ANNUAL REPORT
OF
IOWA HIGHWAY
RESEARCH BOARD
RESEARCH AND DEVELOPMENT
ACTIVITIES
FY 2007

DECEMBER 2007
Attachment 12 to
FY 2007 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, 2007

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

HIGHWAY DIVISION
IOWA DEPARTMENT OF TRANSPORTATION
AMES, IOWA 50010

DECEMBER 2007

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LIST OF ACRONYMS

AASHTO - American Association of State Highway and Transportation Officials

ACC - Asphalt Cement Concrete
ADV - Acoustic Doppler Velocimeter
APWA - American Public Works Association
ASCE - American Society of Civil Engineers
BMP - Best Management Practice
CIPR - Cold In-Place Recycling
CP - Concrete Pavement
CPTP - Comprehensive Public Training Program
CTRE - Center for Transportation Research and Education
DOT - Department of Transportation
DSM - Decision Support Model
FHWA - Federal Highway Administration
FRP - Fiber Reinforced Polymer
FWD - Falling Weight Deflectometer
GIS - Geographic Information System
HMA - Hot Mix Asphalt
IHRB - Iowa Highway Research Board
ISRCIM - Iowa Stormwater Runoff Control Interactive Manual
ISU - Iowa State University
LRFD - Load and Resistance Factor Design
LTAP - owa State University Local Technical Assistance Program
LVR - Low Volume Road
MOVITE - Missouri Valley Section of the Institute of Transportation Engineers
NAT - Nottingham Asphalt Tester
NCHRP - National Cooperative Highway. Research Program
NDT - Non-Destructive Testing
NPDES - National Pollution Discharge Elimination System
NRCS - National Resource Conservation Service
PCA - Portland Cement Association
PCC - Portland Cement Concrete
PI - Principal Investigator
QA - Quality Assurance
QC - Quality Control
QM-E - Quality Management - Earthwork
RC - Reinforced Concrete
RRFC - Railroad Flat Car
RSAP - Roadside Safety Analysis Program
SHRP - Strategic Highway Research Program
SUDAS - Statewide Urban Designs and Specifications
TAC - Technical Advisory Committee
TRB - Transportation Research Board
USGS - United States Geological Survey

RESEARCH AND DEVELOPMENT

The Highway Division of the Iowa Department of Transportation (Iowa DOT) 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 FY2007" 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, 2007; it is also a report on projects completed during the fiscal year beginning July 1, 2006, and ending June 30, 2007. 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, 2007, is listed in Table I.

The Research Board held nine regular meetings during the period of July 1, 2006, to June 30, 2007. Suggestions for research and development were reviewed at these meetings and recommendations were made by the Board.

TABLE I

2007 IOWA HIGHWAY RESEARCH BOARD ..... June 30, 2007

Member	Term Expires	Alternate
Ahmad Abu-Hawash Chief Structural Engineer Iowa DOT - Bridges and Structures 800 Lincoln Way Ames, IA 50010 (515) 239-1393	12-31-09	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	Will Zitterich Assistant Director Iowa DOT – Office of Maintenance 800 Lincoln Way Ames, IA 50010 (515) 239-1396
James Alleman Dept. of CCE Engineering Iowa State University 390 Town Engineering Bldg. Ames, IA 50011 (515) 294-3532	-	-
Dan Waid Hamilton County Engineer 2300 Superior Street, Suite 4 Webster City, IA 50595-3197 (515) 832-9520	12-31-08	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 Director Office of Maintenance 800 Lincoln Way 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	J. Jay Waddingham Franklin County Engineer 1341 Olive Avenue, PO Box 118 Hampton, IA 50441 (641) 456-4671

Jon Singelstad Monona County Engineer PO Box 236 Onawa, IA 51040 (712) 433-2284	12-31-09 District 3	Scott Rinehart Clay County Engineer 300 W. 4th Street #5 Spencer, IA 51301-2806 (712) 262-2825
Jim Berger Director Iowa DOT – Office of Materials 800 Lincoln Way Ames, IA 50010 (515) 239-1843	12-31-09	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	12-31-09	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	Daniel Ahart Shelby County Engineer 1313 Industrial Parkway Harlan, IA 51537 (712) 755-5954 SS#083
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
Steve Gannon Linn County Engineer 1888 County Home Road Marion, IA 52302-9753 (319) 892-6400 SS# 057	12-31-09 District 6	Clark Schloz Jackson County Engineer 201 W. Platt Maquoketa, IA 52060 (563) 652-4782 SS#049s

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, 2007. Total expenditure was $2,740,125.32.

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 24 counties during fiscal year 2007 as part of the Annual Traffic Count Program. This activity consisted of 5700 portable recorder classification counts, 370 portable recorder volume counts and 45 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 98 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 2007 financial summary is:

Beginning Balance 7-1-06		$1,624,114.39
Receipts		
State Road Use Tax Fund (1½% of receipts)	$1,382,837.51	
Federal Aid Secondary (1½% of receipts)	0.00	
Research Income	0.00	
Sub-Total		$1,382,837.51
Total Funds Available		$3,003,951.90
Obligation for Expenditures		
Obligated for Contract Research	$998,558.89	
Non-Contract Engineering Studies	$122,886.31	
Total Expenditures		$1,121,445.20
BALANCE 6-30-07		$1,885,506.70

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 2007 financial summary is:

Beginning Balance (7-1-06)	$ 17,103
FY06 Street Research Funding	$200,000
Total Funds Available for Street Research	$217,103
Total obligated for Expenditure	$195,743
Ending Unobligated Balance 6-30-07	$21,360

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 FY07 was $840,622.28 and the estimate for FY08 is $675,000.

PROJECTS INITIATED DURING FY 2007

TR-561	Laboratory and Field Testing and Evaluation of Precast Bridge Elements
TR-562	Monitoring Wind Induced Vibrations/Stresses in a High Mast Lighting Tower
TR-563	Effects of Implements of Husbandry Farm Equipment on Pavement Performance
TR-564	Adding Scour Estimation to the Iowa Bridge Backwater Software
TR-565	SUDAS & Iowa Specifications: Phase II – Implementation of Recommendations into SUDAS Specifications
TR-566	Investigation of Utility Cut Repair Techniques to Reduce Settlement in Repair Areas: Phase II
TR-567	Development of Stage Discharge Relations for Ungaged Bridge Waterways
TR-568	Modified Sheet Pile Abutments for Low Volume Bridges
TR-569	Quantitative Mapping of Waterways Characteristics at Bridge Waterways
TR-570	Identification of Practices, Design, Construction and Repair Using Trenchless Technology
TR-571	GIS-Based Decision and Outreach Tools for Aggregate Source Management
TR-572	Improving Safety for Slow Moving Vehicles on Iowa's High Speed Rural Roadways
TR-573	Development of LRFD Design Procedures for Bridge Piles in Iowa
TR-574	Structural Design, Construction and Evaluation of a Pre-Stressed Concrete Bridge Using Ultra-High Performance Concrete Pi Girders

14 Projects

PROJECTS COMPLETED DURING FY 2007

The following projects were completed during FY 2007 and the project final reports were approved by the Iowa Highway Research Board:

Project Number	Title	Report Approved
TR-438	Integral Abutment Bridge With Precast Concrete Piles	6/1/07
TR-460	Living Snow Fences	11/15/06
TR-471	Evaluation of Non-Corrosive Deicing Materials and Corrosion Reducing Treatments for Deicing Salts	6/29/07
TR-474	Validation of the Mix Design Process for Cold In-Place Rehabilitation Using Foamed Asphalt	6/29/07
TR-478	Evaluation of Composite Pavement Unbonded Overlays (Installation and Maintenance of Weigh In Motion Detection System on Iowa Hwy 13 in Delaware Co.)	9/29/06
TR-502	Evaluation of Long Term Field Performance of Cold In-Place Recycled Roads	6/29/07
TR-508	Design Guide and Construction Specifications for NPDES Site Runoff Control	7/28/06
TR-510	Laboratory Study of Structural Behavior of Alternative Dowel Bars	9/29/06
TR-513	Decision Support Model for Assessing Archaeological Survey Needs for Bridge Replacement Projects in Iowa	9/29/06
TR-528	Development of a New Process for Determining Design Year Traffic Demands	4/30/07
TR-531	Effective Shoulder Design and Maintenance	6/29/07
TR-542	Development of Continuous Concrete Slab Bridge Standards	11/8/06
TR-547	Investigation of Electro-Magnetic Gauges for Determination of In-Place Density of HMA Pavements	6/29/07

13 Projects

Table II
FINANCIAL SUMMARY OF RESEARCH AND DEVELOPMENT PROJECT EXPENDITURES

July 1, 2006 to June 30, 2007

(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	44,024.25	146,070.67	31,292.50	221,387.42
296	ISU Local Technical Assistance Program (LTAP)	39,965.00	10,746.80	10,000.00	60,711.80
428	Effective Structural Concrete Repair	$1,448.31	394.99	33.24	1,876.54
463	Field Performance Study of Past Iowa Pavement Research: A Look Back	3,992.14	4,988.16	1,000.00	9,980.30
466	Evaluation of Unbonded Ultrathin Whitetopping of Brick Streets		2,031.00	1,494.65	3,525.65
474	Development of a Mix Design Process for Cold-In-Place Rehabilitation Using Foamed Asphalt	3,174.71	1,524.81	288.48	4,988.00
492	Embankment Quality Phase IV - Application to Unsuitable Soils	26,554.67	13,363.70	13,705.89	53,624.26
493	Performance Evaluation of Steel Bridges: Phase II	10,593.77	9,448.84	7,497.56	27,540.17
498	Field Testing of Railroad Flat Car Bridges		37,456.13		37,456.13
501	Optimization and Management of Materials in Earthwork Construction	12,563.44	5,233.81	10,129.36	27,926.61
502	Evaluation of Long Term Field Performance of Cold In-Place Recycled Roads	2,797.74	6,345.67		9,143.41
507	Thin Maintenance Surfaces Phase III - Municipal Streets and Low-Volume Rural Roads	4,097.15	6,193.83	2,337.94	12,628.92
508	Design Guide and Construction Specifications for NPDES Site Runoff Control	11,711.62	10,128.45	4,696.56	26,536.63
510	Laboratory Study of Structural Behavior of Alternative Dowel Bars	1,275.39			1,275.39
513	Decision Support Model for Assessing Archaeological Survey Needs for Bridge Replacement Projects in Iowa	2,250.00	4,029.36		6,279.36
519	Developing Flood-Frequency Discharge Estimation Methods for Small Drainage Basins in Iowa		68,486.00		68,486.00
520	Evaluation of Dowel Bar Retrofits for Local Road Pavements		69,328.44	4,768.78	74,097.22
522	Investigation of Steel Stringer Bridges: Substructures and Superstructures		66,787.84		66,787.84
523	Appropriate Traffic Calming Techniques for Small Iowa Communities	3,095.26	13,844.58	179.48	17,119.32
525	Design Guide for Improved Quality of Roadway Subgrades and Subbases	10,718.94	342.72	2,227.91	13,289.57
528	Development of a New Process for Determining Design Year Traffic Demands	9,643.92	13,124.19	9,552.37	32,320.48
529	Construction and Evaluation of a Prestressed Concrete Bridge Constructed Using Ultra High-Performance Concrete	17,044.19	3,871.68	1,167.51	22,083.38
530	Development of an Improved Integral Bridge Abutment-to-Approach Slab Connection	36,711.89	17,094.83	1,196.79	55,003.51

Project	Project Title	Primary Road Research Fund Expenditures	Secondary Road Research Fund Expenditures	Street Research Fund Expenditures	Total Expenditures
531	Effective Shoulder Design and Maintenance	22,903.71	13,607.08		36,510.79
533	Evaluation of Design Flood Frequency Methods for Iowa Streams	113.40		22.63	136.03
534	Design Procedures and Field Monitoring of Submerged Barbs for Streambank Protection	31,169.79	26,134.82	2,634.40	59,939.01
536	Implementation of the Water Quality Control BMPs & Design & Specifications Manuals in the Iowa Stormwater Runoff Control Interactive Manual	11,589.93	4.42	1,981.80	13,576.15
538	Using Scanning Lasers for Real-Time Pavement Thickness Measurement	8,990.05	5,137.47		14,127.52
539	Instrumentation and Monitoring of Precast, Post-tensioned Bridge Approach Pavement	24,074.92	2,799.30	2,588.06	29,462.28
540	Developing Guidance for Use of Lighting on Rural and Urban Roadways in Iowa	23,464.31	37,048.96		60,513.27
541	The Effects of Headcut and Knickpoint Propagation on Bridges in Iowa	22,949.98	13,382.13	3,241.04	39,573.15
542	Development of Continuous Concrete Slab Bridge Standards	27,681.08			27,681.08
543	Development of Three Span Prestressed Concrete Beam Bridge Standards	1,322.33	205,997.34		207,319.67
545	Development of Self-Cleaning Box Culvert Designs	17,460.21	11,112.59	6,621.08	35,193.88
546	Revision to the SUDAS Traffic Signal Design Guide	7,255.15	25,591.74	3,287.58	36,134.47
547	Investigation of Electro-Magnetic Gauges for Determination of In-Place Density of HMA Pavements	13,970.06	21,920.97	5,090.00	40,981.03
548	Investigation of the Impact of Rural Development on Secondary Road Systems	19,157.08	32,390.09	5,194.97	56,742.14
549	Roadway Design Standards for Rural and Suburban Subdivisions	17,060.49	37,900.10	6,573.52	61,534.11
550	Performance Evaluation of Rubblized Pavements in Iowa	3,988.33	9,096.82		13,085.15
551	Local Agency Pavement Marking Plan	21,886.51	22,107.67	8,010.85	52,005.03
552	Field Evaluation of Timber Preservation Treatments for Iowa Highway Applications	10,823.03	1,073.60		11,896.63
553	Examination of Curing Criteria for Cold In-Place Recycling	24,002.63	39,926.68	2,997.76	66,927.07
554	Performance & Evaluation of Concrete Pavement Granular Subbase	9,893.71	26,603.20	12,426.60	48,923.51
555	Evaluation of Hot Mix Asphalt Moisture Sensitivity using the Nottingham Asphalt Test Equipment	6,193.66	10,105.50	2,912.59	19,211.75
556	Feasibility Investigation of Segmentally Precast Bridge Piers for Accelerated Construction	16,512.78	21,777.76	4,748.89	43,039.43
557	Evaluation of Lignin Derived from Agricultural Co-Products as an Antioxidant in Asphalt	18,546.64	17,247.81	2,495.60	38,290.05
558	Use of Ultra-High Performance Concrete in Geotechnical and Substructure Applications	22,573.28	24,152.59	7,123.59	53,849.46
559	Improved Method for Determining Wind Loads on Highway Sign and Traffic-Signal Structures	4,539.94	1,625.36		6,165.30

Project	Project Title	Primary Road Research Fund Expenditures	Secondary Road Research Fund Expenditures	Street Research Fund Expenditures	Total Expenditures
560	Clear Zone - A Synthesis of Practice and Benefits of Meeting the Ten-Foot Clear Zone Goal on Urban Streets	7,126.06	15,954.04	5,481.00	28,561.10
561	Laboratory, Field Testing and Evaluation of Precast Bridge Elements	38,185.19	168,069.19	29,605.91	235,860.29
562	Monitoring Wind-Induced Vibrations/Stresses in a High Mast Lighting Tower	30,490.95			30,490.95
564	Adding Scour Estimation to the Iowa Bridge Backwater Software		828.00		828.00
565	Implementation of Recommendations into SUDAS Specifications (Phase II of TR-524)	59,536.22	88,554.80	13,088.99	161,180.01
566	Investigation of Utility Cut Repair Techniques to Reduce Settlement in Repair Areas	5,268.20	39,807.20		45,075.40
567	Development of Stage-Discharge Relations for Ungaged Bridge Waterways	10,163.55	2,757.21	3,522.84	16,443.60
568	Modified Sheet Pile Abutments for Low Volume Bridges	4,835.85	4,135.17	402.27	9,373.29
569	Quantitative Mapping of Waterways Characteristics at Bridge Sites	34,356.00	5,788.44	8,435.31	48,579.75
570	Identification of Practices, Design, Construction and Repair Using Trenchless Technology	19,283.37	2,790.96		22,074.33
572	Improving Safety for Slow Moving Vehicles on Iowa's High-Speed Rural Roadways	1,591.50			1,591.50
1027	Secondary Road Research Coordinator		91,312.80		91,312.80
	Contract Research Subtotal	840,622.28	1,537,578.31	239,038.42	2,617,239.01
SPR-PL-1(43)	**FY 2007 Planning and Research Program (Transportation Inventory Engineering Studies Subtotal)**		122,886.31		122,886.31
	Total of Expenditures	840,622.28	1,660,464.62	239,038.42	2,740,125.32

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

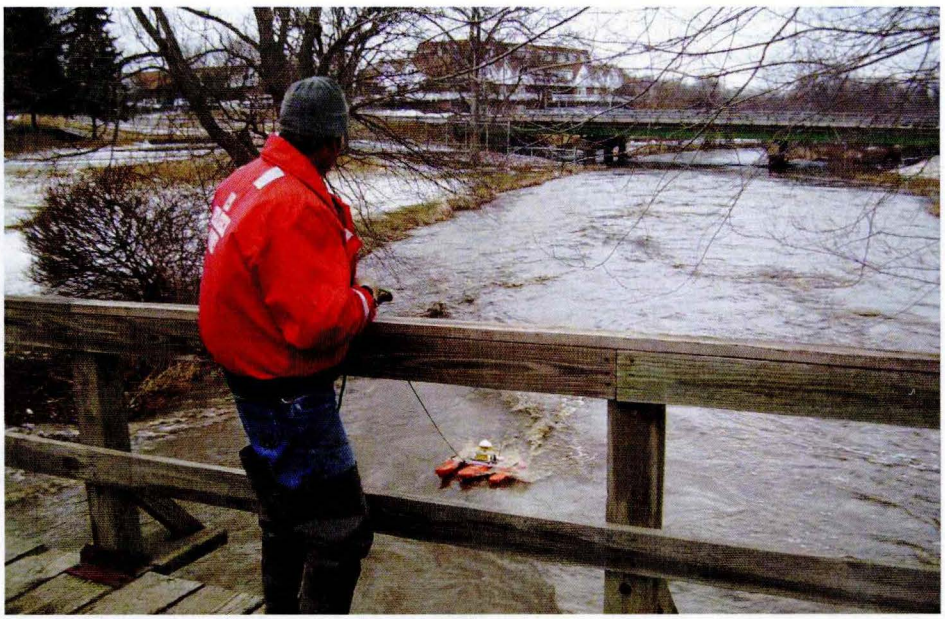
Collection and Analysis of Stream Flow Data

Objective: To collect the data necessary for analytical studies (including flood-frequency discharge estimation) and to define, for any location, the statistical properties and trends in discharge or elevation of streams, lakes, and reservoirs. To 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 in Iowa. Structure design agencies use this data for their designs.



Acoustic Doppler Current Profiler (ADCP) in use at Duck Creek during Davenport flood in March, 2007 - *Photo: U.S. Geological Survey*

HR-296

Agency:
Iowa State University

Principal Investigator:
Duane Smith

Research Period:
October 1, 1986 to December 31, 2007

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: 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: Major ongoing tasks are to:

- Publish at least six *Technology News* newsletters per year
- Conduct at least 10 training courses/workshops per year
- Distribute publications
- Provide service and information to users
- 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.

Participants at the 2007 Expo discover the latest technology and equipment.

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: 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 20 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.

County engineers discuss various topics of interest at TRB - *Photo: The Transportation Research Board, Washington, D.C.*

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: To develop innovative repair methods and/or 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 Fiber Reinforced Polymers (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 bridge and other engineers 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
May 31, 2007

Research Board Funding:
$142,903

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

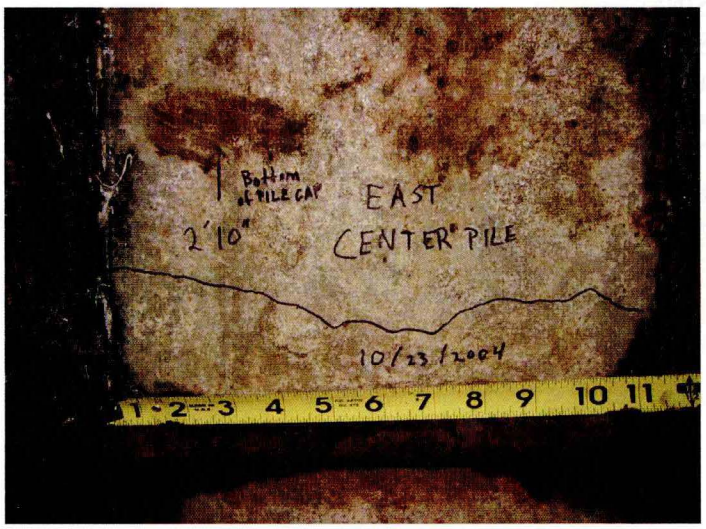
An Integral Abutment Bridge with Precast Concrete Piles

Objective: Research objectives are to:

- 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 is referred to as the Tama County Bridge.
- Establish the longitudinal displacement versus temperature behavior for the abutments of the Tama County Bridge.

Reports: Final Report May 2007.

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.



Upper crack, located 2'10" below abutment

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

Progress: The draft final report is being written and will be delivered in January 2008.

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, 2006

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: 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 2008.

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

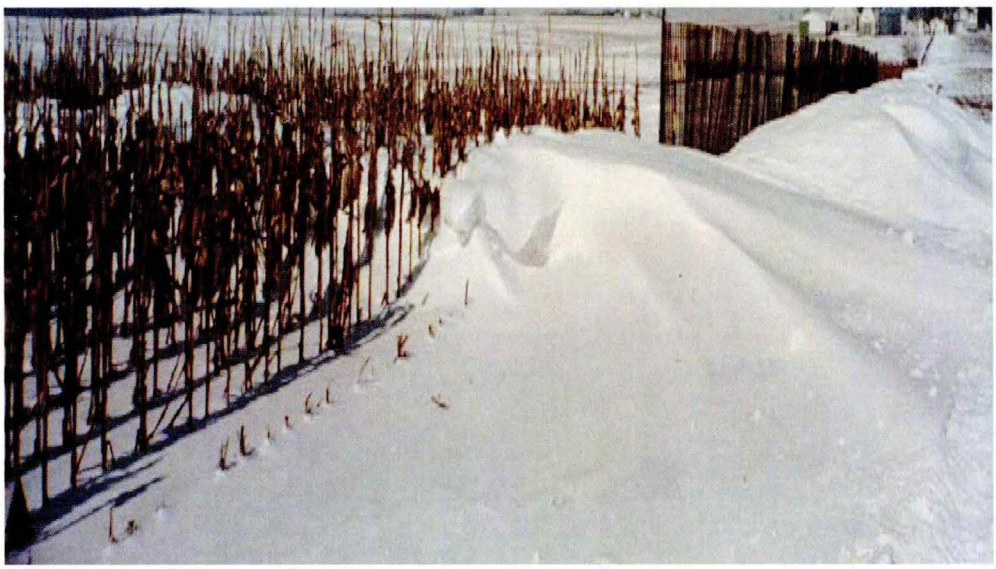
Living Snow Fences

Objective: Main objectives are to:

- Determine the optimal configuration of corn rows and switch grass to "catch" drifting snow. Other living snow fences may also be studied during this part of the study, and direct comparison with artificial (i.e. wooden or plastic) snow fences will be made.
- 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 present 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.

Reports: Final Report, January 2007

Implementation: The results of this study will be presented at an appropriate meeting in Iowa after completion of the project. The report and 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.



Year 1 Tests, 16 rows of corn adjacent to six foot fence

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: 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.

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.

Understanding the impact of pavement research will influence future projects.

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

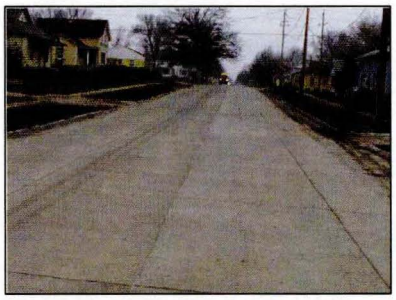
Objective: To demonstrate the design and place an unbonded PCC overlay on an existing base of ACC and brick and to evaluate the performance of the 3" PCC overlay to that of the 3" ACC overlay in the short- and long-term.

Reports: Final Report, June 2006

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

- Distribution of the project reports by the IHRB to public entities and consultants
- Use of the CTRE newsletters and PCC Center publications
- Presentations at the APWA Iowa Chapter annual meetings
- Technology abstracts placed on the Midwest Concrete Consortium Web Page at www.ctre.iastate.edu/mcc/

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 travel meeting at field sites in Iowa. No other technology transfer activities required funding for FY 06-07.

Reports: None

IHRB
IOWA HIGHWAY RESEARCH BOARD

TR-471

Evaluation of 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 June 1, 2007

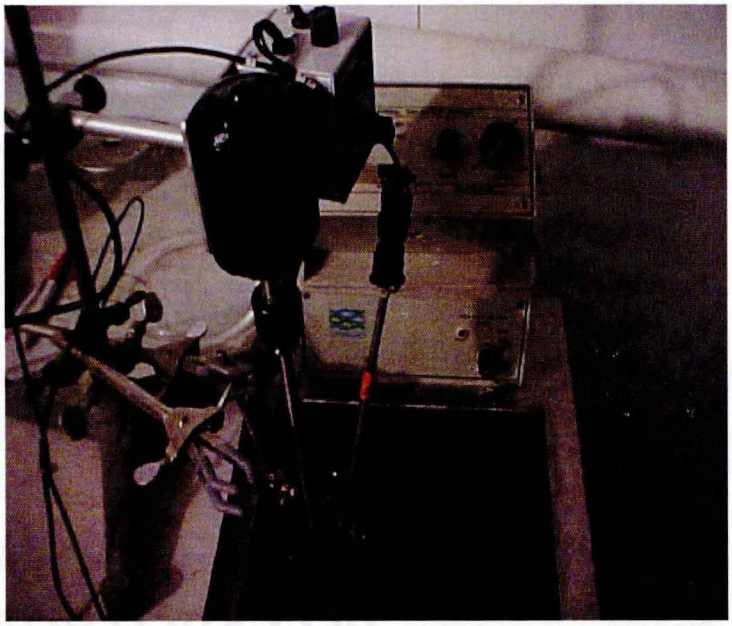
Research Board Funding:
$100,000 (The University of Iowa - $92,000; Iowa State University - $8,000)

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.

Reports: Final Report June 2007

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 email to subscribers on the snow and ice mailing list.



Freezing point experiment in progress

TR-472

Agency:
The University of Iowa

Principal Investigator:
Wilfrid A. Nixon

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

Research Board Funding:
$80,000

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

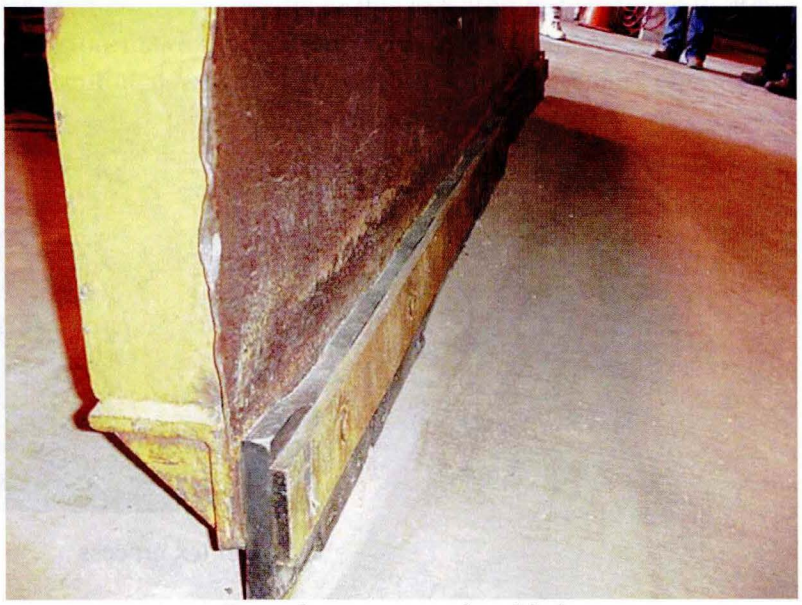
Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipment

Objective: 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. All tests have been completed and an economic analysis is currently underway. It is anticipated that the final report will be complete in 2008.

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 email to all subscribers on the snow and ice mailing list.



Corrosion on snow plow blade

TR-474

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

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

Objective: 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.

Reports: Final Report June 2007

Implementation: The implementation outlook for the proposed project is very realistic, given the 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.

CIR-ReFlex process

TR-480 (SD2002-01)

Agency:
Michigan Technological University

Principal Investigator:
Lawrence L. Sutter

Research Period:
July 15, 2002 to June 30, 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

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

Objective: Objectives are to:

- 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-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, 2005

Research Board Funding:
$90,000

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

Objective: To determine what mixture of calcium chloride and sodium chloride when applied to the road surface under winter weather conditions, provides the best possible level of service to the public in the most economical way possible. In addition, 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; completion of the final report is anticipated in 2008.

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 at www.sicop.net.

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: 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 this project's progress. It is anticipated that the final report will be complete in 2009.

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.

Maintenance Operations for snow removal by Iowa DOT during the winter storm of 2007.

TR-492

Agency:
Iowa State University

Principal Investigator:
David J. White

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

- Final recommendations for QM-E implementation
- A proposed Iowa DOT developmental specification
- Improved data management tools for contractor quality control (QC) and Iowa DOT quality assurance (QA)

Progress: All data has been analyzed.

Reports: The final report is being prepared.

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

Cone Penetration Testing (setup on the left) and soil borings (right) in progress on the Crow Creek embankment. *Photo: Thang Phan, Ph.D. candidate, Geotechnical Engineering, Iowa State University*

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: to study the performance of bridges with suspect or untested design details and 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 late 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.

Evaluating the design of a steel bridge in Iowa

TR-498

Agency:
Iowa State University

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

Research Period:
June 1, 2003 to August 31, 2007

Research Board Funding:
$192,958

Funding Source:
100% State - 100% Secondary funds

Field Testing of Railroad Flat Car (RRFC) Bridges

Objective: 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.

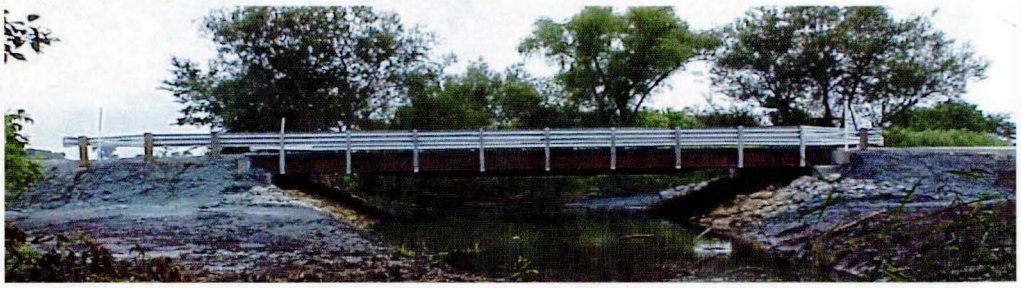
In June, 2005, the need to investigate continuous span RRFC bridges became apparent and thus an extension to the current project to include the testing of three continuous span bridges was proposed and approved by the IHRB.

Progress: The final RRFC bridge to be tested as part of this study (the strengthened RRFC bridge in Winneshiek County) was tested in May, 2007; data has been analyzed. The research team is finishing up the two volume final report (one volume on single span RRFC bridges and one volume on continuous span RRFC bridges) on this project.

During the past year, all tasks associated with this project except for a few parts of the final report have been completed.

Reports: Draft Final Report, August 2007.

Implementation: This research will 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 RRFC bridges.



The finished Buchanan County RRFC Bridge

TR-501

Agency:
Iowa State University

Principal Investigator:
Vern Schaefer

Research Period:
January 1, 2004 to June 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: Objectives are to:

- Identify the impact of not doing material management and optimization through a forensic study of recent geotechnical problems and failures in Iowa.
- 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.

Reports: Work continues on the final report. It is not yet complete.

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.

Soil mixing operation through layered soils, Des Moines, Iowa

TR-502

Agency:
Iowa State University and The University of Iowa

Principal Investigator:
Charles Jahren and Hosin "David" Lee

Research Period:
November 1, 2003 to June 30, 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

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

Objective: To develop understanding of how:

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

Reports: Final Report June 2007

Implementation: The result of this study will allow transportation officials to make decisions with regard to cold in-place asphalt recycling with more confidence, resulting 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.

A typical CIR recycling train

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

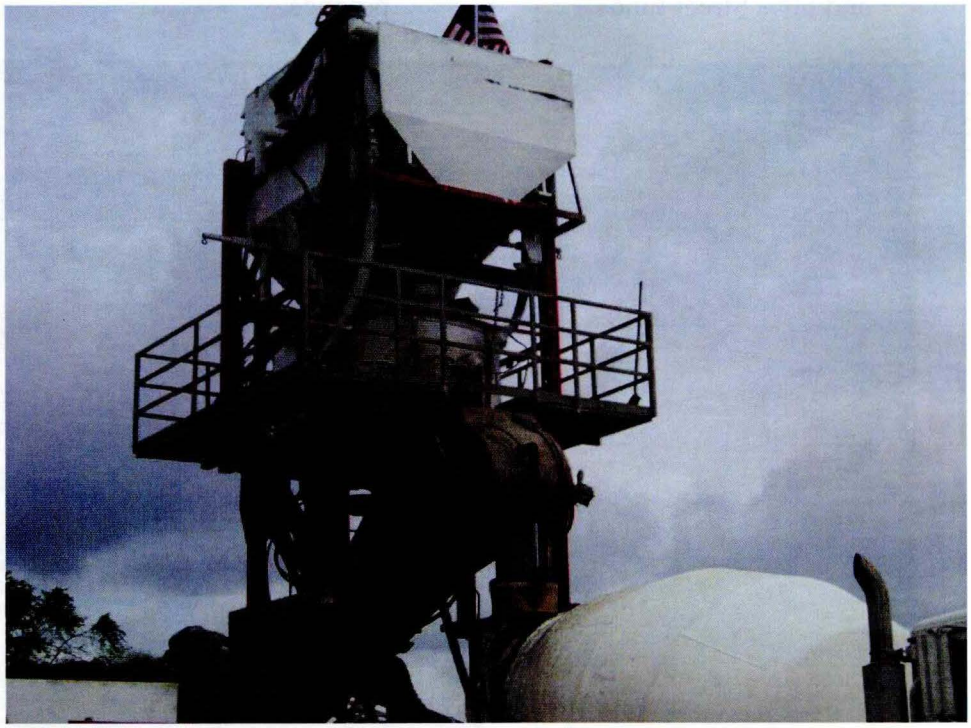
Objective: To find optimal mixing procedures for production of a homogeneous and workable mixture and quality concrete using a two-stage mixing operation.

Specific Objectives:

- Achieve optimal mixing energy and time for a homogeneous cementitious material
- Characterize the homogeneity and flow property of the pastes
- Investigate effective methods for coating aggregate particles with cement slurry
- Study the effect of the two-stage mixing procedure on concrete properties
- Improve production rates

Reports: The final report was submitted on April 16, 2007 to the Director of the CP Tech Center for review.

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.



A two stage PCC mixing tower

TR-507

Agency:
Iowa State University

Principal Investigator:
Charles Jahren

Research Period:
November 1, 2003 to April 30, 2007

Research Board Funding:
$86,373

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

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

Objective: 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

Reports: Final Report, August 2007

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.

Micro-surfacing construction

TR-508

Agency:
Iowa State University

Principal Investigator:
Dale Harrington

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

Research Board Funding:
$207,800

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

Design Guide and Construction Specifications for NPDES Site Runoff Control

Objective: To 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 the addenda for the two SUDAS manuals and place the contents of the erosion and sedimentation control on the Web; and Assist the Iowa DOT in upgrading design standards and specifications for Iowa DOT and county 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.

Sediment in street due to inadequate erosion and sediment control during construction - *Photo: USDA NRCS Photo Gallery*

TR-510

Agency:
Iowa State University

Principal Investigator:
Max Porter

Research Period:
February 1, 2004 to July 31, 2006

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

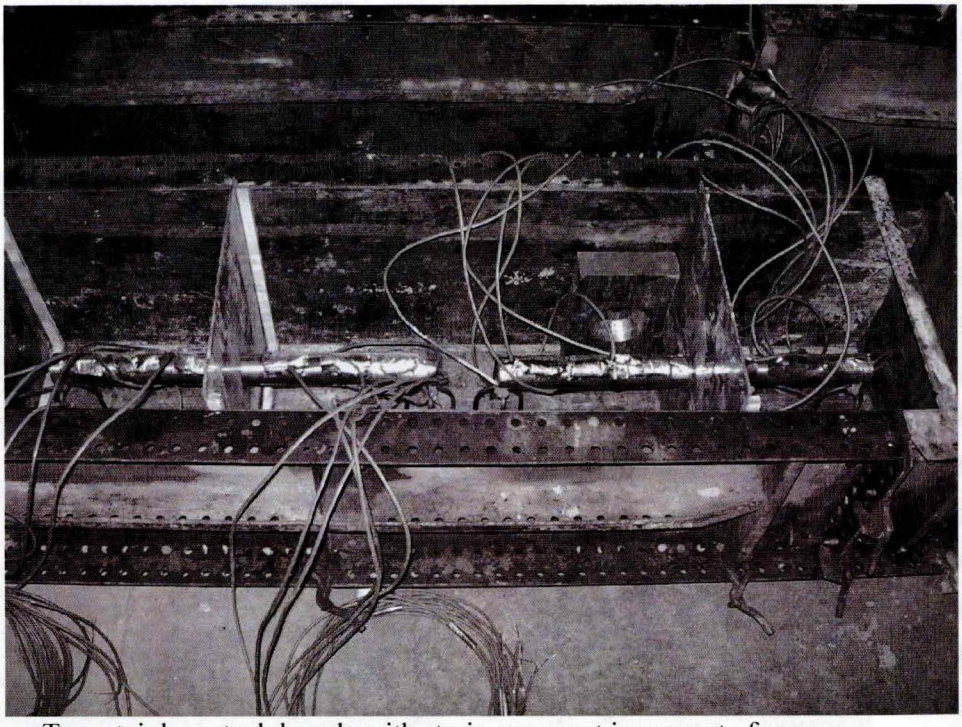
Laboratory Study of Structural Behavior of Alternative Dowel Bars

Objective: 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 will include recommendations made 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



Two stainless steel dowels with strain gages set in concrete forms

TR-513

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

Principal Investigator:
Joe Alan Artz

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

Research Board Funding:
$50,000

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

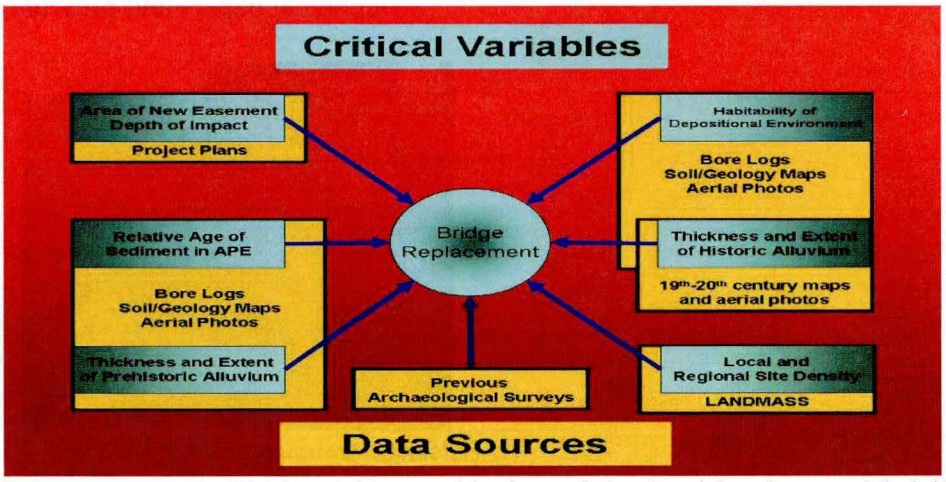
Decision Support Model (DSM) for Assessing Archaeological Survey Needs for Bridge Replacement Projects in Iowa

Objective: To leverage Iowa DOT's 30-year investment in archaeological survey to create a tool for evaluating the archaeological potential of bridge replacement projects, and to:

- 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 DSM that allows project planners and archaeological consultants to apply 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 DSM.
- Develop recommendations for further research to improve, test, and extend the DSM.

Reports: Final Report, September 2006

Implementation: The DSM will be used at the local level by city, county and district engineers; at the state level by the State Historical Preservation Office and Iowa DOT; and by archaeological and engineering/environmental consultants at the individual project level. Self-training is optional employing the user's manual, but additional hands-on, instructor-led training may be necessary.



Data sources and critical variables used in determining Decision Support Model

TR-516

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

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

Objective: Objectives are to:

- 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.
- 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: Data continue to be collected at the field site with instrumentation results being updated bi-monthly.

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 Web sites, and through local and 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.

Existing non-uniform subgrade after pavement removal

Re-compacted uniform subgrade prior to placement of new pavement

TR-517

Agency:
University of Nebraska - Lincoln

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

Research Period:
April 1, 2004 to December 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: To develop general guidelines 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: The final report is currently being drafted and is expected to be delivered by the end of 2007.

Reports: None

Implementation: Generalized guidelines for safety treatment of cross-drainage culverts will greatly simplify development of plans for reconstruction, rehabilitation & resurfacing (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: To instrument and monitor a high-mast tower in the I-35/US 18 interchange near Clear Lake for at least one year to determine vibration types and stress ranges induced at various wind velocities. The natural frequencies and damping characteristics of a number of towers will be evaluated and are very important in the investigation/evaluation of towers.

The objective is to collect long-term behavior information on the performance of one of the eight high-mast lighting towers for the purpose of validating assumptions made previously in an analytical investigation of these and similar 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 should provide information to revise/improve the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals. This, in turn, will improve the design of future towers and the retrofit of existing towers in Iowa and nationwide.

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

Replacement tower base

TR-519 Phase II

Agency:
United States Geological Survey (USGS)

Principal Investigator:
David Eash

Research Period:
June 1, 2004 to September 30, 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: To develop a comprehensive flood-estimation method for unregulated, rural streams in Iowa. Specifically, 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 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 will:

- 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.

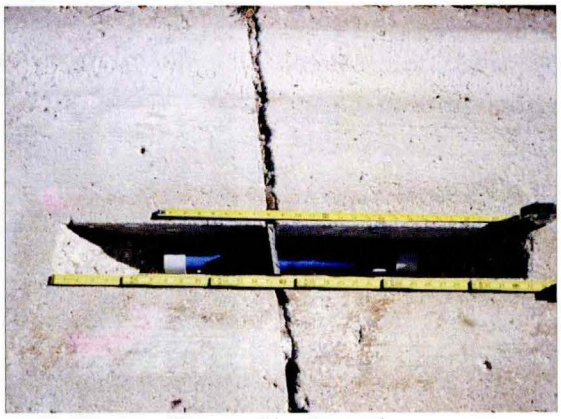
Progress: Collection of final data for deflections, profile and visual distress was completed in August 2007. The final report is currently being drafted.

Reports: Construction Report, February 2006

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

- 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-522

Agency:
Iowa State University

Principal Investigator:
F. Wayne Klaiber

Research Period:
November 1, 2004 to August 31, 2007

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: To develop procedures for assessing, rehabilitating, strengthening and replacing inadequate substructure components or entire substructures and to develop methods to more accurately evaluate and rate non-composite, steel stringer concrete deck bridges.

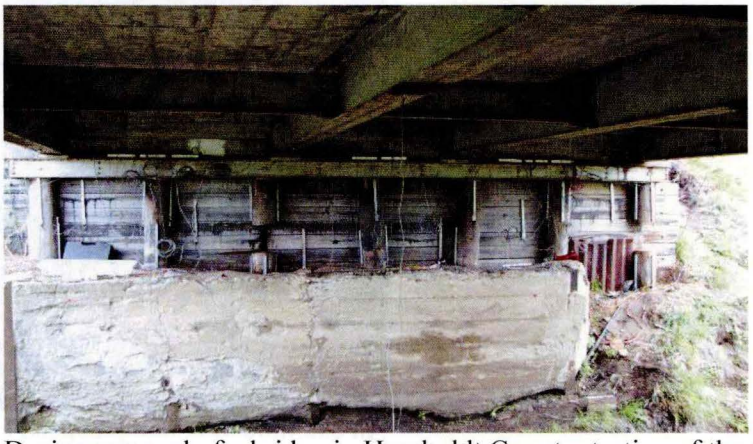
Progress: In the past quarter techniques for repairing damaged timber piling using Fiber Reinforced Polymers (FRP) have been developed and tested in the laboratory. The draft of the final report (Vol 1- *Superstructures* and Vol 2 – *Substructures*) is complete. The research team is currently completing the final report and working on a technology transfer document.

In the past year the project has been completed except for the final report.

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.



During removal of a bridge in Humboldt County, testing of the super- and sub-structure is made; instrumentation on the piling is visible.

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:
$94,782

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

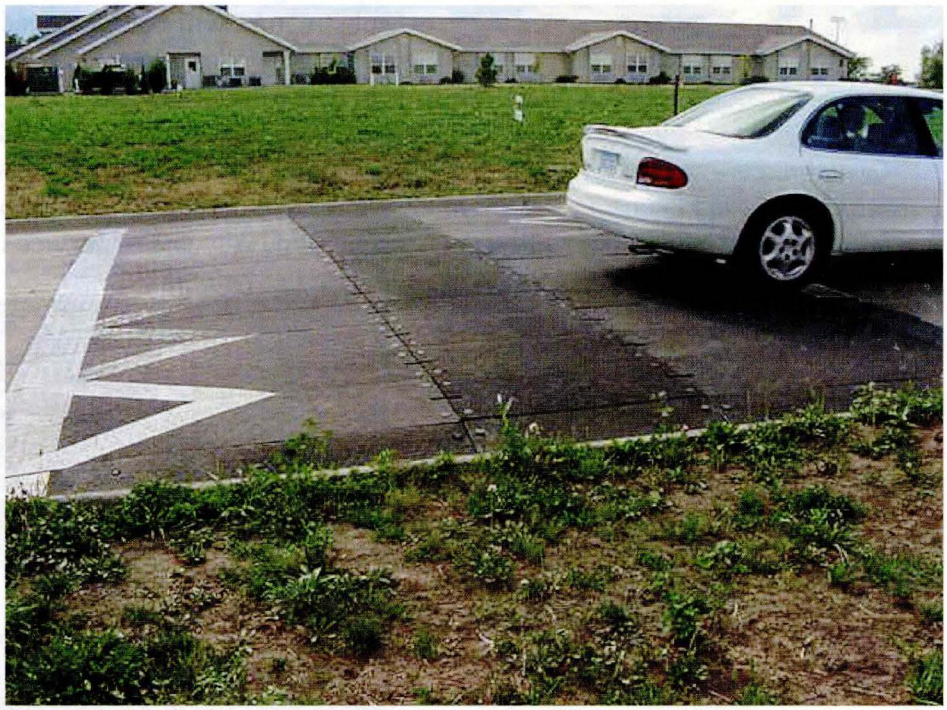
Appropriate Traffic Calming Techniques for Small Iowa Communities

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: All site evaluations have been completed with the exception of the final 12-month data collections. Literature review is 100% completed.

Reports: The final report is 75% completed.

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



An example of a 30 mph speed table used in CTRE study for residential traffic calming in small Iowa communities.

TR-525

Agency:
Iowa State University

Principal Investigator:
Vernon R. Schaefer

Research Period:
November 1, 2004 to August 31, 2007

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: 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.

Reports: Work continues on one section (subdrains) and review of the document is underway. Completion is anticipated in August.

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 Web site, and through presentations made at appropriate local/ regional/national conferences.

TR-528

Agency:
Iowa State University

Principal Investigator:
Neal Hawkins
Reg Souleyrette

Research Period:
December 31, 2004 to May 31, 2007

Research Board Funding:
$125,000

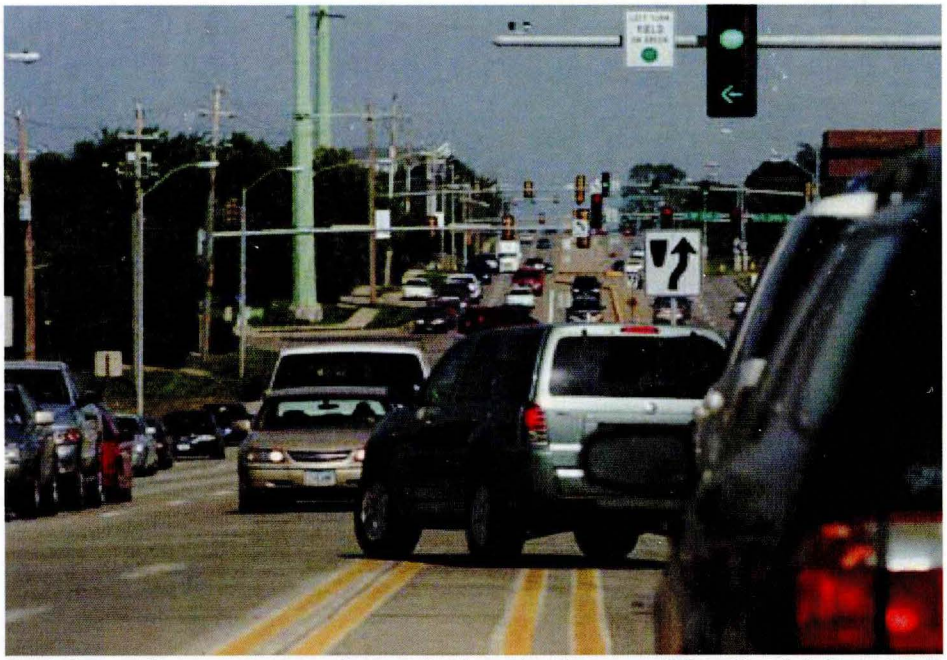
Funding Source:
100 % State -
33 % Primary funds, 34 % Secondary funds and 33 % Street funds

Development of a New Process for Determining Design Year Traffic

Objective: To improve civil engineering design in terms of more consistent roadway performance over the life of the project and develop an alternative and more detailed method for developing traffic projections, creating tools which allow for scenario planning, embracing the traditional planning process and evaluating alternative methods for using existing long range models. In addition, the research seeks to improve the overall relationship between planning and civil transportation design.

Reports: The final report was completed and presented to the Iowa Highway Research Board on April 27, 2007.

Implementation: The research 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 farther away from a new site than the adjacent intersections.



Peak-hour afternoon congestion on University Avenue, West Des Moines, IA

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: A follow-up test was conducted on the final bridge; data are currently being analyzed and compared to those collected previously in the field and laboratory.

Reports: None

Implementation: These advances will be useful to all jurisdictions within Iowa by ultimately reducing costs, utilizing a higher strength material with almost zero permeability. This could essentially eliminate deterioration of bridge decks.

The results of this research will be compiled in design recommendations and specifications that potentially may be adopted by the American Association of State Highway and Transportation Officials (AASHTO).

A UHPC prestressed Bridge constructed on Little Soap Road in Wapello County

TR-530

Agency:
Iowa State University

Principal Investigator:
Brent Phares

Research Period:
March 1, 2005 to April 30, 2008

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

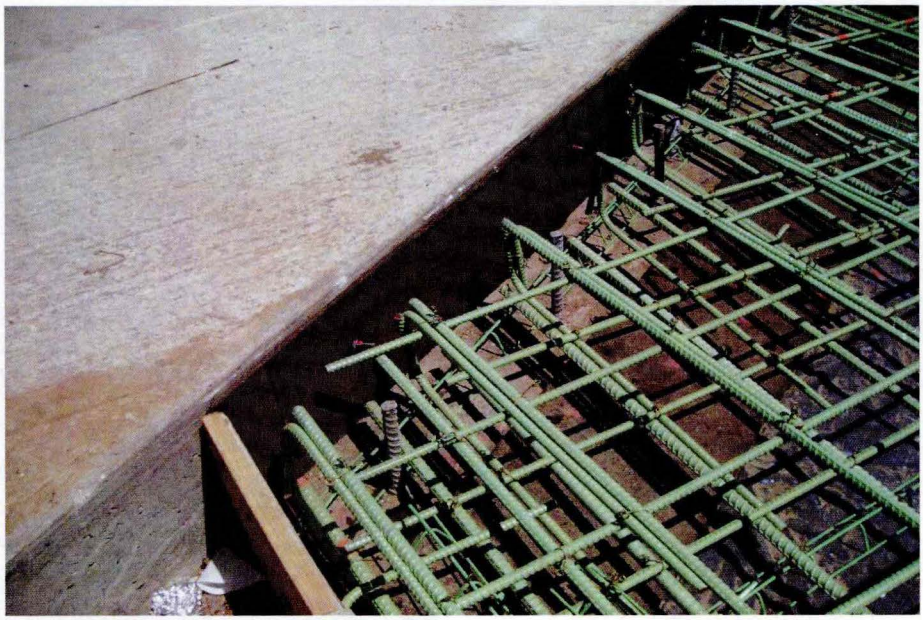
Objective: The objectives of this project are to:

- 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: Behavior monitoring is progressing and will be going on for the next 6 months.

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 statewide.



Installation of an improved bridge-to-pavement connection detail

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: Objectives are to:

- 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.

Reports: The final report was prepared and submitted to the TAC for final review and comment. This project is complete.

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.

S.S. polymer topically applied to the granular shoulder

TR-533

Agency:
The University of Iowa

Principal Investigator:
Allen Bradley

Research Period:
March 1, 2005 to May 31, 2008

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 National Resource Conservation Service/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 were 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; 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: None

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: To model hydraulically the performance of a proposed submerged barb design for the US-169 bridge site and perform a comprehensive field study involving the design, installation and monitoring of submerged barbs at the same site.

Reports: Final Report, September 2007

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.

Students use an Eagle Fish Elite 480 fish-finding sonar/GPS mounted to a tow fish for depth measurements on the Raccoon River near Adel, Iowa.

TR-536

Agency:
The University of Iowa

Principal Investigator:
Marian Muste

Research Period:
April 1, 2005 to December 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: 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: Manuals to be incorporated into the interactive Web site are:

- Iowa Construction Site Erosion Control Manual
- Statewide Urban Standard Design and Specification Manuals for Erosion and Sedimentation Control
- 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 section is still under development.

The software is operationally robust and works well.

Reports: None

Implementation: Once finalized, the Iowa Stormwater Runoff Control Interactive Manual (ISRCIM) will be transferred onto one of the Iowa DOT existing Web servers. Strong outreach, testing and upgrading activities are envisioned during the dissemination of the ISRCIM to a wide category of users; the training programs incorporated in Part 3 of research project TR-508, "Design Guide and Construction Specifications for NPDES Site Runoff Control" presents a major portion of this implementation.

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-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

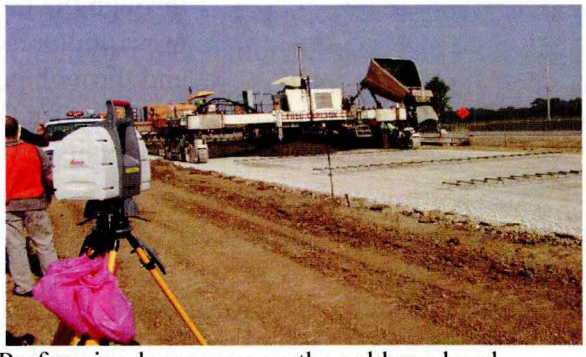
Using Scanning Lasers for Real-Time Pavement Thickness Measurement

Objective: 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 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 specifications are met.

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 is 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.



Performing laser scan on the subbase level

TR-539

Agency:
Iowa State University

Principal Investigator:
Brent Phares

Research Period:
July 1, 2005 to April 30, 2008

Research Board Funding:
$149,126

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

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

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: Data collection has started and will continue for the next 6 months.

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 Web site of Iowa DOT's Office of Bridges and Structures and Iowa State University's Bridge Engineering Center Web site.

TR-540

Agency:
Iowa State University

Principal Investigator:
Shauna Hallmark, Neil Hawkins

Research Period:
June 1, 2005 to March 31, 2008

Research Board Funding:
$124,842

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: To provide agencies in Iowa with information and guidance on the use of lighting so cost-effective decisions can be made. Research will also: Summarize existing lighting guide-lines; Document good lighting practice; Quantify the effectiveness of roadway lighting in reducing the number and severity of night-time crashes; Compare roadway lighting to other safety measures (such as pavement markings, rumble strips, etc.); and Provide information for selection of strategies to reduce night-time crashes from among a range of alternatives and develop recommendations for the use of roadway lighting.

Progress: Tasks 1-3 listed in the proposal are complete. An initial statistical analysis was completed. Several variables were combined since there were only a few observations for each; the analysis looked at crashes by intersection approach. Evaluation of crashes for the intersection as a whole was also made; this task is 90% complete. The Lighting Layout Guideline and Selection Matrix for Guidance Options task is approximately 40% complete. The Incorporate Lighting Information into SUDAS and Identify Future Directions in Roadway Lighting tasks are approximately 20% complete.

Reports: The final report is about 25% complete.

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 a:

- Description of what good lighting incorporates
- 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 September 30, 2008

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% 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 emphasis of this research was the development of a methodology that allows an adequate representation of the distribution of the knickpoint shear stress when secondary currents are present and an estimation of the critical erosion strength and other sediment erodibility parameters for knickpoint erosion.

The study has shown that the presence of secondary currents increases the magnitude of the depth averaged side wall shear stress (at least) by a factor of 2.0. It was also found that the ratio of the maximum to the depth averaged side wall shear stress is greater than 5. These findings suggest that use of the may be a good approximation of the fluid shear stress magnitude for simple channel geometries but not for natural channels characterized by complex geometries.

It was found that the knickpoints during the high flow conditions experienced last spring moved on an average of 8'-12'. The research will provide the rate of migration of knickpoints and assess when the knick points will reach the stabilization structures downstream of county bridges in the area. No study has examined the stability of weirs once the knickpoints reach the structures.

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: 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.

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 at www.dot.state.ia.us/bridge/index.htm.

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

Development of Three Span Prestressed Concrete Beam Bridge Standards

Agency:
WHKS & Company

Principal Investigator:
WHKS & Company

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

Research Board Funding:
$673,690

Funding Source:

Objective: This project involves bringing the superstructure portion of the current three-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").

Reports: Completed Bridge Standards, March 2007

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 at www.dot.state.ia.us/bridge/index.htm.

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.

A three-span prestressed concrete bridge constructed in Jones County

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: 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: The first visit to culverts in Buena Vista County highlighted the peculiarity of the sedimentation process. In essence, the visited sites revealed that the peak of the sedimentation process takes place at an unknown combination of flow conditions (depth, velocities, and discharges) through the culverts.

Following the second visit in the Marion County, it was decided that the best approach to further understand the processes would involve choosing a site where researchers could track the sedimentation process over an extended time interval and start the modeling work for the screening tests using a smaller scale model in order to accommodate a variety of flow conditions and geometries prone to sedimentation.

In order to further understand the hydraulic regimes (triggering/favorable/unfavorable) associated with the sedimentation processes at culverts, two new site visit campaigns were organized at 2- and 3-box culverts located in Johnson County near Iowa City. Besides inferences on the sedimentation process in relationship with the hydraulic regimes, the intention of this third field documentation trip was to select one or two relevant culvert sites, where the sedimentation process can be tracked over time by the project team. The design and the instrumentation needs for conducting the observations were also established.

The site visits illustrated that the range of hydraulic conditions that are prone to trigger sedimentation is vary diverse, hence a series of experiments were designed to identify these regimes. A new experimental facility was built for this purpose. Tests were initiated earlier this year and are currently in progress.

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 June 30, 2008

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, Iowa DOT and municipal agency staff, the signal industry as well as professionals from fields such as electrical, geotechnical and soils engineering.

Progress: A literature review has been completed with focus on completing the design manual this quarter. There is a plan to schedule task force meetings in August to discuss both the design information as well as the specification.

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.

SUDAS specifications are being updated to stay current with new traffic signal technologies and methods used today.

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

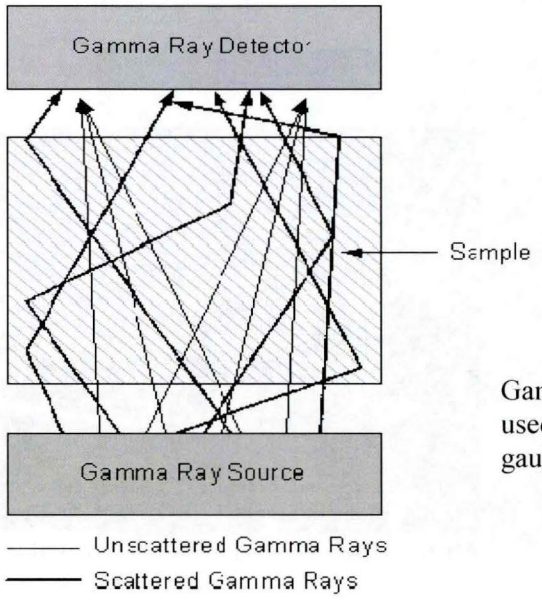
Objective: To establish the accuracy and precision of the Pavement Quality Indicator (PQI) model 301 electromagnetic gauge manufactured by TransTech and the PaveTracker model 2701 electromagnetic gauge manufactured by Troxler as compared to cores.

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: A proposal for Phase II of the study has been approved.

Reports: The research project has been completed. The final report was submitted to and accepted by the IHRB.

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.



Gamma ray technology used in nuclear density gauge

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

Progress: This project is underway with key tasks being addressed. Expected time of completion is Summer 2007. The analytical portion of this project was completed during this fiscal year. The draft final report is currently being prepared. The draft will be reviewed by the TAC and then a presentation scheduled for IHRB. Project presentations were given last autumn at the (MN, IA, NE, KS) MINK multi-state county engineer conference and to the Iowa County Engineer's Conference. A follow-up presentation has been scheduled for the next MINK conference.

Reports: None

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

A rural residential subdivision located in the middle of prime farmland.
Photo: Susan Deblieck, student, Iowa State University

TR-549

Agency:
Iowa State University

Principal Investigator:
Paul Wiegand

Research Period:
December 1, 2005 to July 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

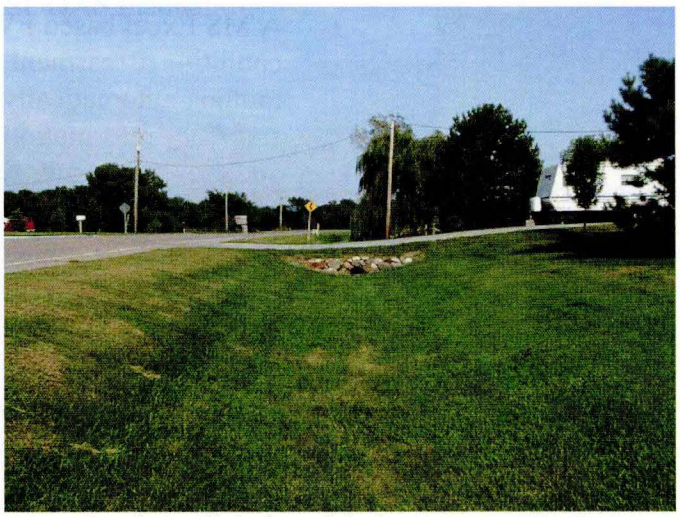
Objective: A preliminary search of county Web sites indicates that only 28% of Iowa counties have specific subdivision public improvement requirements. The Statewide Urban Design and Specification (SUDAS) and Iowa DOT manuals do not have geometric standards for rural cross-sections on low-volume, low-speed 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 draft report was sent to TAC members in January for review and comment. The appropriate comments were incorporated and the final draft was sent to editing. A final TAC meeting to discuss implementation strategies, final edit review, and final submittal will be made by the end of July 2007.

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 to ultimately be incorporated into the SUDAS Design Manual, Chapter 5 (Roadway Design), providing additional geometric design guides and design criteria associated with rural and suburban developments.



Example of a well designed drainage system.

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 back-calculation of FWD deflection data, the rubblized layer modulus values will be determined for various projects and compared with each other for correlating with 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: Good progress has been made during this fiscal year with emphasis on:

- Identifying and selecting existing rubblized pavement sites in Iowa
- Conducting field evaluations - 16 project sites have been visited this year and FWD (falling weight deflectometer) and DCP (dynamic cone penetrometer) testing were conducted; cores were taken from 10 of these sites along with mapping the detailed pavement distress surveys. Remaining project sites will be visited in August and September of 2007 to complete the field investigation and continue with the data analysis and preparation of the project final report to summarize the project findings.
- A MS Excel based FWD data analysis toolbox was created for condition assessment of the rubblized pavement systems. This toolbox automatically analyzes the FWD data and provides summary information on the condition of each pavement layer and plots the results in the longitudinal pavement profile.

Reports: None

Implementation: The results of this study may 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:

- Developing 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.
- Addressing quality control issues for cities and counties to improve the efficiency and effectiveness of pavement markings on all marked public roadways.

Progress: Working with a private contractor to install two test decks was successful. The research team is working with another vendor to install additional materials in both a county and city application. The data collected is being processed using GIS and these results have been shared with these agencies.

Reports: None

Implementation: The findings of this research will be shared through presentations at the County Engineer conference, the ASCE Transportation Conference, the 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.

This project is experimenting with new products and methods to improve both the durability and retroreflectivity of centerline markings.

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: To evaluate the performance of various wood preservatives in the field with particular focus 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 Technical Advisory Committee was formed. A survey of 99 counties has been completed with a response rate close to 60%. Survey data have been reviewed and summarized.

Based on the results from the survey, counties have been selected for review of their timber bridge details. Several bridges have been inspected.

Reports: None

Implementation: Because this topic has national implications and due to involvement by the Forest Products Laboratory (which 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. 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 workshops. Information will be distributed to the wood utilization community and preservation industry through publications in the *Forest Products Journal*, as Forest Products Laboratory General Technical Reports, and through presentations at wood preservation conferences. Additionally, posting of pertinent information on Web sites of the ISU Bridge Engineering Center and the Forest Products Laboratory will be made.

If the Iowa DOT Office of Bridges and Structures is interested in modifying existing standards and/or special provisions for the treatment of timber structural systems this research, it could prove valuable for subsequent implementation. The office will be informed of progress during the study and have representation on the PAC.

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 advance Iowa's development of asphalt recycling technology using 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: Samples from several counties have been tested according to the previous regimen. The TAC has recommended that additional testing should be performed using the covered curing procedure.

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; this includes minimizing 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 owner agencies can apply to monitor the CIR layer in preparation for a timely placement of the wearing surface.

Simple Performance Testing Equipment at The University of Iowa.

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: To 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 to 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: During this period the research has focused mainly on collecting the field data, photos, and conducting field and laboratory tests. Soil and base material samples collected from the fields have been evaluated in the laboratory (gradation, specific gravity, etc.). Ten sites on highways I-35, I-80 and US HWYs 20, 30, and 330 have been tested. In addition to field and laboratory work, the study on literature has continued. A periodic summarization report of completed work from the last several months will be finished shortly.

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 and 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:

- 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.
- Use the results obtained from the Dynamic Modulus and Flow Number Tests to develop a new test protocol for determining moisture susceptibility.

Progress: The NAT has been upgraded. There are not an adequate number of fixtures for testing specimens in the NAT. The shakedown tests will need to be done prior to testing for this study to ensure that the NAT is providing reasonable. The research team examined the effect moisture susceptible mixtures have on pavement life utilizing the M-E PDG. The results illustrate that the dynamic modulus of moisture susceptible mixtures does estimate reduced pavement life.

Reports: None

Implementation: Several products will be developed from this project. The research team will deliver 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. This research will also evaluate different anti-stripping agents and their success in mitigating moisture damage; technology developments will be dispersed through electronic (via compact disc) and paper formats.

TR-556

Agency:
Iowa State University

Principal Investigator:
Matt Rouse

Research Period:
May 1, 20065 to December 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:

- Reinforcement of fragile concrete corners
- Confinement of the concrete at the ends of the segments to provide additional concrete strength and ductility
- Convenient and aesthetically pleasing means for the connection of the exterior reinforcement plates

Progress: Since the beginning of FY2007, the project has been progressing as planned; however, the project is somewhat behind schedule due to laboratory space limitations and scheduling conflicts with other large experiments in the lab. Two of four large-scale experiments are complete, and the remaining two will be completed by early August 2007. A no-cost extension granted until 12/31/2007 will allow the completion of analysis of experimental data, model calibration and report generation.

Reports: None

Implementation: Results of the research will 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

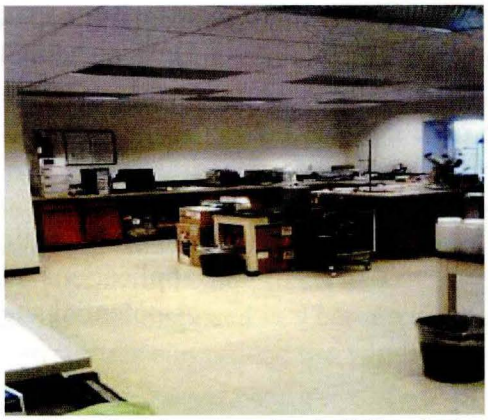
Objective: To evaluate the potential anti-oxidant activity of lignin and evaluate the technical viability of the concept. To achieve this, the research addresses specific aspects of the technical evaluation of the concept. Specifically, the research will:

- Determine the antioxidant activity of lignin in asphalt for lignins that are currently available or are anticipated to become available in the future
- Evaluate the range of applicability of the concept to determine if the activity is beneficial in a number of asphalts.

Progress: A TAC meeting was held this quarter with research results presented. The TAC recommended an additional phase to the project. Additional testing was recommended by the TAC to further evaluate the lignin-asphalt blends. The research team is near a finishing point with experimental testing and anticipates completion in the next quarter. Preliminary analysis of the test results show that blends of lignin-asphalt are beneficial in widening the range of the base asphalt binder grade.

Reports: None

Implementation: Successful completion of the 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.



The laboratory area in the bioprocessing building is designed for small-scale studies and analytical activities.

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: One 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 to design 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 must be used. Ultra-High Performance Concrete (UHPC) provides a unique combination of durability, strength, ductility and aesthetic flexibility, which not only improves longevity of bridges but can produce long-term cost-effective solutions. 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 lead to longer lasting substructures and soil stabilization remedies in different conditions. This research aims to investigate and evaluate the use of UHPC for geotechnical applications related to transportation structures.

Progress: The literature review is approximately 95% complete. The design of test set-up for the laboratory test and construction of the testing frame are complete. The design of the pile cross-sections for laboratory and field tests has been finalized. 2.5 cubic yards was donated to construct the test units; however, discussions are currently underway with the pre-casters and several issues are being solved.

The research team has performed drivability analysis for different piles and compared the drivability of UHPC piles with piles made from other materials. A potential site was discussed with Iowa DOT personnel, the research team and TAC members.

Reports: None

Implementation: Conclusions from this study will provide recommendations on the use of UHPC in geotechnical applications related to transportation facilities for Iowa engineers. A potential site was discussed with Iowa DOT personnel.

TR-559

Agency:
The University of Iowa

Principal Investigator:
George Constantinescu

Research Period:
August 28, 2006 to September 28, 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: All 15 simulations have been completed. The TAC members were happy with the progress and recommended an extra case which considers trucks passing beneath the signs. The parameters for this case are being decided.

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 and relevance to other problems of interest to DOT in a clear manner that is easy to understand for 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 December 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

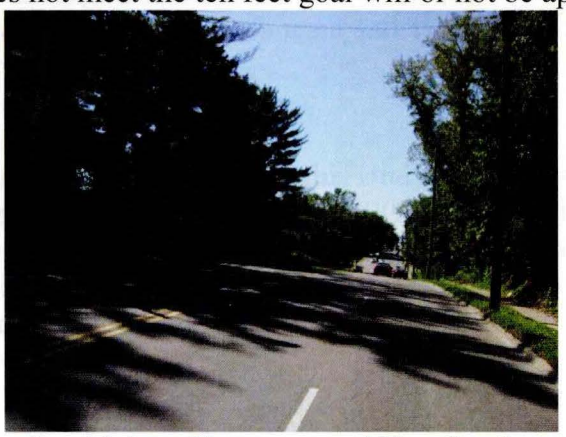
Objective: To determine the state of the practice of clear zone design guidance (standards) and the experiences other jurisdictions have had with applied clear zone guidance; to identify experience in other jurisdictions with clear zone guidance with respect to application of traffic calming designs 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: Goals are to finish a literature review and synthesis of transportation agency clear zone guidance and develop a statistical design.

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 American Society of Civil Engineers (ASCE) transportation engineering conference, the Iowa American Public Works Association (APWA) Chapter conference, and the Missouri Valley Section of the Institute of Transportation Engineers (MOVITE) chapter of Institute of Transportation Engineers (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.



Utility poles along a Des Moines, IA street are within a few feet of the roadway.

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: To test and evaluate precast components for three separate bridge projects in order to assess overall design, construction, and bridge structural performance, and to design and install monitoring systems and perform laboratory structural tests on bridge specimens that represent structural details for use on the three projects.

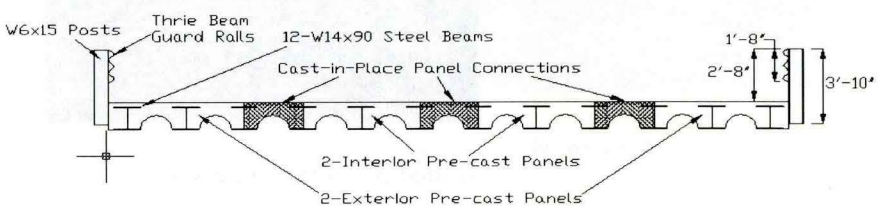
Progress: **Boone County**: Panel leveling tests were completed in the last year. Service load tests were done on a single panel and a two panel setup. Service and ultimate load tests were applied on three spans of the two panel setup and on the third panel. Post-tensioning channel concrete flow tests were completed. Cut pre-stress strands were used to measure the strain in mild reinforcement. All laboratory pier and abutment cap tests were completed, as were field observations during and after the bridge's construction. The magnitude of the post-tensioning forces applied to the bridge was verified.

Blackhawk County: Service and ultimate tests were done on the two abutment caps and the third series of pre-cast joints (3 specimens in each series for a total of 9 tests).

Madison County: Corrosion instrumentation was installed in the box girders. The placement of the girders at bridge site was documented. Field testing was done on the bridge and the initial corrosion readings were recorded. A testing plan for the box girders was developed.

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.



Cross Sections of the Pre-Cast Modified Beam-in-Slab Bridge (PMBISB)

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 field work for the research project to Monitoring Wind-Induced Vibrations/Stresses in a High-Mast Lighting Tower was started in the summer of 2006, with the goal of collecting data for a least one year. The instrumentation is providing information as intended from the original tower shell, the bolted reinforcing jacket and the anchor rods. It has been decided to continue to collect additional data in order to better understand the tower's long-term response to wind.

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.

Bolted Reinforcing Jacket

A bolted reinforcing jacket was placed on a tower in the I-35 & US 18 Interchange near Clear Lake.

TR-563
(TPF-5, 148)

Agency:
Minnesota Department of Transportation

Principal Investigator:
Tim Clyne (Minnesota Department of Transportation)

Research Period:
July 2006 to July 2009

Research Board Funding:
$105,000

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

The Effects of Implements of Husbandry "Farm Equipment" on Pavement Performance (MnROAD Study)

Objective: To determine the pavement response under various types of agricultural equipment (including the impacts of different tires and additional axles) and to compare this response to that under a typical 5-axle semi tractor-trailer. This may be accomplished by constructing new instrumented test sections at MnROAD and/or to retrofit instrumentation into the existing test sections. The final scope and work plan for the study will be developed by the participating agencies.

Progress: The pavement test sections at the MnROAD facility are being placed. Paving completion is expected by late fall, 2007. Actual road tests should commence in spring, 2008.

Reports: None

Implementation: This research will allow policy and design decision-making to be driven by direct experimental results rather than by models that may not have been calibrated for the types of loadings and tire configurations of current and evolving agricultural equipment.

Agricultural equipment traveling on the roadway

TR-564

Agency:
Digital Control, Inc.

Principal Investigator:
LaDon Jones

Research Period:
September 1, 2006 to August 31, 2007

Research Board Funding:
$52,000

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

Adding Scour Estimation to the Iowa Bridge Backwater Software

Objective: To add a new major component to the *Iowa Bridge Backwater* software (published in 2003), *The Estimation of Scour at Bridges*. Adding scour estimation will be the most significant portion of this project and provide a valuable time saving tool for city, county and state engineers.

In addition to scour, the following items will also be completed as part of Version 2 of the software as suggested by users of the current software:

- Improved convergence and iteration on backwater with overtopping
- Improved label scaling on plots and graphs
- Design flowrate copying
- Updated User Manual
- Online Help

Progress: Completed tasks include: Improved convergence and iteration on backwater with overtopping; improved label scaling on plots and graphs; and design flowrate copying. Estimation of scour at bridges is approximately 25% complete. Tasks still to be addressed are: Updated user manual and on-line help.

Reports: None

Implementation: The Iowa Bridge Backwater Version 2 software will be utilized by city and county engineers, the Iowa DOT staff and consultants for the design of bridges along the State's primary and secondary road system.

One copy of the program will be provided to each county engineer's office in Iowa.

TR-565

Agency:
Snyder & Associates

Principal Investigator:
Wade Greiman

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

Research Board Funding:
$188,929

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

Review of Inconsistencies Between SUDAS and Iowa DOT Specifications – Phase II: Implementation of Recommendations Into SUDAS Specifications

Objective: To improve Iowa DOT Standard Specifications to include items of work typically associated with construction in urban areas; rather than duplicating work already performed in the development of the Statewide Urban Design and Specifications (SUDAS), this project will adopt, by reference, portions that apply uniquely to urban items of work.

Phase 1 - This first step "Review of Inconsistencies Between DOT and SUDAS Specifications," is completed. Both sets of specifications and standard drawings were reviewed in detail.

Phase 2 - Recommendations from Phase 1 will be applied for the selected sections, incorporating them into the SUDAS Specifications and standard drawings. **Phase II** will focus on revising those areas the Phase 1 review committee identified as being the highest priority for the Iowa DOTs successful utilization of the SUDAS Specifications. These areas include: trench and backfill, trenchless construction, storm and sanitary sewers, water mains, manholes, intakes, sidewalks, recreational trails, driveways, and utility locations.

Progress: Specification changes have been reviewed and approved by both SUDAS and Iowa DOT. Final editing is being conducted for presentation in early 2008.

Reports: None

Implementation: The Iowa DOT will adopt, by reference, recommendations that apply to urban items of work. The result would be uniform specifications that can be applied to urban work statewide, likely resulting in lowered construction costs and improved quality. Consistency will result in how items are constructed, what materials are used, and how measurement and payment are made will be gained.

TR-566

Agency:
Iowa State University

Principal Investigator:
Larry Stevens

Research Period:
December 1, 2006 to May 31, 2009

Research Board Funding:
$165,316

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

Utility Cut Repair Techniques – Investigation of Improved Utility Cut Repair Techniques to Reduce Settlement in Repaired Areas: Phase II

Objective: Based on the results of Phase I, the research team will monitor the constructed utility cuts for two more years, construct new trenches using the three methods suggested by the research team in Phase I and instrument utility trenches to further understand the mechanisms of trench backfill settlement and load distribution.

The research in **Phase II** examines utility cut construction practices by continued monitoring of restored cuts and improving the understanding of trench settlement and load transfer through the instrumentation of utility trenches. The goal of increasing the pavement patch life and reducing the maintenance of the repaired areas is priority.

Progress: A meeting with City of Ames personnel took place on May 31, 2007, to assure the city has the necessary materials for constructing the proposed trenches as well as to confirm the location for the instrumented trenches. Visits were made to multiple sites in Ames, Des Moines, Davenport, and Cedar Rapids to obtain elevations measurements to continue or start monitoring settlement. Four sites in Ames, Des Moines and Cedar Rapids have been tested using the FWD. Three of the recommended trenches to be constructed for monitoring have been completed. They will be monitored using elevation surveys and FWD testing. Proposed instrumented trenches are to be installed as soon as the instrumentation arrives. A summary of all of the data from the site visits and lab tests has been prepared.

Reports: None

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

TR-567

Agency:
The University of Iowa

Principal Investigator:
Thanos Papanicolaou

Research Period:
August 1, 2006 to September 30, 2009

Research Board Funding:
$112,000

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

Development of Stage Discharge Relations for Ungaged Bridge Waterways in Western Iowa

Objective: To establish stage-discharge relationships for 10 ungaged streams in western Iowa through implementation of a semi-automatic sensor network. This project seeks to describe and document knickpoint propagation and identify and prioritize at-risk sites, thereby avoiding potential safety and asset risks due to knickpoint propagation and channel vertical shift.

Progress: Logging water level sensors have been installed at the appropriate locations. Over the next year, water levels, velocity and stream discharge measurements will be made.

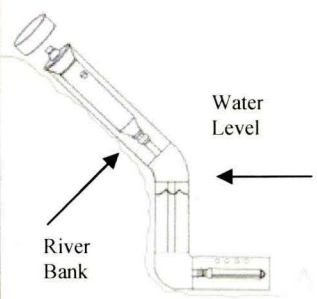
Reports: None

Implementation: This research will provide stage-discharge relations for small to medium size ungaged streams in western Iowa and comparisons with other ongoing studies, a tool for predicting river response based on discharge data, explain scour and erosion processes at bridge waterways while indicating how past, present, and possible future changes in river or stream dynamics may affect bridge waterway stability as a function of discharge.

Description and documentation of knickpoint propagation in the HCA region will aid in identifying and prioritizing at-risk sites, thereby avoiding potential safety and asset risks due to knickpoint propagation and channel vertical shift.

Main findings would presented at conferences and information made available to those interested agencies.

Installation of Water Level Loggers(left) and drawing (below) of Logger Placement



TR-568

Agency:
Iowa State University

Principal Investigator:
David J. White

Research Period:
January 1, 2007 to December 31, 2009

Research Board Funding:
$153,912

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

Modified Sheet Pile Abutments for Low Volume Bridges

Objective: To develop a design approach for sheet pile bridge abutments for short span, low-volume bridges including calculation of lateral stresses from retained soil and bearing support for the superstructure; formulate an instrumentation and monitoring plan to evaluate performance of sheet pile abutment systems including evaluation of lateral structural forces and bending stresses in the sheet pile sections.

Also, to evaluate and understand the cost and construction effort associated with building the sheet pile bridge abutment demonstration project and materials that provide recommendations for use and potential limitations of sheet pile bridge abutment systems.

Progress: A literature review is nearly complete. Relevant resources have been obtained and are currently in the process of being compiled. Communications with steel manufacturers have given insight to possible design approaches as well as availability and costs for steel sheet piling.

Three preliminary site visits for bridge site alternatives have been conducted. Other county visits (potentially Boone, Buchanan, Tama, and Winnebago) will be conducted very soon. After all bridge site alternatives have been reviewed and analyzed, two or three preferred sites will be selected for a comprehensive soil investigation and further analysis.

Reports: None

Implementation: The final report will provide recommendations for site investigation and design of sheet pile bridge abutments for LVRs. A summary sheet will be made available at appropriate local/regional conferences.

The observations and conclusions from this study will provide recommendations for use of sheet pile abutments in LVRs and in-situ soil testing. County engineers (responsible for 80% of Iowa's LVRs) can implement recommendations for use of an alternative abutment system.

TR-569

Agency:
The University of Iowa

Principal Investigator:
Marian Muste

Research Period:
January 15, 2007 to August 15, 2008

Research Board Funding:
$85,891

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

Quantitative Mapping of Waterways Characteristics at Bridge Sites

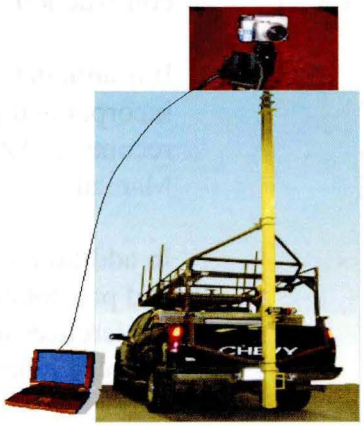
Objective: The short term and immediate purpose is to dramatically improve current capabilities for quantifying and monitoring bridge scour. Eventually this methodology can be refined to include long term development of bridge monitoring platforms. These platforms would be comprised of multiple non-intrusive instruments (image, acoustic-, and laser-based principles proven through this research), allowing cost effective, informative, comprehensive measurements with improved accuracy and information detail at minimal effort and expense. This methodology is especially well suited for monitoring small bridges typical in Iowa and surrounding states.

Progress: The software is robust and was further perfected to extract new features from the raw information. A paper describing the technique was drafted.

Reports: None

Implementation: A software package that calculates quantitative mapping of bridge waterways will be developed and be a modular structure so equipment interchange and addition of hardware can be easily accommodated. The code developed will be an open source to all interested parties. Companion user manuals will be provided instructing users on methodology background and implementation.

The details of the Mobile Large-Scale Particle Image Velocimetry (MLSPIV) truck-based prototype will be available for users willing to construct such observational platforms with demonstrations for various interested user groups to illustrate the prototype's developed capabilities. The final report will be issued and delivered in both electronic and hard copy formats.



MLSPIV unit with mast deployed and ancillary equipment

TR-570

Agency:
Iowa State University

Principal Investigator:
Muhannad Suleiman

Research Period:
March 1, 2007 to February 28, 2009

Research Board Funding:
$174,980

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

Identification of Practices, Design, Construction, and Repair Using Trenchless Technology

Objective: To collect and analyze information recommending practices for design, construction and repair using trenchless technology for use by state and local jurisdictions; these recommendations will be a synthesis of known field practices and/or documented research from studies conducted as part of this research, which can be used by jurisdictions in their utility and restoration permit process.

These recommendations will be proposed for incorporation into the Statewide Urban Design and Specifications (SUDAS) Design Manual Chapter 14.

Progress: The research team is about 40% done with the literature review. This will document methods of trenchless technology and their effects on surrounding soil and adjacent structures. The research team has sent the on-line survey to several state and industry engineers across Iowa and surrounding states. The research team started the field evaluation by visiting six sites during the months of May through July. In total, 41 site visits were conducted to observe construction and collect information about the site as well as collect soil samples. Ground heave of about 1' was observed on one of the visited projects. This project is the Iowa State University football practice field.

Reports: None

Implementation: The observations and conclusions from this study will provide recommendations on effective utility installation and repair. State, county and city transportation agencies/ jurisdictions can implement the recommendations for utility construction or repair.

It is anticipated that the best practices recommendations will be incorporated in the SUDAS Design Manual and the specification recommendations will be included in the SUDAS Specifications Manual.

In addition to the written report, a summary sheet will be created and presentations will be made at appropriate local and regional conferences and the research team will publish the results in refereed journals.

TR-571

Agency:
Iowa Department of Natural Resources - Geological Survey

Principal Investigator:
Robert D. Libra

Research Period:
May 1, 2007 to April 30, 2008

Research Board Funding:
$86,357

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

GIS - Based Decision and Outreach Tools for Aggregate Source Management

Objective: To create useful statewide mapping tools for Iowa DOT and local entities with a focus on initial investigations, including locations and descriptions of aggregate resource and factors with implications for extraction; consultation with county planning and zoning officials (Iowa State Association of Counties-County Zoning Affiliate), Iowa DOT Office of Materials and the Iowa Limestone Producers Association (ILPA) will assure development of tools that best address aggregate resources and the barriers to aggregate access.

Progress: Contract Initiated in April 2007.

Reports: None

Implementation: The final product will be delivered in two mediums for two specific audiences: shapefiles created of historical and current quarry operations for the State, with data linked as specified by Iowa DOT for staff use and the Internet Map Service (IMS) created for use by Iowa DOT, planning groups and the public.

This data will be used in planning aggregate source access prior to planning and development of residential/business subdivisions. Internet Map Service with GIS layers relevant to aggregate access planning and education with National standard GIS metadata will accompany all layers/coverages.

TR-572

Agency:
Iowa State University

Principal Investigator:
Neal Hawkins

Research Period:
June 1, 2007 to November 30, 2008

Research Board Funding:
$99,881

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

Improving Safety for Slow Moving Vehicles on Iowa's High Speed Rural Roadways

Objective: To focus on improving transportation safety for drivers of slow-moving vehicles and other drivers in the proximity of these vehicles on the public roadway system; this work will include the guidance of an advisory panel made up of IHRB members, city and county engineers, City/Iowa DOT planners, industry repre-senttatives and other relevant stakeholders.

A matrix of recommended strategies in dealing with agricultural and non-motorized user groups based upon roadway conditions such as speed, shoulder treatment, volume, and frequency of use by these groups and seasonal variations will be made.

Progress: Contract initiated in June 2007

Reports: None

Implementation: This research seeks to improve safety for both motorists and operators of slow moving vehicles on Iowa's roadways. This work will focus on design and technology improvement strategies which to date have not been addressed in a systematic way based upon crash experience and exposure and will assist technical and nontechnical staff in assessing what can be done to improve safety for slow moving vehicles while providing links to other resources and best practices.

An Amish buggy travels along one of Iowa's high speed rural roads.

TR-573

Agency:
Iowa State University

Principal Investigator:
Sri Sritharan

Research Period:
July 1, 2007 to June 30, 2009

Research Board Funding:
$250,000

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

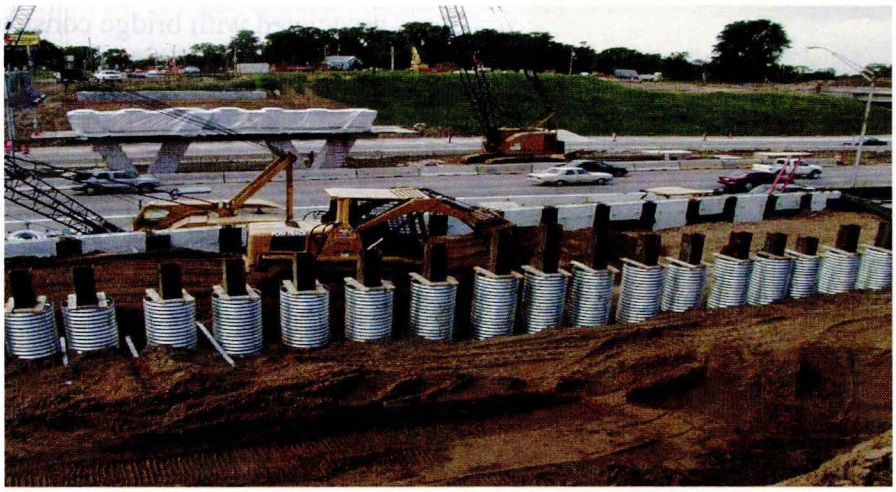
Development of LRFD Design Procedures for Bridge Piles in Iowa

Objective: To examine current pile design and construction procedures used by the Iowa DOT and recommend changes and improvements to those that are consistent with available pile load test data, soils information and bridge design practice recommended by Load and Resistance Factor Design (LRFD). It is a priority to work towards recommended changes that do not significantly increase design and construction costs.

Progress: The research team has been designing a Web site for the project to be used to conduct on-line surveys and a detailed electronic database that will include all relevant data for piles that are considered to have produced reliable data under static load tests. The team is currently using the available data through the database to determine the pile capacity using different methods and running wave equation analysis on logged piles.

Reports: None

Implementation: This research will provide direct benefits to bridge infrastructure in Iowa, including the development and implementation of LRFD design procedures for bridge piles in Iowa to ensure the uniform reliability of bridges while providing cost-effective solutions to foundation designs in accordance with the LRFD specifications and local soil conditions. A training course will be designed for engineers at the Iowa DOT, emphasizing the importance of collaboration between structural, geotechnical and construction engineers. Other participants from transportation agencies will also be attending.



Abutment piles behind a MSE wall for a bridge over I-235 in Des Moines, IA

TR-574

Agency:
Iowa State University

Principal Investigator:
Terry Wipf

Research Period:
April 1, 2007 to September 30, 2010

Research Board Funding:
$80,000

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

Structural Design, Construction and Evaluation of a Prestressed Concrete Bridge Using Ultra High-Performance Concrete Pi Girders

Objective: To optimize the design and use of Pi girders while advancing the state-of-the-art in bridge concrete construction technology. In addition, this research will continue to foster an important partnership with FHWA and industry that is contributing to the standardization and use of the next generation of high performance materials.

Progress: Contract Initiated in April 2007.

Reports: None

Implementation: The successful application of ultra high performance concrete (UHPC) will further advance development of cost-effective use for implementation by all jurisdictions within Iowa as ultimately costs are reduced through:

- Taking advantage of a higher strength material
- Taking advantage of a material with almost zero permeability which could essentially eliminate deterioration of bridge decks
- The optimization, validation, and acceptance of the proposed girder cross section represent a significant step in more widespread adoption

The benefits associated with this work will be a reduction in costs associated with bridge construction and, more significantly, reduce costs associated with bridge maintenance.

Further advances with UHPC may yield bridge designs in which the deck and super-structure last for the same duration, thus eliminating the need for intermittent and costly deck replacement. These benefits will be easily quantified at that time by a significant reduction in life-cycle costs associated with bridge ownership.

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 communications with various 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.