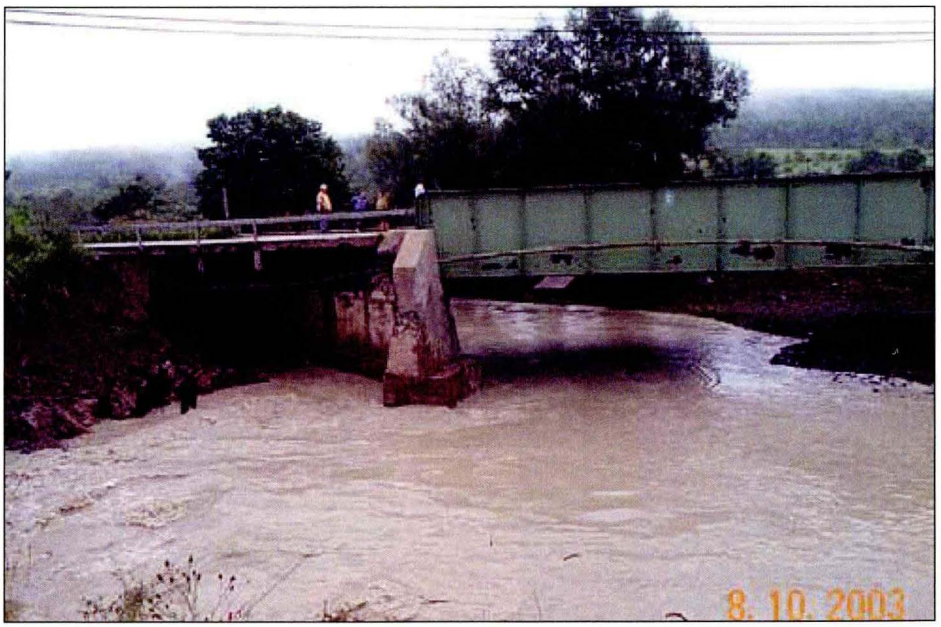
A Guide for Monitoring and Protecting Bridge Waterways Against Scour

Objective: The objective of this project is to prepare a comprehensive, well-illustrated, and practical manual that will substantially help engineers in monitoring, maintaining, and protecting bridge waterways so as to mitigate or manage scour occurring at the bridge structures.

Progress: The research is fully underway with the first four tasks to be completed under the project: 1) Establish an advisory panel of engineers from DOT, counties, and cities to seek input regarding the structure and content of manual. 2) Prepare a preliminary, detailed outline for manual. 3) Meet engineers to discuss monitoring procedure. 4) Review the bridge-waterway portions of the monitoring procedures presently in use by DOT, counties, and cities.

Reports: None

Implementation: The primary product of this project will be a practical manual that will aid engineers to monitor bridge waterways. If deemed necessary, the manual could be introduced and explained in a workshop setting.



Waterway scour threatens bridge abutment and embankment.

TR-516

Measurement of Seasonal Changes and Spatial Variation in Pavement Subgrade Support Properties - A Link to Pavement Performance

Agency:
Iowa State University

Principal Investigator:
David J. White

Research Period:
May 1, 2004 to April 30, 2008

Research Board Funding:
$40,000

Funding Source:
100% State -
75% Primary funds,
15% Secondary funds
and 10% Street funds

Objective:

- Conduct field tests on newly compacted subgrade (after construction and prior to paving) to document spatial variation in stiffness parameters,
- Monitor changes in subgrade stiffness due to seasonal variation in moisture and temperature, and
- Measure the influence of matric suction (difference of pore air pressure and pore water pressure) and the water content of the soil in the laboratory to establish a database for Iowa soil types.

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

Reports: None

Implementation: The resulting technology transfer will be incorporated into the final report of the Embankment Quality Phase IV TR-492 project. It is envisioned that the conclusions will be used as a basis for developing proposed statewide specification changes.

The research findings and conclusions will be disseminated through electronic distribution of the final report, the Iowa DOT and CTRE's Websites, and through local/regional presentation. It is also expected that the final recommendations will be implemented at the national level through publication of technical papers and presentation at TRB in Washington, D.C.

TR-517

Guidelines for Safety Treatment of Roadside Culverts

Agency:
University of Nebraska - Lincoln

Principal Investigator:
Dean L. Sicking and Ronald K. Faller

Research Period:
April 1, 2004 to January 31, 2005

Research Board Funding:
$24,995

Funding Source:
100% State - 45% Primary funds, 45% Secondary funds and 10% Street funds

Objective: General guidelines will be developed for safety treatment alternatives for cross-drainage culverts. Cost-effective analysis procedures will be utilized to determine traffic characteristics and roadside geometries for which each of the above safety treatments are most cost-beneficial.

Progress: A contract has been initiated between the Iowa DOT and the University of Nebraska - Lincoln to conduct the research.

Reports: None

Implementation: Generalized guidelines for safety treatment of cross-drainage culverts will greatly simplify development of plans for 3R projects. These guidelines will provide reasonably accurate and consistent safety treatment designs for roadside cross-drainage culverts. Further, the simplified design guidelines will significantly reduce the effort required to develop safety treatment plans for roadside cross-drainage culverts.

It is anticipated that the Iowa DOT will be able to immediately implement the simplified design guidelines developed under the study proposed herein. A short seminar will be presented at the end of this study in order to train Iowa highway designers in the application of the guidelines.

TR-518

Agency:
Iowa State University and Robert J. Dexter

Principal Investigator:
Terry J. Wipf and Robert J. Dexter

Research Period:
July 1, 2004 to December 31, 2005

Research Board Funding:
$80,819 (Iowa State University - $59,519; Robert J. Dexter - $21,300)

Funding Source:
100% State - 100% Primary funds

Monitoring Wind-Induced Vibrations/Stresses in a High-Mast Lighting Tower

Objective: A high-mast tower in the I-35/U.S. 18 interchange near Clear Lake needs to be instrumented and monitored for at least one year to determine the type of vibrations and stress ranges that are being induced at various wind velocities. The natural frequencies and damping characteristics of a number of towers also need to be determined.

The objective of this research is to collect long-term behavior information on the performance of one of the eight high-mast lighting towers in the I-35/U.S. 18 interchange near Clear Lake, IA, for the purpose of validating assumptions made by others in an analytical investigation of these and similar towers.

The natural frequencies and damping characteristics of a number of towers need to be determined because they are very important in the investigation/evaluation of towers.

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

Reports: None

Implementation: The research will likely provide information to revise/improve the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals. This, in turn, would improve the design of future new towers and the retrofit of existing towers not only in Iowa but nationwide.

The research has the potential to result in considerable savings for the Iowa DOT in inspection manpower and tower retrofit/replacement costs.

TR-519

Agency:
United States Geological Survey (USGS)

Principal Investigator:
David Eash

Research Period:
June 1, 2004 to September 30, 2006

Research Board Funding:
$78,000

Funding Source:
44.3% Federal funds and 55.7% State - 45% Primary funds, 45% Secondary funds and 10% Street funds

Developing Flood-Frequency Discharge Estimation Methods for Small Basins in Iowa

Objective: The objectives of this study are to develop and evaluate flood-frequency discharge estimation methods for rural, ungaged streams in Iowa with drainage areas less than 50 square miles. Specifics objectives are to:

- Develop regional regression equations, which only include basin characteristics that are considered easy for users to apply, to estimate 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year flood-frequency discharges.
- Develop a probabilistic rational method, from a base runoff coefficient map developed for Iowa, to estimate 2-, 5- 10-, 25-, 50-, and 100-year flood-frequency discharges.
- Evaluate the predictive accuracy of flood-frequency discharge estimates calculated using the newly developed regional regression equations, the probabilistic rational method, the 2001 regional regression equations, and the Iowa Runoff Chart by comparing estimates computed using these four methods to estimates computing using Bulletin 17B flood-frequency analyses.

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

Reports: None

Implementation: This study will provide a flood-estimation method that will enable engineers, managers, and planners to estimate flood-frequency discharges for small drainage basins with great predictive accuracy. Regional regression equations developed in this study will only include basin characteristics that are considered easy for users to apply. The probabilistic rational method of flood estimation developed in this study will present runoff coefficient and rainfall frequency maps of the state from which users will determine runoff and rainfall values for small drainage basins. The study will produce a standard USGS Scientific Investigation Report that will describe the study and present example applications of flood-estimation methods.

TR-520

Agency:
Iowa State University

Principal Investigator:
James K. Cable

Research Period:
August 1, 2004 to July 31, 2008

Research Board Funding:
$146,708

Funding Source:
100% State - 95% Secondary funds and 5% Street funds

Evaluation of Dowel Bar Retrofits for Local Road Pavements

Objective: This research seeks to provide the following:

- Evaluate the feasibility of using elliptical or round dowels to retrofit an 8-inch depth local road pavement as part of a retrofit/grind rehabilitation project.
- Evaluate the impact of applying two, three or four dowels in the outer wheel path only on pavement performance.
- Evaluate the impact of utilizing FRP or steel dowels in the retrofit of the test pavement, on long-term performance.
- Determinate the relative cost of elliptical shaped dowels (FRP and steel) for the retrofit project.

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

Reports: None

Implementation: The report will provide guidance to counties and cities on the following:

- Relative number of dowels per joint required to achieve a given level of performance.
- Relative costs versus performance of the various dowel material types.
- Potential benefits of dowel bar retrofits versus overlay alternatives for this type of pavement rehabilitation.

The results of this research are expected to provide guidance to local government officials in the use of dowel bar retrofits as a method of rehabilitation. This will provide local governments with an alternative to extensive overlays or reconstruction of such pavements.

HR-1027

Agency:
Iowa Department of Transportation

Principal Investigator:
Edward J. Engle

Research Period:
March 1980, on-going

Research Board Funding:
$70,000/year (covers salary and state share of costs for FICA, IPERS, health insurance, vehicle costs and expenses)

Funding Source:
100% State - 100% Secondary funds

Secondary Road Research Coordinator

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 15 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 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.

HR-1081

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

Research Period:
January 1, 2003 to December 31, 2004

Research Board Funding:
$25,000

Funding Source:
100% State -
100% 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: The ground penetrating radar system can easily map the location of the rebar in concrete slabs. Three-dimensional representations of the objects can be easily created if the data is collected in an organized fashion. Results for detecting alkali silica reaction expansion and cracking are less clear, although there is clearly a loss of signal in the region where cracking would be expected. The test slabs are being monitored weekly to refine the measurements.

The pavement profile scanner is expected to be in Iowa in late July and August of 2004. The system will be used to recollect data from the four field sites that were documented in the phase I report. The new results will be compared to the test results obtained in 2003 to see if system refinements have impacted the quality of the data produced by the pavement profile scanner.

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.