ANNUAL REPORT
OF
IOWA HIGHWAY RESEARCH BOARD RESEARCH AND DEVELOPMENT ACTIVITIES
FY 2006

DECEMBER 2006

Attachment 10 to
FY 2006 Annual Report -
Research, Intelligent Transportation Systems, and
Technology Transfer Activities

Iowa Department of Transportation

IHRB
IOWA HIGHWAY RESEARCH BOARD

ANNUAL REPORT
OF
IOWA HIGHWAY RESEARCH BOARD
RESEARCH AND DEVELOPMENT ACTIVITIES

FOR THE
FISCAL YEAR ENDING JUNE 30, 2006

RESEARCH AND TECHNOLOGY BUREAU
(515) 239-1447
www.operationsresearch.dot.state.ia.us

HIGHWAY DIVISION
IOWA DEPARTMENT OF TRANSPORTATION
AMES, IOWA 50010

DECEMBER 2006

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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
CFRP - Carbon Fiber Reinforced Polymer
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
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 "Iowa Highway Research Board Research and Development Activities FY2006" 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, 2006; it is also a report on projects completed during the fiscal year beginning July 1, 2005, and ending June 30, 2006. 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, 2006, is listed in Table I.

The Research Board held seven regular meetings during the period of July 1, 2005, to June 30, 2006. Suggestions for research and development were reviewed at these meetings and recommendations were made by the Board.

TABLE I

2005-2006 IOWA HIGHWAY RESEARCH BOARD MEMBERS

Member	Term Expires	Alternate
Ahmad Abu-Hawash Chief Structural Engineer Iowa DOT Bridges and Structures 800 Lincoln Way Ames, IA 50010 (515) 239-1393	12-31-06	Deanna Maifield Methods Engineer Iowa DOT Office of Design 800 Lincoln Way Ames, IA 50010 (515) 239-1402
John Adam Deputy Director Iowa DOT - Statewide Operations Bureau 800 Lincoln Way Ames, IA 50010 (515) 239-1333	12-31-08	James Berger Director of Materials Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1843
James Alleman Dept. of CCE Engineering Iowa State University 390 Town Engineering Bldg. Ames, IA 50011 (515) 294-3532	-	-
Lyle Brehm Tama County Engineer 1002 W. 5th Street Tama, IA 52339-2216 (614) 484-3341	12-31-02	Wade Weiss Green County Engineer 114 N. Chestnut Jefferson, IA 50129 (515) 386-3316
Scott Dockstader District Engineer Iowa DOT - District 1 1020 S. Fourth Street Ames, IA 50010 (515) 239-1194	12-31-07	Robert Younie Construction Engineer Iowa DOT - District 1 1020 S. Fourth Street Ames, IA 50010 (515) 239-1542
Robert Ettema 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	12-31-07 District 2	Danny Waid Howard County Engineer 137 N. Elm Street Cresco, IA 52136 (563) 547-2620 SS# 045

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	Mark Kerper Assistant Director Office of Location and Environment Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1591
John Joiner Public Works Director 515 Clark Avenue P.O. Box 811 Ames, IA 50010 (515) 239-5165	12-31-08	Ronald Knoche City Engineer 410 E. Washington Street Iowa City, IA 52240-1825 (319) 356-5138
Jeff Krist Project Manager Public Works Department 209 Pearl Street Council Bluffs, IA 51503 (712) 328-4635	12-31-06	Richard Fosse Director of Public Works 410 E. Washington Street Iowa City, IA 52240-1825 (319) 356-5141
Mark Nahra Delaware County Engineer 2139 Highway 38 P.O. Box 68 Delaware, IA 52036 (563) 927-3505 SS# 028	-	-
John Rasmussen Pottawattamie County Engineer 223 South 6th Street Council Bluffs, IA 51501 (712) 328-5608 SS# 078	12-31-08 District 4	Jim Ebmeier Mills County Engineer 403 Railroad Avenue Glenwood, IA 51534 (712) 527-4873 SS# 078
Roger Schletzbaum Marion County Engineer 402 Willetts Drive Knoxville, IA 50138 (641) 828-2225 SS# 063	12-31-07 District 5	Jim Armstrong Appanoose County Engineer 1200 Highway 2 W Centerville, IA 52544 (641) 856-6193 SS# 004
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

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, 2006. Total expenditure was $3,109,442.42.

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 investigator, 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 (TRB), 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 2006 as part of the Annual Traffic Count Program. This activity consisted of 5900 portable recorder classification counts, 170 portable recorder volume counts and 50 manual counts. Traffic volumes from these counts are used to develop Motor Vehicle Traffic Flow Maps for each county showing the Annual Average Daily Traffic (AADT) on specific road sections within each county.

Secondary roads geometrics and current condition inventories were requested from and were submitted by all 99 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 2006 financial summary is:

Beginning Balance 7-1-05		$2,553,235.15
Receipts		
State Road Use Tax Fund (1½% of receipts)	$1,176,250.45	
Federal Aid Secondary (1½% of receipts)	0.00	
Research Income	0.00	
Sub-Total		$1,176,250.45
Total Funds Available		$3,729,485.60
Obligation for Expenditures		
Obligated for Contract Research	$1,862,750.87	
Non-Contract Engineering Studies	242,620.34	
Total Expenditures		$2,105,371.21
BALANCE 6-30-06		$1,624,114.39

STREET RESEARCH FUND

The Street Research Fund was established in 1989 under Section 312.3A of the Iowa Code. Each year $200,000 is 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 2006 financial summary is:

Beginning Balance (7-1-05)	$ 957
FY06 Street Research Funding	200,000
Total Funds Available for Street Research	$200,957
Total obligated for Expenditure	$183,854
Ending Unobligated Balance 6-30-06	$17,103

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 FY06 was $751,387.35 and the estimate for FY07 is $750,000.

PROJECTS INITIATED DURING FY 2006

TR-541 The Effects of Headcut and Knickpoint Propagation on Bridges in Iowa

TR-542 Development of Continuous Concrete Slab Bridge Standards

TR-543 Development of Three Span Prestressed Concrete Beam Bridge Standards

TR-544 Technology Transfer Toolbox: A Research Implementation How-To Guide

TR-545 Development of Self-Cleaning Box Culvert Designs

TR-546 Revision to the SUDAS Traffic Signal Design Guide

TR-547 Investigation of Electromagnetic Gauges for Determination of In-Place Density of HMA Pavements

TR-548 Investigation of the Impact of Rural Development on Secondary Road Systems

TR-549 Roadway Design Standards for rural and Suburban Subdivisions

TR-550 Performance Evaluation of Rubberized Pavements in Iowa

TR-551 Local Agency Pavement Marking Plan

TR-552 Field Evaluation of Timber Preservation Treatments in Iowa Highway Applications

TR-553 Examination of Curing Criteria for Cold In-Place Recycling

TR-554 Performance and Evaluation of Concrete Pavement Granular Subbase

TR-555 Evaluation of Hot-Mix Asphalt Moisture Sensitivity Using the Nottingham Test Equipment

TR-556 Feasibility Investigation of Segmentally Precast Bridge Piers for Accelerated Construction

TR-557 Evaluation of Lignin Derived from Agricultural Co-Products as an Antioxidant in Asphalt

TR-558 Use of Ultra-High Performance Concrete in Geotechnical and Substructure Applications

TR-559 Improved Method for Determining Wind Loads on Highway Sign and Traffic-Signal Structures

TR-560 Clear Zone - A Synthesis of Practice and Benefits of Meeting the Ten-Foot Clear Zone Goal on Urban Streets

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PROJECTS COMPLETED DURING FY 2006

The following projects were completed during FY 2006 and the project final reports were approved by the Iowa Highway Research Board:

Project Number	Project Title	Completion Date
TR-412	Development of a Computer Controlled Underbody Plow	1/27/2006
TR-427	Evaluation of High-Slump Concrete for Bridge Deck Overlays	10/28/2005
TR-466	Evaluation of Unbonded Ultrathin Whitetopping of Brick Streets	6/30/2006
TR-473	Rehabilitation of Concrete Pavements Utilizing Rubblization and Crack and Seat Methods	9/30/2005
TR-483	Evaluation of Hot Mix Asphalt Moisture Sensitivity Using the Nottingham Asphalt Test	10/28/2006
TR-484	Materials and Mix Optimization Procedures for PCC Pavements	4/1/2006
TR-489	Innovative Solutions for Slope Stability Reinforcement and Characterization in Iowa Soils	1/27/2006
TR-503	Utility Cut Repair Techniques – Investigation of Improved Utility Cut Repair Techniques	2/24/2006
TR-511	Design and Construction Procedures for Concrete Overlay and Widening of Existing Pavements	10/28/2005
TR-514	Development of a Manual of Practice for Roadway Maintenance Workers	6/30/2006
TR-515	A Guide for Monitoring and Protecting Bridge Waterways Against Scour	4/1/2006
TR-521	Field & Laboratory Investigation of Hydraulic Structures Facilitating Fish Abundance & Passage Through Bridges in Iowa	2/24/2006
TR-524	Review of Inconsistencies Between SUDAS and Iowa DOT Specifications	6/30/2006
TR-526	Feasibility of Cooperative Development of Wetland Mitigation Projects	2/24/2006
TR-527	Guidelines for Removal of Traffic Control Devices in Rural Areas	12/8/2005
TR-532	Evaluation of Transverse Joint Forming Methods in PCC Pavement	2/24/2006
TR-535	Reuse of Lime Sludge from Water Softening and Coal Combustion Byproducts	9/30/2005
TR-537	Iowa Data Collection and Analysis for the 2005-2006 National Surface Characteristics	2/24/2006
TR-538	Using Scanning Lasers for Real-Time Pavement Thickness Measurement	6/30/2006

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Table II

FINANCIAL SUMMARY OF RESEARCH AND DEVELOPMENT PROJECT EXPENDITURES

July 1, 2005 to June 30, 2006

(Active projects with no current fiscal year expenditures are not included)

Project	Project Title	Primary Road Research Fund Expenditures	Secondary Road Research Fund Expenditures	Street Research Fund Expenditures	Total Expenditures
140	Collection and Analysis of Stream Flow Data	76,697.59	121,865.27	23,351.96	221,914.82
296	ISU Local Technical Assistance Program (LTAP)	10,000.00	63,247.80	42,263.77	115,511.57
466	Evaluation of Unbonded Ultrathin Whitetopping of Brick Streets			5,924.95	5,924.95
473	Rehabilitation of Concrete Pavements Utilizing Rubblization and Crack and Seat Methods	3,646.60	2,668.64		6,315.24
474	Development of a Mix Design Process for Cold-In-Place Rehabilitation Using Foamed Asphalt	29,934.54	26,583.24	8,462.48	64,980.26
483	Evaluation of Hot Mix Asphalt Moisture Sensitivity Using the Nottingham Asphalt Test Equipment		2,698.08		2,698.08
484	Materials and Mix Optimization Procedures for PCC Pavements		4,233.70	1,178.08	5,411.78
489	Innovative Solutions for Slope Stability Reinforcement and Characterization in Iowa Soils	4,224.46	23,371.91		27,596.37
492	Embankment Quality Phase IV - Application to Unsuitable Soils	13,680.23	6,366.94	5,551.22	25,598.39
493	Performance Evaluation of Steel Bridges: Phase II	104,767.67	28,075.72	2,323.44	135,166.83
498	Field Testing of Railroad Flat Car Bridges		50,401.32		50,401.32
501	Optimization and Management of Materials in Earthwork Construction	25,772.71	6,498.13	4,363.58	36,634.42
502	Evaluation of Long Term Field Performance of Cold In-Place Recycled Roads	18,610.72	20,738.92		39,349.64
503	Utility Cut Repair Techniques - Investigation of Improved Utility Cut Repair Techniques to Reduce Settlement in Repaired Areas		1,873.12	3,896.13	5,769.25
505	Improving PCC Mix Consistency & Production by Mixing Improvements	9,719.35	4,678.59	3,629.09	18,027.03
506	Determination and Evaluation of Alternate Methods for Managing and Controlling Highway-Related Dust, Phase II - Demonstration Project		9,723.40		9,723.40
507	Thin Maintenance Surfaces Phase III - Municipal Streets and Low-Volume Rural Roads		483.56	13,734.23	14,217.79
508	Design Guide and Construction Specifications for NPDES Site Runoff Control		16,708.26	22,682.48	39,390.74
509	AASHTO 2002 Pavement Design Guide Implementation Plan - Phases I and II		543.99		543.99
510	Laboratory Study of Structural Behavior of Alternative Dowel Bars	29,797.63	11,391.14		41,188.77
511	Design and Construction Procedures for Concrete Overlay and Widening of Existing Pavements	18,442.47	19,898.59		38,341.06
513	Decision Support Model for Assessing Archaeological Survey Needs for Bridge Replacement Projects in Iowa		99.63		99.63
514	Development of a Manual of Practice for Roadway Maintenance Workers		32,423.50		32,423.50
515	A Guide for Monitoring and Protecting Bridge Waterways Against Scour	11,356.06	29,178.33	2,088.11	42,622.50
516	Measurement of Seasonal Changes and Spatial Variation in Pavement Subgrade Support Properties - A Link to Pavement Performance	2,107.26	4,045.92	640.09	6,793.27
518	Monitoring Wind-Induced Vibrations/Stresses in a High Mast Lighting Tower	1,636.08			1,636.08
519	Developing Flood-Frequency Discharge Estimation Methods for Small Drainage Basins in Iowa		47,311.00		47,311.00
520	Evaluation of Dowel Bar Retrofits for Local Road Pavements		6,859.00	136.42	6,995.42
521	Field & Laboratory Investigation of Hydraulic Structures Facilitating Fish Abundance & Passage through Bridges in Western Iowa Streams	13,482.26	11,583.64	2,512.60	27,578.50

Project	Project Title	Primary Road Research Fund Expenditures	Secondary Road Research Fund Expenditures	Street Research Fund Expenditures	Total Expenditures
522	Investigation of Steel Stringer Bridges: Substructures and Superstructures		108,490.50		108,490.50
523	Appropriate Traffic Calming Techniques for Small Iowa Communities	12,162.95	34,480.53	2,430.74	49,074.22
524	Review of Inconsistencies Between SUDAS and Iowa DOT Specifications	52,138.41	38,620.00	27,719.58	118,477.99
525	Design Guide for Improved Quality of Roadway Subgrades and Subbases	36,566.99	29,352.52	13,093.09	79,012.60
526	Feasibility of Cooperative Development of Wetland Mitigation Projects	10,788.74	14,981.00		25,769.74
527	Guidelines for Removal of Traffic Control Devices in Rural Areas		43,561.12		43,561.12
528	Development of a New Process for Determining Design Year Traffic Demands	14,676.44	25,215.68	19,229.71	59,121.83
529	Construction and Evaluation of a Prestressed Concrete Bridge Constructed Using Ultra High-Performance Concrete	4,919.82	45,746.45		50,666.27
530	Development of an Improved Integral Bridge Abutment-to-Approach Slab Connection	28,692.96	46,225.05	191.46	75,109.47
531	Effective Shoulder Design and Maintenance		40,737.71		40,737.71
532	Evaluation of Transverse Joint Forming Methods in PCC Pavement	19,194.88	20,309.94		39,504.82
533	Evaluation of Design Flood Frequency Methods for Iowa Streams	2,621.91	33,387.20	2,680.35	38,689.46
534	Design Procedures and Field Monitoring of Submerged Barbs for Streambank Protection	25,454.30	13,881.95	2,405.60	41,741.85
535	Reuse of Lime Sludge from Water Softening and Coal Combustion Byproducts	3,655.43	10,490.00	3,497.00	17,642.43
536	Implementation of the Water Quality Control BMPs & Design & Specifications Manuals in the Iowa Stormwater Runoff Control Interactive Manual	10,214.37	14,516.68		24,731.05
537	Iowa Data Collection and Analysis for the 2005/2006 National Surface Characteristics Field Experiment Plan	29,675.85	42,388.69	1,717.26	73,781.80
538	Using Scanning Lasers for Real-Time Pavement Thickness Measurement	38,895.08	31,266.09	1,015.02	71,176.19
539	Instrumentation and Monitoring of Precast, Post-tensioned Bridge Approach Pavement	8,244.68	60,611.33		68,856.01
540	Developing Guidance for Use of Lighting on Rural and Urban Roadways in Iowa	10,037.34	34,125.96		44,163.30
541	The Effects of Headcut and Knickpoint Propagation on Bridges in Iowa		15,304.48	2,496.46	17,800.94
542	Development of Continuous Concrete Slab Bridge Standards	14,649.00	249,146.43		263,795.43
543	Development of Three Span Prestressed Concrete Beam Bridge Standards	8,937.33	220,686.80		229,624.13
545	Development of Self-Cleaning Box Culvert Designs		4,546.57		4,546.57
546	Revision to the SUDAS Traffic Signal Design Guide	2,714.59	2,725.60	4,691.50	10,131.69
547	Investigation of Electro-Magnetic Gauges for Determination of In-Place Density of HMA Pavements	3,481.59	2,906.43		6,388.02
548	Investigation of the Impact of Rural Development on Secondary Road Systems	12,842.92	7,609.91	2,805.03	23,257.86
549	Roadway Design Standards for Rural and Suburban Subdivisions	7,965.21	15,278.34	3,735.04	26,978.59
550	Performance Evaluation of Rubblized Pavements in Iowa	6,102.11	9,284.19	3,142.40	18,528.70
551	Local Agency Pavement Marking Plan	6,701.21	24,038.84		30,740.05
552	Field Evaluation of Timber Preservation Treatments for Iowa Highway Applications		28,082.82	8,533.80	36,616.62
554	Performance & Evaluation of Concrete Pavement Granular Subbase	136.36	9,349.19		9,485.55
555	Evaluation of Hot Mix Asphalt Moisture Sensitivity using the Nottingham Asphalt Test Equipment	3,077.00	383.64	819.39	4,280.03

Project	Project Title	Primary Road Research Fund Expenditures	Secondary Road Research Fund Expenditures	Street Research Fund Expenditures	Total Expenditures
558	Use of Ultra-High Performance Concrete in Geotechnical and Substructure Applications	248.06			
561	Laboratory, Field Testing and Evaluation of Precast Bridge Elements		41,457.75		41,457.75
1027	Secondary Road Research Coordinator		84,325.34		84,325.34
1081	Development of In-Situ Detection Methods for Material Related Distress (MRD) in Concrete	2716.19			2,716.19
	Contract Research Subtotal	751,387.35	1,957,066.07	242,942.06	2,951,147.42
SPR-PL-1(42)	FY 2006 Planning and Research Program (Transportation Inventory Engineering Studies Subtotal)		158,295.00		158,295.00
	Total of Expenditures	751,387.35	2,115,361.07	242,942.06	3,109,442.42

HR-140

Agency:
United States Geological Survey

Principal Investigator:
Rob Middlemis-Brown

Research Period:
July 1, 1967 to September 30, 2007
Annual Renewal

Research Board Funding:
$222,379

Funding Source:
45% Federal funds, 55% State - 40% Primary funds, 50% Secondary funds and 10% Street funds

Collection and Analysis of Stream Flow Data

Objective: Collect the data necessary for analytical studies (including flood-frequency discharge estimation) to define, for any location, the statistical properties and trends in discharge or elevation of streams, lakes, and reservoirs. Define the water-surface-elevation profiles and corresponding discharges along streams in basins with at least 100 mi^2 of drainage area for selected floods. Evaluate the flood characteristics and hydraulics at existing and proposed flow structures in basins of all sizes when requested.

Progress: Data collection and annual reporting of stream flow data is ongoing annually.

Reports: Annual Report, Flood Event Reports

Implementation: Flood frequency and discharge data is used for sizing hydraulic structures across the state. Structure design agencies use this data for their designs.

HR-296

Agency:
Iowa State University

Principal Investigator:
Duane Smith

Research Period:
October 1, 1986 to December 31, 2006

Research Board Funding:
$130,000

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:
$37,400

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 2006, a total of 19 county engineers were sent to TRB.

Reports: None

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

TR-428

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

Effective Structural Concrete Repair

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 at the April 2004 meeting. 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-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 and report preparation are underway. A final report is expected in early 2007.

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 June 30, 2007

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: Issues have created challenges with this project, such as identifying aggregates that would be of interest to the two sponsors of the project, the Indiana and Iowa Departments of Transportation. These issues have now been resolved, and work can be accelerated on this project. A final report is expected in early 2007.

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-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: Delays resulting from obtaining appropriate winter conditions for testing as well as administrative delays have slowed progress on this project. It is anticipated that a final report will be prepared in 2007.

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-460

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.

Living Snow Fences

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: A draft final report has been submitted and should be presented to the Iowa Highway Research Board in January 2007.

Reports: Draft Final Report, September 2006

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-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: A draft final report has been submitted and should be presented to the Iowa Highway Research Board in January 2007.

Reports: Draft Final Report

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.

Reports: Final Report, June 2006

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

Finished Project

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.

This project also provides 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 Iowa Highway Research Board's annual traveling meeting at field sites in Iowa. No other technology transfer activities required funding for FY 06-08.

Reports: None

TR-471

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

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

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: A final report is currently being written and should be presented to the Iowa Highway Research Board in 2007.

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

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

Agency:
The University of Iowa

Principal Investigator:
Wilfrid A. Nixon

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

Research Board Funding:
$80,000

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

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

Progress: There have been numerous delays in the progress of this project. It is anticipated that the final report will be complete in late 2007.

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 June 30, 2005

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 design guidelines to the Iowa DOT.

Reports: Final Report, September 2005

Implementation: The structural value of the fractured slabs will provide more accurate information for the design of overlays over rubblized and crack and seat pavements. The design guide may be used by pavement designers for improvement of the pavement designs.

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 June 30, 2007

Research Board Funding:
$270,513

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: All necessary RAP materials were collected from seven different sources. The developed foamed asphalt mix design process was successfully validated against seven different RAP materials. The SPT equipment from Interlaken was successfully installed and calibrated at the Asphalt laboratory of the University of Iowa. A time extension was needed because the Interlaken SPT equipment needed extra time in calibration and the Wirtgen foaming equipment broke down and it had to be shipped to Wirtgen in Tennessee for repair. Both the Interlaken SPT equipment and the Wirtgen foaming equipment are now operational. The Dynamic modulus test and flow number test are scheduled to be completed by the end of March, 2007, and the additional three months are needed to analyze the data and write a final report.

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-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.

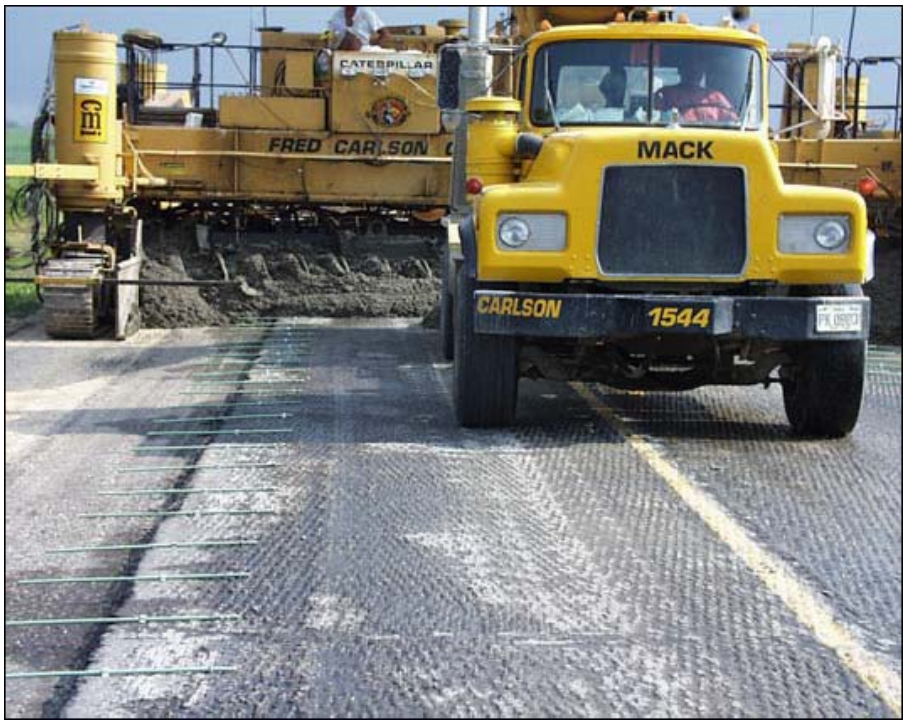
Evaluation of Composite Pavement Unbonded Overlays

[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.

Reports: Final Report, September 2006

Implementation: The results of this project and two others in Iowa indicate that a design process now exists to provide engineers with a cost-effective thin PCC overlay response to pavement rehabilitation needs.



Stapled #4 bars that tie the widening unit to the thin overlay

TR-480

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

Agency:
Michigan Technological University

Principal Investigator:
Lawrence L. Sutter

Research Period:
July 15, 2002 to March 31, 2007

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

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: Thin section specimens from the bridge decks examined previously prepared. All specimens for Task 6 have been placed in the appropriate solutions. Work at the University of Toronto continues on identifying distress mechanisms and determining scaling potential of various deicers.

Reports: Progress Report, August 2006

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-483

Agency:
Iowa State University

Principal Investigator:
Brian J. Coree

Research Period:
August 1, 2002 to September 30, 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.

Reports: Final Report, October 2005

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, 2005

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.

Reports: Final Report, April 2006

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-488

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

Agency:
The University of Iowa

Principal Investigator:
Wilfrid A. Nixon

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

Research Board Funding:
$90,000

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

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

Progress: There have been numerous delays in the progress of this project. It is anticipated that the final report will be complete in late 2007.

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 December 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 Borehole Shear Test.
- 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.

Reports: Final Report, January 2006

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-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: There have been numerous delays in the progress of this project. It is anticipated that the final report will be complete in late 2007.

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 August 31, 2007

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: The construction and data collection (Task 4) phase is still on going. Regular meetings have also been conducted to keep ISU personnel updated about the projects progress, address necessary questions, and develop plans for onsite data collection. ISU personnel have made approximately 20 trips to the site in the past 3 months. Activities have mostly involved independent QA testing, the primary focus of which has been DCP and moisture testing. To date more than 80 DCP/moisture tests (approximately 10% the contractors test total) and 30 moisture tests have been completed. Proctor, sieve analysis, Atterberg limit, and expansion index tests have also been conducted and analyzed. A new DCP calculation sheet was created for the contractor's quality control specialist to assist in calculating proper DPI values. The new sheet provides a more efficient, reliable, and quick means to calculating DCP test values. Data collection will continue through the 2007 construction season.

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 December 31, 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: The tasks have been completed. A final report is expected to be complete by early 2007.

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-498

Agency:
Iowa State University

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

Research Period:
June 1, 2003 to December 31, 2006

Research Board Funding:
$192,958

Funding Source:
100% State - 100% Secondary funds

Field Testing of Railroad Flat Car (RRFC) Bridges

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

In June, 2005, the need to investigate continuous span RRFC bridges became apparent and thus an extension to the current project to include the testing of three continuous span bridges was proposed and approved by the IHRB.

Progress: The work associated with simple span railroad flatcar (RRFC) bridges has been completed. During the past year the majority of the work associated with continuous span bridges has also been completed. Two two-span RRFC bridges in Buchanan County were tested during the summer of 2006 and one three span RRFC bridge in Winnebago County was tested this fall. Analyses of the field load test data have been completed for the two Buchanan County RRFC bridges and are nearly complete for the Winnebago County RRFC bridge. A theoretical grillage analyses is currently being developed for use in developing design procedures for RRFC bridges. In addition to the design procedures, a rating procedure for multi-span RRFCs is being developed.

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 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.

TR-501

Agency:
Iowa State University

Principal Investigator:
Vern Schaefer

Research Period:
January 1, 2004 to May 31, 2007

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 Field and laboratory work is complete. The final report is currently being written. And will be complete mid-2007.

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

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

Agency:
Iowa State University and The University of Iowa

Principal Investigator:
Charles Jahren and Hosin "David" Lee

Research Period:
November 1, 2003 to January 31, 2007

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

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: The research has been completed and a final report is in preparation. The report is expected to be ready for presentation to the board in early 2007.

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

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

Agency:
Iowa State University

Principal Investigator:
Vernon R. Schaefer

Research Period:
October 1, 2003 to March 31, 2006

Research Board Funding:
$119,412

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

Objective:

- To identify pavement cost effective and durable patching techniques. 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.

Reports: Final Report, February 2006

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-505

Agency:
Iowa State University

Principal Investigator:
Vernon R. Schaefer

Research Period:
October 1, 2003 to December 31, 2006

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: Laboratory concrete testing is complete. Analysis of the field data obtained is being undertaken. Report preparation has begun to document the laboratory and field results. There has been difficulty in identifying and developing a full scale field test section. Due to difficulties in determining a field test location, the final report will be written on the laboratory work completed to date.

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

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

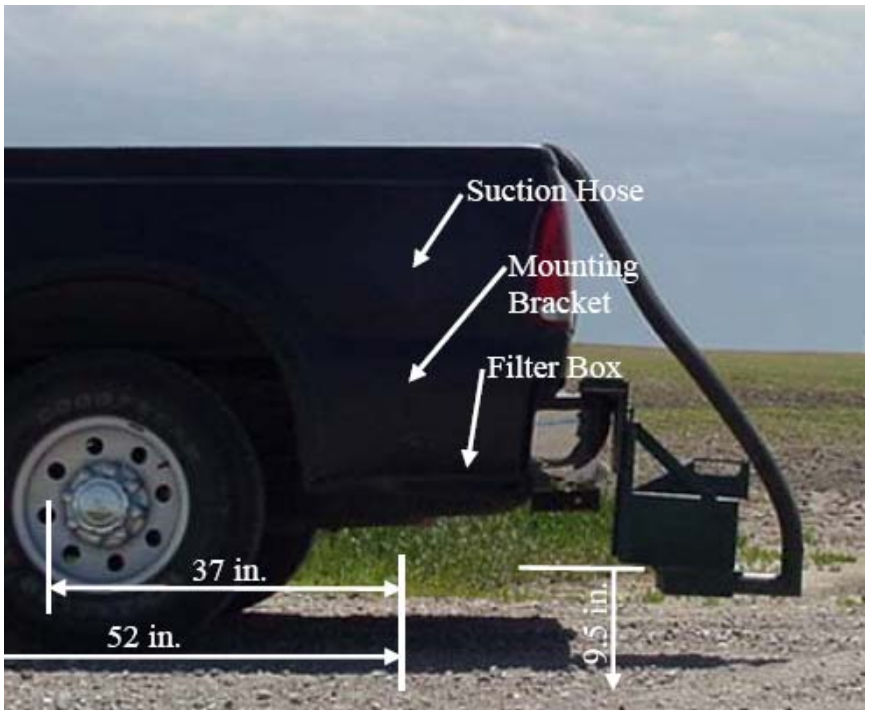
Funding Source:
100% State - 100% Secondary funds

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

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.

Reports: Final Report, June, 2005

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.



Mounted Dustometer

TR-507

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

Agency:
Iowa State University

Principal Investigator:
Charles Jahren

Research Period:
November 1, 2003 to March 31, 2007

Research Board Funding:
$86,373

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

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 research has been completed. A final report and manual are being finished up and will be presented to the board in early 2007.

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 including report(s) and a manual of practice.

TR-508

Design Guide and Construction Specifications for NPDES Site Runoff Control

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

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.

Reports: Final Report, July 2006

Implementation: This project 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.

Reports: Final Report, May 2005

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.

Reports: Final Report, September 2006

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

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

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

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.

Reports: Final Report, October 2005

Implementation: The results will be implemented through:

- 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-513

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

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

Principal Investigator:
Joe Alan Artz

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

Research Board Funding:
$50,000

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

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.

Reports: Final Report, September 2006

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 December 31, 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.

Reports: Final Report, June 2006

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 December 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.

Reports: Final Report, April 2006

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: Instrumentation data are still being collected. A case study is being conducted to measure the temperature, moisture content, frost depth, and depth to water table on a completed project on US 20. The case study aims to document the measurements of changes in engineering properties of subgrade materials due to spatial and seasonal effects.

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

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

Guidelines for Safety Treatment of Roadside Culverts

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: This project involves identifying the benefits of implementing various safety treatments for roadside culverts. Although the project was originally intended only to examine the benefits of extending culverts, the scope of this project changed when safety grates were successfully tested on 3:1 slopes. This scope change caused the project to be delayed. The Roadside Safety Analysis Program (RSAP) has been used to determine the important variables that affect the benefits of the various safety treatment options. RSAP was then run to identify the actual benefits associated with each option over the range of each important variable. RSAP results are currently being compiled and the final report will soon begin to be drafted.

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/US 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/US 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: This project has been completed. A phase II study (TR-562) began in mid 2006. The draft final report is currently under review.

Reports: Draft Final Report, December 2006

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 Phase II

Agency:
United States Geological Survey (USGS)

Principal Investigator:
David Eash

Research Period:
June 1, 2004 to July 31, 2009

Research Board Funding:
$243,622

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

Implementing a StreamStats Web Site for Iowa and Developing Flood-Estimation Equations for Small and Large Drainage Basins

Objective: The objectives of this proposed amendment to Project TR-519 are to develop a comprehensive flood-estimation method for unregulated, rural streams in Iowa. Specific objectives are to:

- Implement an interactive StreamStats Web site for 100 percent of Iowa that allows users to easily select stream sites and estimate flood-frequency discharges by automating the measurement of basin characteristics and calculation of regression estimates.
- Develop two sets of regional regression equations to estimate 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year flood-frequency discharges.
- Develop the smallest drainage-area range for a transition zone as possible for Iowa to prevent the possibility of small-basin regression estimates exceeding large-basin regression estimates.

Progress: The objectives for phase I have been accomplished. Additional phase II funding for the implementation of StreamStats was approved and work has begun.

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" 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.

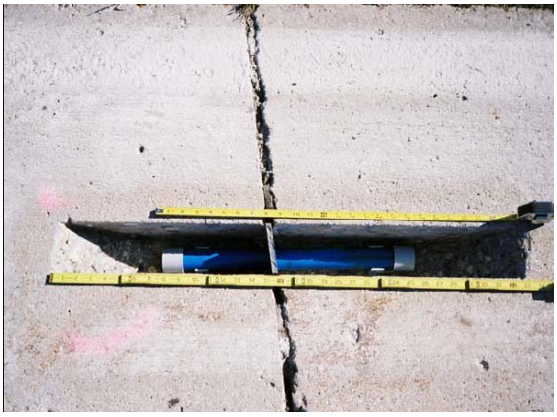
Progress: Construction of the test sections is complete. Annual performance evaluation and testing is being conducted.

Reports: Construction Report, February 2006

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.



Proper Slot Length

TR-521

Field and Laboratory Investigation of Hydraulic Structures Facilitating Fish Abundance and Passage through Bridges in Western Iowa Streams

Agency:
The University of Iowa

Principal Investigator:
Thanos Papanicolaou

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

Research Board Funding:
$59,628

Funding Source:
25 % Hungry Canyons Alliance,
25 % Iowa DNR,
50 % State (IHRB) - 40 % Primary funds, 50 % Secondary funds and 10 % Street funds

Hungry Canyons Alliance

Objective: The objective of the research is to evaluate the hydraulic performance of fish passage structures located in close proximity to bridges in western Iowa.

Reports: Final Report, February 2006

Implementation: This research will result in specifications and design criteria for constructing control structures which meet the needs of protecting bridges and facilitating fish passage.

A plan/side panoramic view of a fish ladder

TR-522

Agency:
Iowa State University

Principal Investigator:
F. Wayne Klaiber

Research Period:
November 1, 2004 to December 31, 2006

Research Board Funding:
$274,780

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

Investigation of Steel Stringer Bridges: Substructures and Superstructures

Objective: The objective of this proposed investigation is twofold: Development of procedures for assessing, rehabilitating, strengthening, and replacing inadequate substructure components or entire substructures; Develop methods to more accurately evaluate and rate non-composite, steel stringer, concrete deck bridges

Progress: Testing of the proposed six bridges has been completed. Rating of these bridges by a consulting firm has also been completed. It will be possible to compare the ratings from the DOT and the consultant with the ratings that were completed by the research team. The research team ratings include both a theoretical rating, and a performance based rating using the field test data obtained from the testing of the bridges. The portion of the final report compiling the rating information and the results from the field tests is nearing completion.

Pile Integrity tests were performed at one bridge in Mahaska County to determine the in-service pile length or major defects below the ground level. The tests were conducted near the abutments to determine the adjacent soil profile which will be used to determine the soil characteristics, which will in turn be used in a numerical modeling study for this bridge. The research team is currently waiting on the delivery of FRP so that several pile strengthening schemes can be investigated.

Reports: Quarterly Report, November 2006

Implementation: By employing the substructure evaluation procedure, bridge owners will be able to evaluate the strength of the elements in various types of substructure. Procedures for replacing deficient substructure elements or the entire substructure will be developed.

By using the rating factor developed in this part of the investigation, it will be possible to more accurately evaluate existing non-composite-steel stringer concrete deck bridges. In some cases it should be possible to remove posting and obtain several more years of service from a particular bridge.

TR-523

Agency:
Iowa State University

Principal Investigator:
Shauna Hallmark
Neal Hawkins
David Plazak

Research Period:
December 1, 2004 to October 31, 2007

Research Board Funding:
$64,718

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

Appropriate Traffic Calming Techniques for Small Iowa Communities

Objective: The purpose of this research is to evaluate and provide guidance on the use of different traffic calming techniques that can be used by both engineers and communities to select economically feasible alternatives for conditions typical of Iowa's county roads and other major roads within small rural communities.

Progress: The following tasks have been completed: Determine the state of the practice; Identify pilot study areas; Identify scope of traffic calming problem; and Determine measures of effectiveness. In addition, the pilot studies are about 60% finished.

Reports: None

Implementation: The information from this research will be combined with other traffic studies literature into a practical workshop which could be administered by LTAP.

TR-524

Agency:
Snyder and Associates

Principal Investigator:
Wade Greiman
David Moeller
Mark Land

Research Period:
December 1, 2004 to April 1, 2006

Research Board Funding:
$154,481

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

Review of Inconsistencies between SUDAS and Iowa DOT Specifications

Objective: The objective of this research is to review the Iowa DOT specifications and SUDAS specification section by section and develop recommendations for possible changes that will allow the SUDAS specifications to be incorporated into or by reference without any conflicts with the Iowa DOT specifications.

Reports: Final Report, June 2006

Implementation: Having uniformity of specifications and bidding processes across jurisdictional boundaries helps both the contractors and funding agencies work efficiently. Implementation of this project will involve the modification of both sets of specifications. Thereafter, any new changes will need to be made to both.

TR-525

Agency:
Iowa State University

Principal Investigator:
Vernon R. Schaefer

Research Period:
November 1, 2004 to December 31, 2006

Research Board Funding:
$153,212

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

Design Guide for Improved Quality of Roadway Subgrades and Subbases

Objective: The objective of this investigation is to analyze, synthesize, and present, in a practical design guide, the findings of recent research relating to subbase and subgrade from Iowa and other states. The design guide will be incorporated into the Iowa DOT and SUDAS manuals.

Construction practices for subgrades and subbases will be reviewed and analyzed so as to identify typical problems that can occur due to poor construction practices. An assessment of stabilization and treatment techniques in relation to construction of subgrades and subbases will be conducted with the goal of selecting reliable geotechnical and foundation treatments. The purpose and expected outcome of best practices for different subgrade and subbase types and treatments will be outlined.

Progress: The TAC has met multiple times to get the design guide sections completed. It is anticipated that the guide will be finished shortly.

Reports: None

Implementation: The conclusions and design guide from this study will provide recommendations on roadway subgrade and subbase design. The design guide and integrated best practices 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.

In addition to the written report, a summary sheet and a PowerPoint presentation will be created for dissemination through SUDAS and the Iowa DOT. The study's findings and conclusions will be disseminated through electronic distribution of the final report, CTRE's website, and through presentations made at appropriate local/regional/national conferences.

TR-526

Agency:
Iowa State University

Principal Investigator:
Timothy Ellis
Stephen J. Andrle

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

Research Board Funding:
$59,925

Funding Source:
100 % State - 75% Primary funds, 25 % Secondary funds

Feasibility of Cooperative Development of Wetland Mitigation Projects

Objective: The objectives of this project are to:

1. Determine the need for cooperative wetland mitigation projects.
2. Identify resources
3. Develop a conceptual framework to facilitate more centralized wetlands mitigation strategies that would reduce costs and improve effectiveness.

Reports: Final Report, February 2006

Implementation: A workshop will be held with the assistance of LTAP on cooperative development of wetland mitigation projects for the purpose of publicizing the recommended framework and beginning the process of creating a working procedure for cooperative development of wetland mitigation projects.

TR-527

Agency:
Iowa State University

Principal Investigator:
Reg Souleyrette
Tom Maze

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

Research Board Funding:
$75,000

Funding Source:
100 % State -
100 % Secondary funds

Guidelines for Removal of Traffic Control Devices in Rural Areas

Objective: The objective of this research is to study the effectiveness of rural stop control with a goal of developing warrants that can be used to support engineering decisions made by county and rural city staff to reduce or eliminate unnecessary control.

Reports: Final Report, December 2005

Implementation: As much as possible, technology transfer will be leveraged by making it part of other ongoing efforts by state and local technical organizations. The final report will be available to all interested parties. The FHWA may be interested in investigating the recommended criteria for inclusion in the MUTCD.

TR-528

Agency:
Iowa State University

Principal Investigator:
Neal Hawkins
Reg Souleyrette

Research Period:
December 31, 2004 to December 31, 2006

Research Board Funding:
$125,000

Funding Source:
100 % State -
33 % Primary funds, 34 % Secondary funds and 33 % Street funds

Development of a New Process for Determining Design Year Traffic

Objective: The objective of this research is to improve civil engineering design in terms of more consistent roadway performance over the life of the project. This will be accomplished through developing an alternative and more detailed method to develop traffic projections, to create tools which allow for scenario planning, to embrace the traditional planning process and evaluate alternative methods to using existing long range models, and to improve the overall relationship between planning and civil transportation design.

Progress: The research is finished and preparation of a final report is underway.

Reports: None

Implementation: These research findings will result in an example methodology along with the actual tools needed to conduct scenario planning and development of traffic forecasts. The results have the potential to change the way traffic impact studies are conducted in allowing for the review of impacts much further away from a new site than the adjacent intersections.

TR-529

Agency:
Iowa State University

Principal Investigator:
Brent Phares

Research Period:
February 1, 2005 to October 31, 2008

Research Board Funding:
$154,310

Funding Source:
45 % FHWA,
31 % Wapello County,
24 % State (IHRB) - 49 % Primary funds, 49 % Secondary funds and 2 % Street funds

Construction and Evaluation of a Prestressed Concrete Bridge Using Ultra-High Performance Concrete

Objective: The overall objectives of the work are to:

- Advance the state-of-the-art in concrete bridge construction technology by constructing the first bridge in the United States to use a novel concrete mix.
- Develop experience in the State of Iowa in the design and construction of bridges using advanced materials.
- Develop recommended design procedures for the shear design of ultra high performance concrete beams.

Progress: The Bridge has been constructed and is open to traffic. The laboratory portion of the project is complete. A field test plan has been developed and the first field load test will be conducted in the late summer of 2006.

Reports: None

Implementation: These new advances will be of use to all jurisdictions within Iowa as they will ultimately reduce costs by taking advantage of:
1) a higher strength material and
2) a material with almost zero permeability which could essentially eliminate deterioration of bridge decks.

The result of these advances will ultimately be in the form of design recommendations and specifications that would likely be adopted by the American Association of State Highway and Transportation Officials.

TR-530

Agency:
Iowa State University

Principal Investigator:
Brent Phares

Research Period:
March 1, 2005 to April 30, 2007

Research Board Funding:
$169,433

Funding Source:
100 % State - 48 % Primary funds, 48 % Secondary funds and 4 % Street funds

Development of an Improved Integral Bridge Abutment-to-Approach Slab Connection

Objective: The objectives of this project are as follows:

- Develop an effective approach slab-to-integral abutment connection detail for use on Iowa bridges
- Install a structural monitoring system to document and assess the performance of the connection detail and its effects on overall bridge performance

Progress: Construction of the bridge and installation of the instrumentation is complete. Behavior monitoring has begun and will continue over two winter seasons.

Reports: None

Implementation: The successful development of an integral abutment-to-approach slab connection will be useful to all jurisdictions within Iowa. This improved connection detail will be incorporated into the Iowa DOT standard bridge plans and utilized for state, city and county bridge projects throughout the state.

TR-531

Agency:
Iowa State University

Principal Investigator:
David J. White

Research Period:
March 1, 2005 to May 31, 2007

Research Board Funding:
$103,323

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

Effective Shoulder Design and Maintenance

Objectives:

- Identify practices for design, construction and maintenance of granular shoulders that result in reduced rutting and drop-off, improved safety, reduced maintenance costs, and extended performance life with recommendations specific to Iowa materials and conditions.
- Document several granular shoulder sites where poor and good performance has been observed in order to better understand the factors contributing to shoulder problems.
- On a pilot basis, evaluate and compare the performance of several test sections using chemical stabilization and mechanical reinforcement techniques including application of waste and recycled materials in construction.
- Perform a cost/benefit analysis to investigate owner costs of alternative systems.

Progress: Multiple shoulder projects were constructed during the year with a variety of stabilization practices tested. These included geosynthetics, soybean oil, Portland cement, fly-ash and others. Each site was tested over time for structure and evidence of rutting or drop-off.

Reports: None

Implementation: The observations and conclusions from this study will provide recommendations on best practices and maintenance procedures used on granular shoulders. State, county and city transportation agencies/jurisdictions can implement these recommendations. The results of this project will be implemented when 1) specifications and Materials Instructional Memoranda are updated to reflect the findings, and 2) transportation officials make improved project selection decisions by selection of more effective construction materials.

TR-532

Agency:
Iowa State University

Principal Investigator:
James K. Cable

Research Period:
March 1, 2005 to February 28, 2006

Research Board Funding:
$79,240

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

Evaluation of Transverse Joint Forming Methods in PCC Pavement

Objective: The objective of this research is to evaluate currently available and conceptual joint forming equipment and methods for transverse joints. The goal is to find a method that can be efficiently and cost effectively employed at the time of pavement construction to form transverse joints (or induce the vertical crack that acts as a joint) in a dowelled or plane concrete pavement.

Reports: Final Report, February 2006

Implementation: The results of this research are not applicable. Test sections did not produce cracks as was hoped. The test sections were sawed after a few weeks.

TR-533

Agency:
The University of Iowa

Principal Investigator:
Allen Bradley

Research Period:
March 1, 2005 to February 28, 2007

Research Board Funding:
$99,544

Funding Source:
100 % State -
51 % Primary funds, 45 % Secondary funds and 4 % Street funds

Evaluation of Design Flood Frequency Methods for Iowa Streams

Objective: The objective of this project is to assess the predictive accuracy of two standard design flood methods, the Rational Method and the NRCS (or SCS) method, for flood frequency estimation on Iowa streams. The evaluation will be based on comparisons of flood frequency estimates at sites with sufficiently long stream gage records.

Progress: A set of 46 streamgages was chosen from the Midwest region, each with a drainage area of 200 acres or less and 20 or more years of record. A flood frequency was estimated for each site using standard statistical methods. Watershed characteristics were collected and stored for each of the 46 basins; and the flood frequency was estimated using the Rational Method and the NRCS curve number approach. Comparisons of the design methods were made to address the differences and an alternative flood frequency estimation technique was developed in order to mitigate the differences between the two design methods.

Reports: Quarterly Progress Report, September 2006

Implementation: The results of this project will be most relevant to city and county engineers, who are frequently engaged in design and planning of stormwater management facilities for changing land use conditions. Research findings will be presented to the Iowa Stormwater Comprehensive Workgroup, which plays an advisory role in SUDAS. The evaluation may result in specific recommendations for changes in the current SUDAS procedures.

TR-534

Agency:
The University of Iowa

Principal Investigator:
Thanos Papanicolaou

Research Period:
May 1, 2005 to October 31, 2007

Research Board Funding:
$140,000

Funding Source:
100 % State - 48 % Primary funds, 48 % Secondary funds and 4 % Street funds

Design Procedures and Field Monitoring of Submerged Barbs for Streambank Protection

Objectives: 1) Model hydraulically the performance of a proposed submerged barb design for the US-169 bridge site. 2) Perform a comprehensive field study involving the design, installation and monitoring of submerged barbs at the same site.

Progress: The study utilizes a commercial Surfacewater Modeling System (SMS) software package with a 2-D solver to evaluate the large scale effects of the design. Quantitative and qualitative evaluation based on previous fundamental studies showed the Iowa DOT design effectively reduced the flow-induced shear stress, velocity, and depth along the river bank. Results also showed the current Iowa DOT design will produce adequate sedimentation between structures and effectively move the bank line back towards its historic location. Future results from the continuation of this study will help to further reduce the ambiguity of barb design. Two field seasons have been completed and sonar is being used to monitor the scour holes. The final stage includes comparisons of field and modeling results and identification of any discrepancies between the two.

Reports: None

Implementation: The results of this research will provide: 1) Specifications on the range of flow conditions that are detrimental for bank erosion and scour around barb structures. 2) A classification of barbs based on their hydraulic performance under various flow conditions. 3) Criteria regarding the stability of the structures for future design recommendations. 4) A detailed technical report describing the performance of the recommended structures, as well as summarizing the performances of alternative structures.

TR-535

Agency:
Iowa State University

Principal Investigator:
J. Hans van Leeuwen

Research Period:
March 1, 2005 to July 31, 2005

Research Board Funding:
$34,967

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

Reuse of Lime Sludge from Water Softening and Coal Combustion Byproducts

Objective: The objectives of this project are as follows:

1. Obtain evidence that shows that using lime sludge stabilized with fly ash and mixed with bottom ash will not harm the environment if used as a fill material.

2. Obtain additional data for direct shear testing and California Bearing Ratio (CBR) so that a conclusive analysis can be completed.

3. Continue testing for strength, density, moisture, and temperature variation on the test embankment built in July 2004. Without the measurements in the spring, a comparison of data before and after a full season of freezing and thawing cannot be made.

Reports: Final Report, September 2005

Implementation: The final report contains the information needed for highway design engineers and professionals to use for project design. These designers will use the results to design structural fills for highway projects where lime sludge is available at a reasonable transportation expense. Designers will have the ability to determine necessary material amounts using the research information.

TR-536

Agency:
The University of Iowa

Principal Investigator:
Marian Muste

Research Period:
April 1, 2005 to May 31, 2007

Research Board Funding:
$44,048

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

Implementation of the Water Quality Control BMPs and Design and Specifications Manuals

Objective: The objective of this project is to incorporate the content of the new best management practices and design and specification manuals for erosion and sediment control measures (currently under development through project TR-508, "Design Guide and Construction Specifications for NPDES Site Runoff Control") in the existing web-based erosion control expert system.

Progress: The manuals to be incorporated in the interactive website are:

1. Iowa Construction Site Erosion Control Manual
2. Statewide Urban Standard Design and Specification Manuals for Erosion and Sedimentation Control
3. Design of Guidelines and Specifications for Improving Stormwater Water Quality

The Best Management Practices and Design and Specification Guidelines for Erosion and Sedimentation Control have been incorporated into the interactive manual. The Water Quality part is still under development.

Reports: None

Implementation: Once finalized, the Iowa Stormwater Runoff Control Interactive Manual (ISRCIM) will be transferred on one of the IDOT existing web servers. Strong outreach, testing and upgrading activities are envisioned during the dissemination of the ISRCIM to a wide category of users. Major role in this regard will play the training programs incorporated in Part 3 of research project TR-508, "Design Guide and Construction Specifications for NPDES Site Runoff Control." Additionally, training sessions on ISRCIM use will be organized according to requests formulated by IHRB, Iowa cities and counties, and other specialized state offices with responsibilities in the area of sediment, sedimentation, and water quality control.

TR-537

Agency:
Iowa State University

Principal Investigator:
Tom Cackler

Research Period:
April 1, 2005 to March 31, 2006

Research Board Funding:
$96,700

Funding Source:
87 % Other Sources, 13 % State (IHRB) - 49 % Primary funds, 49 % Secondary funds and 2 % Street funds

Iowa Data Collection and Analysis for the 2005/2006 National Surface Characteristics Field Experiment Plan

Objective: The objectives of this research are as follows:

1. To design, procure, build, test, and evaluate various concrete pavement texture patterns that address noise reduction in relationship to friction, smoothness, and texture, as well as their time rates of change in service.
2. To analyze data from over 35 existing sites in the U.S., benchmarking Iowa values.
3. To develop best practice guidance to Iowa for optimizing texturing, balancing noise considerations with friction and smoothness.

Reports: Final Report, February 2006

Implementation: The outcome of the project will include a set of best practices that can be used to improve the means of texturing concrete pavements in the State of Iowa. It is anticipated that these best practices will work within the bounds of the new FHWA Technical Advisory on "Surface Texture for Asphalt and Concrete Pavements". The best practices are anticipated to identify pavement surfaces that are not only quieter, but do not compromise safety, smoothness, or performance.

Implementation of these best practices will be accomplished with a cooperative effort between industry, the PCC Center and the Iowa DOT. Their application can be the subject of stand-alone workshops and/or a component of existing technology transfer activities already underway.

TR-538

Agency:
Iowa State University

Principal Investigator:
Ed Jaselskis

Research Period:
May 1, 2005 to April 30, 2006

Research Board Funding:
$100,000

Funding Source:
20 % Other Sources, 80 % State (IHRB) - 49 % Primary funds, 49 % Secondary funds and 2 % Street funds

Using Scanning Lasers for Real-Time Pavement Thickness Measurement

Objective: The principal objective of the research is to develop the algorithms that can process real time laser scanning data to create an accurate 3D model of the pavement that can then be used to determine pavement thickness at any point. Such a device may potentially greatly reduce the need for state DOTs to take cores in order to assess this aspect of quality. A device such as this can also be considered for in process control of the paver since real time concrete depths will be calculated. This method may eliminate the need for the owner and contractor to take depth measurements during the paving process.

Reports: Final Report, June 2006

Implementation: A non-destructive system will greatly reduce the need to take core samples after the paving process is complete. Also, this system will provide a much denser sampling of thickness measurements, which will increase accuracy of the quality control program. Having real time feedback on actual pavement thickness means that the contractor does not need to pave at a higher than specified thickness to assure that the contractor meets the specifications.

Other direct benefits will be the cost savings from not needing to do pavement depth checks during the paving operation (both contractor and owner). This sensor will be able to provide real time depth measurements as a profile of the concrete will be generated. Volume of concrete in place will be easily determined using this approach. The system would fit on any paver that can provide position coordinates and may be retrofitted onto a paver by using relative position control. It is also possible that if the point cloud is sufficiently dense, pavement smoothness can also be determined using this approach.

TR-539

Instrumentation and Monitoring of Precast, Post-tensioned Bridge Approach Pavement

Agency:
Iowa State University

Principal Investigator:
Brent Phares

Research Period:
July 1, 2005 to December 31, 2007

Research Board Funding:
$149,126

Funding Source:
100 % State - 49 % Primary funds, 49 % Secondary funds and 2 % Street funds

Objective: A structural health monitoring system will be installed to document and evaluate the performance of a precast, post-tensioned approach pavement and its effects on overall bridge performance. The research team will install a monitoring system to collect overall bridge movement and bridge component strain data over an extended period of time of more than two years. Evaluation of performance will be formulated through comparisons with recognized codes and standards including the AASHTO specifications.

Demonstrating the benefits of a precast, post-tensioned approach pavement through this pilot project may provide an opportunity for the Iowa DOT to successfully pursue CPTP funding for accelerated construction of other precast concrete pavement projects under the FHWA Highways for Life program.

Progress: Construction of the bridge and installation of the instrumentation is complete. Behavior monitoring has begun and will continue over two winter seasons.

Reports: None

Implementation: The successful development of a Precast, Post-tensioned bridge approach pavement system will be a useful extension to the proposed integral abutment-approach slab connection that is currently being studied by the research team under IHRB project TR-530. An improved approach pavement system may be incorporated into the Iowa DOT standard bridge plans and utilized for bridge projects throughout the state.

These results will be distributed to the engineering community through the publication of technical papers in the engineering press and presentations at bridge and transportation conferences, and through posting of pertinent information on the website of the Office of Bridges and Structures and the website of the Bridge Engineering Center.

TR-540

Agency:
Iowa State University

Principal Investigator:
Shauna Hallmark, Neil Hawkins

Research Period:
June 1, 2005 to May 31, 2007

Research Board Funding:
$124,872

Funding Source:
53.6 % State - 40 % Primary funds, 58 % Secondary funds and 2 % Street funds

Developing Guidance for Use of Lighting on Rural and Urban Roadways in Iowa

Objective: The main goal is to provide agencies in Iowa with information and guidance on the use of lighting so that cost-effective decisions can be made. Objectives include summarizing existing lighting guidelines, documenting good lighting practice, quantifying the effectiveness of roadway lighting in reducing the number and severity of night-time crashes, comparing roadway lighting to other safety measures, such as pavement markings, rumble strips, etc. and providing information to decision-makers to select strategies to reduce night-time crashes from among a range of alternatives and developing recommendations for the use of roadway lighting

Progress: During this fiscal year, the researchers participated in several workshops on lighting fundamentals. A synthesis of the state of the practice is nearly completed as well as a thorough literature review. Researchers have obtained and summarized warrants for street lighting for 20 states and conducted a lighting survey of Iowa counties. They've collected safety data for around 350 rural intersections. A Bayesian analysis of the safety data is about 80% complete.

Reports: None

Implementation: The project will result in a lighting guidance document that will be incorporated into SUDAS. The guidance document will provide a rural and urban application matrix which recommends where roadway lighting should be prioritized based upon roadway, land use, safety, and traffic conditions. The lighting guidance document will provide the following information:

- A description of what good lighting is
- Summary of available and applicable design standards or warrants used by other national, state, and local agencies
- Recommendations on where lighting is likely to be the most effective and when other strategies, should be considered to provide night-time guidance to drivers
- Recommendations on type, configuration, and layout of lighting to address glare and other issues as well as use resources cost effectively
- Information to allow agencies to determine the costs and benefits of installing lighting

TR-541

Agency:
The University of Iowa

Principal Investigator:
Thanos Papanicolaou

Research Period:
Sept 1, 2005 to August 31, 2007

Research Board Funding:
$63,749

Funding Source:
80 % State (IHRB) - 40 % Primary funds, 50 % Secondary funds and 10 % Street funds

The Effects of Headcut and Knickpoint Propagation on Bridges in Iowa

Objective: Recent research suggests that headcuts and knickpoints, where they form and migrate, account for 60 percent or more of the bed erosion in susceptible streams. The objective of this research is twofold: 1) Understand the processes causing formation and migration of headcuts and knickpoints in the field, and 2) Develop a sound but practical model that predicts the formation and migration of headcuts and knickpoints, and associated scour.

Progress: The design phase of the project has been completed and preliminary measurements regarding knickpoint migration have been obtained. An intense field monitoring effort is continuing which entails the following activities:
A. Select fixed (e.g. sedimeter, eco-sounder) and portable (e.g. ADV, Large-Scale Image Velocimetry) instruments to survey the scour processes.
B. Specify the location for scour measurements and the field procedures used in the monitoring.

Existing laboratory measurements by the University of Iowa suggest that within a hole, two distinct recirculation patterns form. Mapping of the eddy structures has been completed which is believed to cause the migration of the knickpoints.

Reports: None

Implementation: Knowledge of the initiation of knickpoint formation will allow the design and construction of grade-stabilization structures at an early stage before sizeable knickpoints have developed.

The specific products of the project will be 1) A practical manual what will aid engineers in monitoring knickpoints, and 2) The development of a model that will predict migration rate and scour depth of knickpoints.

TR-542

Agency:
Stanley Consultants

Principal Investigator:
Stanley Consultants

Research Period:
July 18, 2005 to Oct 31, 2006

Research Board Funding:
$390,000

Funding Source:
100% State (IHRB) - Cost Center 632000-$75,000; Primary funds-$55,000; Secondary funds-$260,000

Development of Continuous Concrete Slab Bridge Standards

Objective: The Department proposes to develop the county "J" standard slab bridge plans. This project involves bringing the superstructure portion of the current three-span continuous concrete slab bridge secondary road standards 24' and 30' (MJ7200-95 and MJ9000-95) into conformance with the LRFD Specifications, updating the current standards into compliance with Office of Bridges & Structures Design Manual and Policies, and creating new J-Standards for additional roadway widths of 40' and 44'.

Bridge lengths are to include: 70', 80', 90', 100', 110', 120', 130', 140', and 150'. Skews are to include 0°, 15°, 30°, and 45°. The task involves 144 different combinations of lengths, skew and widths. Bridges will carry open rails or F-section rails, except the 24' width will only prescribe open rails. Bridges will have integral abutments and either pile bent piers. Substructure design shall be in accordance with the 17th Edition of AASHTO Standard Specifications. The intent is to have the standards completed by October 31, 2006.

Reports: Completed Bridge Standards, November 2006

Implementation: The detail sheets are available to all Local Jurisdictions in Iowa, as well as the Iowa DOT, in Microstation and PDF format on the Iowa DOT Web page. Cost savings from using these standards rather than using individual consultant designs for each bridge would then be available for use in other parts of the roadway network.

TR-543

Agency:
WHKS & Company

Principal Investigator:
WHKS & Company

Research Period:
July 18, 2005 to March 31, 2007

Research Board Funding:
$673,690

Funding Source:

Development of Three Span Prestressed Concrete Beam Bridge Standards

Objective: This project involves bringing the superstructure portion of the current three (3) span prestressed concrete beam bridge secondary road standards (H24-87 and H30-94 Standards) into conformance with the LRFD specifications, updating the current secondary standards (H24-87 and H30-94) to comply with the Office of Bridges & Structures Design Manual and Policies, and creating new H-Standard for additional roadway widths (40'-0" and 44'-0"). The attached file shows the matrix of the 135 different combinations of lengths, skews and widths.

Progress: 100% final standard plans have been submitted for the H24, H30, and H40 series. The 100% final standard plans should be submitted in December 2006 for the H44 series. Final acceptance and availability of the full set of standards should occur in early 2007.

Reports: None

Implementation: The detail sheets are available to all Local Jurisdictions in Iowa, as well as the Iowa DOT, in Microstation and PDF format on the Iowa DOT Web page. Cost savings from using these standards rather than using individual consultant designs for each bridge would then be available for use in other parts of the roadway network.

TR-544

Agency:
Iowa DOT

Principal Investigator:
Ed Engle

Research Period:
Two years from the start of the project

Research Board Funding:
$20,000

Funding Source:
80% State – 40% Primary, 50% Secondary, 10% Street

Technology Transfer Toolbox: A Research Implementation How-To-Guide

Objective: The objective of the project is to develop an application-oriented, results-driven Interactive Systematic Approach to support the implementation of research results. This will be accomplished through the development of an Implementation Planning Tool, which will include 4 modules [implementation plan module, marketing module, executive briefing module, and a scheduling/tracking module] with a shared body of knowledge of user needs.

Progress: This is a pooled fund study with input being sought from 30 states. As of June 30, 2006 the lead state (Pennsylvania DOT) had received commitment for less than half of the desired funding. The lead organization has not yet decided how or if they will proceed with the project.

Reports: None

Implementation: This project will provide tools to the participating organizations for tracking implementation of research.

TR-545

Agency:
The University of Iowa

Principal Investigator:
Marian Muste
Peter Haug

Research Period:
March 15, 2005 to February 28, 2008

Research Board Funding:
$144,785

Funding Source:
80 % State -
40 % Primary funds,
50 % Secondary funds and 10 % Street funds

Development of Self-Cleaning Box Culvert Designs

Objective: The objective of this project is to identify and/or develop methods for constructing, or retro-fitting box culverts so that the typical flow through a culvert will clean the culvert's barrels and keep the structure performing well with little or no maintenance.

Progress: Site visits were organized at multi-barrel culvert sites that have sedimentation problems to learn more about the origin of sedimentation process, techniques presently used for cleaning culverts and for gathering input as to specific ideas for culvert cleansing that could be tested in the laboratory testing associated with this project. Ample reports regarding the site visits were prepared. Following the site visits, it was realized that the nature of the sedimentation processes at visited sites is more complex than originally envisioned. Specifically, the culverts presenting problems are of the low-headwater type, some culverts draining adjacent catchments through ephemeral streams. The site findings required additional literature review dealing with this particular type of culverts. Using the input gathered from the site visits, a series of laboratory experiments are currently under design and construction. The laboratory tests are effective way to identify, develop, and confirm conceptual methods for culvert self-cleansing. Given the complexity of the sedimentation processes for low-headwater culverts, is was however concluded that the laboratory results have to be associated with a set of numerical simulations to fully clarify the combination of flow conditions leading to the culvert sedimentation.

Reports: None

Implementation: The methods identified will be limited to those that can be contained within the right-of-way of the roadway under which the culvert passes. It is anticipated that the results of the project will be applicable to culverts in general. These results should be of practical benefit at both the state and local levels.

TR-546

Agency:
Iowa State University

Principal Investigator:
Neal Hawkins

Research Period:
December 1, 2005 to November 30, 2007

Research Board Funding:
$80,000

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

Revision to the SUDAS Traffic Signal Design Guide

Objective: To update and publish new Chapter 13 (Traffic Signal Design) and Division 8 (Traffic Signal Specification) documents for the SUDAS manual. This effort will require a significant amount of collaboration with numerous groups including a project advisory group, the SUDAS Traffic Signal Sub-Committee, consultants, contractors, DOT and municipal agency staff, the signal industry, as well as professionals from other fields such as electrical, geotechnical, and soils engineering.

Progress: The advisory group has met several times. A draft manual is expected to be ready for review in early autumn, 2006.

Reports: None

Implementation: The findings of this research will be shared through incorporation into the SUDAS manual as well as through presentations at the County Engineer conference, MOVITE Traffic Engineering Conference, ASCE Transportation Conference, APWA conference, and through a variety of other professional, municipal, and national group presentations.

TR-547

Agency:
Iowa State University

Principal Investigator:
Chris Williams

Research Period:
November 1, 2005 to February 28, 2007

Research Board Funding:
$50,896

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

Investigation of Electromagnetic Gauges for Determination of In-Place Density of HMA Pavement

Objective: To establish the accuracy and precision of the PQI model 301 electro-magnetic gauge manufactured by Trans-Tech and the PaveTracker model 2701 electro-magnetic gauge manufactured by Troxler as compared to cores.

The secondary objective is to investigate the use of these gauges for determining differences in density at and near the longitudinal joint and in areas of segregation, when observed.

Progress: The research team has completed the field sampling and field testing of the mixes. Slabs for 10 of the 15 mixtures have been made and tested with the remaining to be made in the near future. The first three of six tasks are complete.

Reports: Quarterly Report, September 2006

Implementation: Based upon the completion of the above objectives, a determination of the ability of newer, non-nuclear technologies to replace core samples for evaluating in-place asphalt pavement density will be performed. Assuming a non-nuclear device or system is identified as a suitable replacement of core samples for evaluating in-place asphalt pavement density, an implementation plan will be developed to include recommended calibration procedures, methods for assessing measurement variability, and routine operation of the device or system for Iowa DOT.

TR-548

Agency:
Iowa State University

Principal Investigator:
David Plazak

Research Period:
December 1, 2005 to April 30, 2007

Research Board Funding:
$80,000

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

Investigation of the Impact of Rural Development on Secondary Road Systems

Objective: This project is quantifying the traffic and fiscal impacts of two common types of rural development on the secondary road system in Iowa. The two types of development are rural residential subdivisions, which are commonly found 30 minutes or less from centers of employment, and livestock production facilities, which are typically located in more remote areas.

Progress: The residential portion of this project is just about finished. A significant rework of the assumptions underlying the residential portion was undertaken after consultation with county engineers.

The second part of this project focuses on farming operations. This is about half finished. The scope has enlarged somewhat due to the emergence of ethanol plants on the scene.

Reports: None

Implementation: The research team will work with the Iowa Association of Counties and its affiliated groups, the Local Technical Assistance Program (LTAP), Iowa State Extension to Communities, Iowa Chapter of the American Planning Association, and other associations and agencies who serve these groups to disseminate information about the results of the research and knowledge of how to use the impact tool. The research team will work with Extension and LTAP to develop a series of informational workshops on the topic of rural development impacts on transportation networks.

TR-549

Agency:
Iowa State University

Principal Investigator:
Paul Wiegand

Research Period:
December 1, 2005 to May 31, 2007

Research Board Funding:
$112,500

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

Roadway Design Standards for Rural and Suburban Subdivisions

Objective: A preliminary search of county websites indicates that only 28% of Iowa counties have specific subdivision public improvement requirements. The Statewide Urban Design and Specification (SUDAS) and Iowa DOT manuals do not have geometric standards for rural cross-sections on low-volume, low-speed facilities.

This project will determine what standards are currently in place in Iowa and surrounding states for street geometrics, pavement cross-section, width and thickness, as well as the type of facility needed to handle drainage.

Progress: The research began with submittal of a questionnaire to County Engineers and Zoning Administrators concerning existing requirements for subdivision and connecting roadway paving. Thirty-four responses were received. Following discussion of the survey results and appropriateness of regulations, the Committee drafted roadway design parameters for the road in the subdivision and the connecting roadway.

Reports: None

Implementation:

Once the recommended standards are determined, they will be reviewed by the SUDAS program's District SUDAS Committees and Board of Directors and ultimately be incorporated into the SUDAS Design Manual, Chapter 5 (Roadway Design), to provide additional geometric design guides and design criteria associated with rural and suburban developments.

TR-550
Phase II

Agency:
Iowa State University

Principal Investigator:
Halil Ceylan

Research Period:
December 1, 2005 to August 31, 2007

Research Board Funding:
$46,212

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

Performance Evaluation of Rubblized Pavements in Iowa

Objective: Based on IHRB project TR-473, the primary objective of this study is to evaluate the structural condition of existing rubblized concrete pavements across Iowa through Falling Weight Deflectometer (FWD) tests, Dynamic Cone Penetrometer (DCP) tests, visual pavement distress surveys, etc. Through backcalculation of FWD deflection data, the rubblized layer modulus values will be determined for various projects and compared with each other for correlating with the long term pavement performance. The results will be useful in establishing design modulus and for providing AASHTO layer coefficient recommendations for rubblized PCC layers.

Progress: During this phase of the project, research efforts have been focused on completing the literature review, identifying the rubblized pavement sites in Iowa, organizing a Technical Advisory Committee (TAC) meeting in mid April, and preparing and submitting a technical paper related to the structural analysis of rubblized concrete pavements using neural networks based pavement layer backcalculation models. Efforts were also undertaken to categorize the identified rubblization sites based on Iowa DOT District maps.

In addition, rubblized pavement site visits have been coordinated with the Special Investigation Office of the Iowa DOT to start the pavement coring, FWD (Falling Weight Deflectometer) testing and DCP (Dynamic Cone Penetrometer) testing along with visual pavement distress mapping in September and October of 2006.

Reports: None

Implementation: The results of this study, if favorable, could result in better estimates of the minimum HMA overlay thickness required for rubblized concrete pavements. If successful, the Iowa DOT and the counties may implement the validated procedure for design of HMA overlay thickness for rubblized concrete pavements.

TR-551

Agency:
Iowa State University

Principal Investigator:
Neal Hawkins

Research Period:
January 1, 2006 to December 31, 2008

Research Board Funding:
$157,081

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

Local Agency Pavement Marking Plan

Objective: The study assists local agencies which rely heavily on contractors for application of pavement markings by producing a Reflectivity Guideline to assist in identifying needs due to wear or marking damage over the winter and in developing marking needs and priorities each spring, in addition to:

1. Application Matrix - Develop a County and City pavement marking application matrix which will provide guidance on the selection of marking materials based on roadway type, pavement service life, user needs, and other factors specific to local agency conditions.
2. Quality Control - Address quality control issues for Cities and Counties to improve the efficiency and effectiveness of pavement markings on all marked public roadways.

Progress: Researchers have ordered and received the LTLX retro-reflectivity machine and have been using it in the field to get used to the device. They have presented a project work plan to the TAC. The City of West Des Moines will be one of the case studies and beginning work to collect community pavement marking information. Researchers have developed and conducted a survey with 33 counties responding and 8 cities. Additional follow-up calls will be made to communities as well as with industry.

Reports: None

Implementation: The findings of this research will be shared through presentations at the County Engineer conference, ASCE Transportation Conference, APWA conference, and through a variety of other professional, municipal, and national group presentations. The guidelines developed could eventually be incorporated into a pavement marking design section within the SUDAS manual.

TR-552

Agency:
Iowa State University/ USDA

Principal Investigator:
F.W. Klaiber/M. LaViolette

Research Period:
April 1, 2006 to September 30, 2007

Research Board Funding:
$99,960

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

Field Evaluation of Timber Preservation Treatments in Iowa Highway Applications

Objective: Evaluate the performance of different wood preservatives in the field. A particular focus will be placed on preservative treatments used in Iowa, although additional information at the national level, where pertinent to Iowa, will also be included in the project scope. Current specifications and testing procedures will be reviewed and correlated with inspection findings in an effort to assess adequacy of initial treatment and the effects of treatment barrier compromise on durability. Recommendations will be made following this assessment.

Progress: The project investigators, including faculty and staff from Iowa State University and the USDA Forest Products Laboratory, conducted a comprehensive literature search to document previous timber preservative procedures applicable to Iowa bridges. The Project Advisory Committee has also been formed.
The research team also conducted a survey of the 99 county engineers from Iowa to ascertain their timber bridge inventory, preservative practices and document their successful and problem timber bridge details. A series of site visits to document bridge details reported in the survey is planned for Fall/Winter 2006.

Reports: None

Implementation: The involvement of the Forest Products Laboratory who provides national support to various governmental agencies related to wood systems, it is anticipated that many other states and counties will be interested in the results of the project. Information will be distributed to the wood utilization community and preservation industry through publications in the industry literature.

TR-553

Agency:
The University of Iowa

Principal Investigator:
Hosin "David" Lee

Research Period:
April 1, 2006 to March 31, 2008

Research Board Funding:
$100,000

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

Examination for Curing Criteria for Cold In-Place Recycling

Objective: To further Iowa's development of asphalt recycling technology, this study explores technically sound and more effective ways to identify minimum in-place CIR properties necessary to permit placement of the HMA overlay or chip seal.

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

Reports: None

Implementation:

Research efforts focus on procedures that will minimize the CIR exposure time while retaining the potential for the owner agency's investment to succeed, which is to minimize the risk of CIR layer and HMA damages. One of the procedures to be researched is a maturity curve for CIR layer under various curing conditions. The research will develop a better analysis tool that the industry and the owner agency can apply to monitor the CIR layer in preparation for a timely placement of the wearing surface.

TR-554

Agency:
Iowa State University

Principal Investigator:
David White

Research Period:
May 1, 2006 to April 30, 2008

Research Board Funding:
$149,996

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

Performance and Evaluation of Concrete Pavement Granular Subbase

Objective: The research will determine if recycled PCC pavement subbase is performing adequately by evaluating representative pavement sections with comparisons to virgin aggregate subbase sections (in particular with respect to the specification changes since 1992) and evaluate the variation in subbase stiffness and permeability by performing multiple tests within a given test section using semi non-destructive methods (i.e. permeability measurements through core hole, pavement FWD tests, and down hole LWD and DCP tests).

The research will also determine the gradation of the subbase materials using bag samples and non-destructive X-Ray CT scanning of epoxy filled core samples and characterize the ride quality and geometric characteristics of the pavement layer for correlation to the subbase properties. Evaluation of the pavement drainage system at each test section site by inspecting the subdrain outlets will be made with development of suggested material guidelines and specifications for construction of pavements using recycled PCC aggregate for subbase.

Progress: Contract initiated.

Reports: None

Implementation: The conclusions of this study will provide recommendations on the use of recycled PCC aggregate as subbase. The Iowa DOT, county, and city transportation agencies/jurisdictions will be responsible for implementing the findings and recommendations.

Laboratory and field test results will be summarized in figure and table format and include recommendations for material properties and construction practices.

TR-555

Agency:
Iowa State University

Principal Investigator:
Chris Williams

Research Period:
April 1, 2006 to July 31, 2007

Research Board Funding:
$75,000

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

Evaluation of Hot-Mix Asphalt Moisture Sensitivity Using the Nottingham Test Equipment

Objective: This project evaluates the moisture susceptibility of the individual components of HMA through an experimental plan which will isolate different variables. Dynamic Modulus and Flow Number testing will be used to evaluate the moisture susceptibility of the HMA.

Research objectives include:
1. Compare the test results for materials tested in a moisture saturated environment and a dry environment. The research plan will integrate a range of Iowa DOT asphalt mixtures.
2. Use the results obtained from the Dynamic Modulus and Flow Number Tests to develop a new test protocol for determining moisture susceptibility.

Progress: Field mixes have been collected and the mixtures have been characterized. A preliminary plan for shakedown testing has been developed. The literature review has been completed and will be updated periodically.

Reports: Quarterly Report, September 2006

Implementation: Several products will be developed from this project. The research team will deliver clear and concise recommendations on acceptable test protocol conditions and limitations along with appropriate user variability in the draft final and final reports. The final report will include an executive summary. The research team will also provide quarterly progress reports to the Technical Advisory Committee. The research team will also evaluate different anti-stripping agents.

The implementation plan will include recommendations for integrating moisture testing. The research project will also evaluate different anti-stripping agents and their success in mitigating moisture damage. The technology developed as a result of this study will be delivered in an electronic, via a compact disc, and paper form.

TR-556

Agency:
Iowa State University

Principal Investigator:
Matt Rouse

Research Period:
May 1, 20065 to July 31, 2007

Research Board Funding:
$89,623

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

Feasibility Investigation of Segmentally Precast Bridge Piers for Accelerated Construction

Objective: To simulate, evaluate and test several component materials, connection details, and component configurations to identify the most cost-effective and structurally advantageous means of constructing a radically different design approach of segmentally precast bridge piers for accelerated construction. The basic proposed pier assembly features steel belts at the ends of segments, external reinforcement of segment joints which have bolted connections, and bearing pads between segments to avoid labor-intensive grouting procedures

This steel belt assembly serves three purposes:
1. Reinforcement of fragile concrete corners
2. Confinement of the concrete at the ends of the segments to provide additional concrete strength and ductility
3. Convenient and aesthetically pleasing means for the connection of the exterior reinforcement plates

Progress: The project start date was May 1, 2006, so the project was still in the very early stages as of the end of the fiscal year. As of June 30, 2006, literature review was ongoing, arrangements for participation of members to serve on the Technical Advisory Committee were being made, and initial planning for laboratory testing was under way. The project is on schedule, and no significant problems have been encountered.

Reports: None

Implementation: Results of the research would include cost-benefit analyses of varying materials and component configurations, calibrated analytical models for future designs, and recommendations for full-scale field prototype demonstrations.

TR-557

Agency:
Iowa State University

Principal Investigator:
Chris Williams

Research Period:
March 1, 2006 to April 30, 2008

Research Board Funding:
$50,000

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

Evaluation of Lignin Derived from Agricultural Co-Products as an Antioxidant in Asphalt

Objective: To evaluate the potential anti-oxidant activity of lignin and evaluate the technical viability of the concept. To achieve the project goal, the research will address specific aspects of the technical evaluation of the concept.

Specifically, the proposed research will:
1. Determine the antioxidant activity of lignin in asphalt for lignins that are currently available or are anticipated to become available in the future
2. Evaluate the range of applicability of the concept to determine if the activity is beneficial in a number of asphalts.

Progress: Some preliminary blending and testing has been completed. Initial results indicate that high levels of lignin have an emulsifying effect on the binder. However, lower levels of lignin do not show this emulsifying effect. The research team is investigating whether moisture present in the lignin is creating the emulsifying behavior.

Reports: Quarterly Report, September 2006

Implementation: Successful completion of the proposed research will provide the technical validation required to continue with a more rigorous research and development activity, which will include a series of performance-based laboratory tests and a demonstration of the concept in a field trial of new highway construction.

TR-558

Agency:
Iowa State University

Principal Investigator:
Muhannad Suleiman

Research Period:
July 1, 2006 to November 30, 2007

Research Board Funding:
$80,266

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

Use of Ultra-High Performance Concrete in Geotechnical and Substructure Applications

Objective: A quarter of our nation's 590,000 bridges, including their substructures, are currently classified as structurally deficient or functionally obsolete, primarily due to material deterioration. This is driving the engineering community toward designing durable bridges and infrastructures that can last for a minimum of 75-years with minimal maintenance. To achieve longer life of bridges, new and innovative materials needs to be used. Ultra-High Performance Concrete (UHPC) provides a unique combination of durability, strength, ductility and aesthetic flexibility, which can not only improve longevity of the bridges, but can produce cost-effective solutions in the long run. Iowa is one of the pioneering states in the use of UHPC in bridge superstructure applications. The unique engineering properties of UHPC show great potential for producing durable foundation elements, which in turn will lead to longer lasting substructures and soil stabilization remedies in different condition. The research aims to investigate and evaluate the use of UHPC for geotechnical applications related to transportation structures.

Progress: During this fiscal year the team has been working on: 1) literature review, 2) design the laboratory test set-up, 3) analytical procedure to evaluate the drivability of UHPC piles. This research project is getting national attention. At a recent Prestressed/Precast Concrete Institute (PCI) conference Federal Highway Administration engineers showed interest in the research project and suggested a few ideas that may be incorporated in the current project in increase the value of the project beyond the boundaries of the State of Iowa.

Reports: None

Implementation: The conclusions of this study will provide recommendations on the use of UHPC in geotechnical applications related to transportation facilities for Iowa engineers.

TR-559

Agency:
The University of Iowa

Principal Investigator:
George Constantinescu

Research Period:
August 21, 2006 to August 31, 2007

Research Board Funding:
$45,253

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

Improved Method for Determining Wind Loads on Highway Sign and Traffic-Signal Structures

Objective: To obtain information on the airflow around highway sign and traffic signal structures and then to estimate the unsteady forces and moments acting on them using state-of-the-art Computational Fluid Dynamics (CFD) tools including Large Eddy Simulation (LES), to perform structural analysis of the highway sign and traffic structures subjected to these loads, and to study new design ideas for the panels that will include a certain number of holes to reduce the pressure forces acting on them under strong wind conditions.

Additionally, there is a need to determine how best to minimize wind loads on structure supporting signs and lights. Several options are available for doing this:

- Develop improved shape and dimensions of signs and their support structures
- Develop air-flow panels (panels with holes disposed on a certain pattern) to reduce wind loadings (especially drag form) and addition of flow-modifying fixtures.

Progress: Contract Initiated

Reports: None

Implementation: The report will present the methodology (e.g., description of CFD and structural analysis codes, parameters, boundary conditions, assumptions, etc.), definition of test cases and presentation of simulation results, comparison among the numerical methods, design recommendations, relevance for other problems of interest to DOT in a clear manner that is easy to understand for practicing engineers. The essential benefit resulting from the project would be a better understanding of the effects of wind on highway sign and traffic signal structures including a dynamic analysis of the aeroelastic effects and the degree to which the presence of holes disposed in a certain pattern over the main plate of these structures can reduce the wind loads.

TR-560

Agency:
Iowa State University

Principal Investigator:
Tom Maze

Research Period:
July 1, 2006 to May 31, 2007

Research Board Funding:
$54,814

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

Clear Zone – Synthesis of Practice and Benefits of meeting the Ten-Foot Clear Zone Goal on Urban Streets

Objective: To determine the state of the practice of clear zone design guidance (standards) and the experiences other jurisdictions have had with applied clear zone guidance; to identify experience in other jurisdictions with clear zone guidance with respect to application of traffic calming designs and/or context sensitive solutions, and to observe the benefits or drawbacks in Iowa that have resulted from providing ten feet of clear zone or from providing less than the ten foot goal.

Progress: Contract Initiated

Reports: None

Implementation: The project will produce a concise report and a technology transfer brief, and if invited, the investigators will make presentations at the Iowa ASCE transportation engineering conference, the Iowa APWA Chapter conference, and the MOVITE chapter of ITE biannual conference.

The principle benefit of this project will be a better understanding of the benefits of meeting the ten foot clear zone goal and the costs of providing something less than ten feet. The result should also help the Iowa DOT clarify their policy on clear zone width so that there is less uncertainty in the process of whether a project that does not meet the ten feet goal will or not be approved.

TR-561

Agency:
Iowa State University

Principal Investigator:
Terry Wipf

Research Period:
May 1, 2006 to April 30, 2008

Research Board Funding:
$341,089

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

Laboratory and Field Testing and Evaluation of Precast Bridge Elements

Objective: Perform testing and evaluation of precast components for three separate bridge projects to assess overall design, construction, and bridge structural performance. The research team will design and install monitoring systems and perform laboratory structural tests on bridge specimens that represent structural details for use on the three projects.

Progress: Boone County: Two test specimens have been constructed and tested. All of the specimens tested to date have strength four to five times the design strength. The third set of substructure test specimens has been cast. Also, a test has been developed to check and analyze the leveling process used in the field to level the deck panels.

Blackhawk County: The first abutment cap has been service load tested and loaded to failure. The closure pour for the first set of connection tests has been completed. The second set of connections has been completed and is waiting for the closure pour. The formwork for the third set of connections has been assembled.

Madison County: The casting of the box girder sections has started. The research team is currently installing corrosion monitoring sensors in each of the production girders. Two additional box girders will be cast for testing in the ISU structures laboratory.

Reports: None

Implementation: Demonstrating the benefits of precast, post-tensioned bridge components through this project may provide an opportunity for the Iowa DOT and Iowa County Engineers to design and construct more cost-effective and durable bridges. The benefits derived from developing accelerated construction concepts may also be significant.

TR-562

Agency:
Robert Connor & Assoc

Principal Investigator:
Robert Connor /Bruce Brakke (Iowa DOT)

Research Period:
July 14, 2006 to June 30, 2007

Research Board Funding:
$36,755

Funding Source:
100 % State -
100 % Primary funds

Field Instrumentation and Testing of High-Mast Lighting Towers in the State of Iowa

Objective: The Iowa DOT owns 233 high-mast lighting towers ranging from 100’ to 180’ tall. In 2003, a 140' tower collapsed due to a fracture at the welded connection at the base plate. Subsequently, cracks were found in twenty other towers. In addition to the cracks at the base plate, a crack was also found at the welded access opening detail on one tower. The cracked towers were removed from service.

The goal is to determine how the reinforcing jacket affects the tower’s response to wind induced vibrations and to also determine the magnitude of stresses in both the jacket and the original tower, including the anchor rods.

Progress: The contract executed June 14, 2006 to instrument and monitor a bolted, reinforcing jacket on a tower in the I-35/US18 Interchange near Clear Lake.

The instrumentation was installed during the last week of June. The stresses induced by wind will be monitored for 12 months.

The instrumentation is providing information as intended from the original tower shell, the jacket and the anchor rods.

Reports: None

Implementation: The research will likely provide a more cost effective repair to cracked high-mast towers and a more efficient retrofit for un-cracked towers with fatigue susceptible details. The Iowa DOT would be able to expeditiously address the problems associated with these towers at a large cost savings.

HR-1027

Agency:
Iowa Department of Transportation

Principal Investigator:
Edward J. Engle

Research Period:
March 1980, on-going

Research Board Funding:
$85,000/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 visiting 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 40 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.

Reports: Final Report, August 2005

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.