MICHIGAN
STATEWIDE PLANNING AND RESEARCH, PART II, PROGRAM

FISCAL YEAR 2010
ANNUAL REPORT

October 1, 2009 – September 30, 2010

MICHIGAN DEPARTMENT OF TRANSPORTATION
OFFICE OF RESEARCH & BEST PRACTICES

TABLE OF CONTENTS

Statewide Planning and Research (SPR), Part II, Program
Fiscal Year 2010 Annual Report

STATEWIDE PLANNING AND RESEARCH, PART II, PROGRAM
2010 ANNUAL REPORT

Introduction

The Statewide Planning and Research (SPR), Part II, Program is a multi-modal program where the highest priorities are given to research in the following four transportation categories: Congestion Management, Traffic and Safety, Intelligent Transportation Systems (ITS), and Infrastructure (Bridges and Highways).

This annual report is for the Michigan Department of Transportation (MDOT) SPR, Part II, Program for Fiscal Year (FY) 2010. The purpose of this program is to conduct research that concurs with MDOT's mission of "providing the highest quality integrated transportation services for economic benefit and improved quality of life." The report covers the period from October 1, 2009 through September 30, 2010. The main components of this report are:

- Executive Overview
- Project Budget and Expenditure Summary Tables (tables 1-5)
- Research Program Highlights (table 3a)
- Project Progress Reports

During FY 2010, nine projects were completed with current and previous year's expenditures of $2.24 million (table 3a). The project focus areas include: Administrative Services; Bridges and Structures; Pavements, Construction, Materials and Maintenance; and the Bureau of Planning's Strategic Planning and Programs/Programming. In addition, ten projects were completed in the following three program categories: Pooled Fund Studies, seven; In-House Studies, two; and Administrative Items, one.

The Office of Research and Best Practices (ORBP) is responsible for managing MDOTs research, development, and technology transfer activities under the SPR, Part II, Program. Annually, MDOT submits a proposed SPR, Part II, Program project template to the Federal Highway Administration (FHWA), Michigan Division, for review and approval. After receiving program approval on September 25, 2009, ORBP secured obligation of the SPR, Part II, funds. All FY 2010 research work activities proceeded after October 1, 2010.

Approved research projects are contracted to universities and consultant firms, or performed by researchers within MDOT. Implementation of research results is important and emphasized by ORBP at oversight, advisory, and project management levels.

This annual report provides an overview of projects continued from FY 2009, new projects started in FY 2010, projects proposed to start in FY 2011, and projects completed during the current fiscal year. If you need additional information regarding a specific project listed in the document, please contact ORBP's Transportation Research Program Section Manager, Michael Townley, at 517-373-7424.

A special recognition goes to MDOT project managers for providing project-related information, and to ORBP staff members - André Clover, Nancy Crider, Annette Nealey, Trudy Schutte, and Michael Townley - for completing and editing the contents of this report.

EXECUTIVE SUMMARY

The FY 2010 SPR, Part II, Program consisted of 60 projects with a total expenditure of $4,642,736.28. The research program, in addition to Administration Items, In-House Studies, and Pooled Fund Studies, includes active projects in eleven focus areas of the four advisory level groups:

Delivery and Operations

- System Planning and Strategic Measures
- Safety and Systems Operations and Mobility
- Pavement, Construction, Materials and Maintenance
- Intelligent Traffic Systems

Planning and Finance

- Strategic Planning and Programs/Programming
- Environment
- Work Force Development
- Administrative Services

Program/Project Development

- Bridges and Structures
- Design and Geotechnical

Multi-Modal Transportation

- Rail

During FY 2010, 35 projects continued from FY 2009, 25 new projects started, and 14 projects were proposed for FY 2011. All research projects, with the exception of the In-House Studies, are contracted to universities and consulting firms. The following table summarizes the FY 2010 expenditures:

Program Categories	Expenditures
Administration Items	$15,904.14
In-House Research	$25,119.52
Contract Research Studies (continued from FY 2009)	$1,826,009.36
Contract Research Studies (started in FY 2010)	$1,071,993.26
Pooled Fund Studies	$1,703,710.00
Total	**$4,642,736.28**

SPR, Part II, Annual Report Tables

Summary tables 1 through 5 list projects under the following headings: Administrative Items, In-House Studies, Active Contract Research Studies, Proposed Contract Research Studies (scheduled start after October 1, 2010), and Active Pooled Fund Studies. The tables provide details such as project number, financial information, research agency, principal investigator (PI), project title, and start and end dates. Table 3a summarizes the projects completed in FY 2010.

Quarterly/Annual SPR, Part II Project Progress Reports

The progress reports on pages 1 through 124 are provided by the project managers (PMs). The reports list expenditures and activity from the start of the project through the final quarter of FY 2010. The financial information for each project lists the total expenditures, expenditures to date, and the budget as authorized by the Michigan State Administrative Board (excluding Pooled Funds Studies). Summary tables 1 through 5 index these reports by page number.

FY 2010 Program Milestones

- Completed nine Contract Research Studies projects with current and previous year expenditures of $2.24 million as shown in the table on page ix.
- Completed seven Pooled Fund Studies, two In-House Research Studies, and one Administrative Items project with current and previous year expenditures of $1.83 million.
- Published a quarterly ORBP newsletter that provided a means of communication and technology transfer with stakeholders.

FY 2010 Program Milestones (cont'd)

- Initiated 11 new research projects in FY 2010. PM's led research advisory panels (RAPs) and held kickoff, initial, and intermediate meetings to guide and manage the PI's research.
- Improved the ORBP research management process in response to recommendations from PMs, focus area managers (FAMs), PIs, and university contract administrators. As a result, ORBP will:
    - Provide opportunities for internal and external communication within and between all levels of MDOT and external stakeholders;
    - Allow external stakeholders equal access during research idea development;
    - Dedicate more time for meaningful input from all research stakeholders;
    - Train stakeholders to understand their role in the improved research program.
- Trained PMs and FAMs on October 15, 2009 to introduce the improved process and receive feedback. The training touched on project management, invoice review, how to conduct a project meeting, and report review.
- Developed the FY 2012-2013 SPR, Part II, Biennial Program.
    - On December 14, 2009, MDOT's Research Executive Committee (REC) identified 22 strategic research priorities for MDOT's research needs with input from MDOT's chief operations officer, chief administrative officer, the engineer of ORBP, bureau directors, and the region representative.
    - In January 2010, ORBP announced its call for research ideas, seeking internal and external stakeholder input from all research partners, resulting in 160 submitted research ideas.
    - ORBP distributed the new research ideas to MDOT's technical staff and managers for review and ranking, and compiled the results. The REC vetted the ranked ideas for final identification of 29 new research ideas moving forward in the FY 2012-2013 SPR, Part II, Biennial Program.
    - ORBP trained research champions (RCs) to develop problem statements (PSs).
    - RCs developed the 29 research ideas into PSs. The final review and approval of PSs will include many levels within MDOT. This review will be conducted throughout October and November 2010.
- Hosted the 2010 Research Summit on May 6, 2010 at the Kellogg Hotel and Conference Center at Michigan State University, East Lansing. The summit brought together MDOT experts and external stakeholders to refine and develop new research ideas. The results were instrumental in directing the program focus.
- Met with university research partners to finalize the contract terms and conditions for research projects.
    - At the start of FY 2010, the Indefinite Delivery of Services (IDS) research contracts between MDOT and university stakeholders expired. As all MDOT research activities conducted by universities are governed by an IDS research contract, an interim contract was established to allow research activities to continue during subsequent contract negotiations.
    - A series of meetings between Michigan universities and MDOT has led toward clarification and resolution of, among others, patent and copyright requirements, invoice processing requirements, and the importance that the research results in an implementable research product for MDOT.
    - The IDS research contract terms have been agreed to by MDOT and its university partners.

FY 2010 Program Milestones (cont'd)

- Submitted the proposed FY 2011, SPR, Part II, Program for review and approval to the Federal Highway Administration (FHWA) on August 2, 2010. The early submittal to FHWA helped fulfill our commitment to reduce funding uncertainty as universities hire graduate students for the academic year.
- Received FHWA approval of the FY 2011, SPR, Part II, Program on September 17, 2010.

FY 2011 Program Goals

- Initiate new FY 2011 research projects with kickoff meetings and provide guidance to PMs throughout the year.
- Plan and host a peer exchange with other state research program administrators on December, 7-9, 2010. The focus of the peer exchange will be implementation of research results.
- Update the *Research and Implementation Manual* to reflect contract and program process improvements.
- Continue development of the FY 2012-2013 SPR, Part II, Biennial Program, including the following steps:
    - Obtain REC approval of the problem statements for request for proposals (RFP) posting.
    - Post RFPs for FY 2012 projects on January 14, 2011.
    - Score submitted proposals, select vendors to conduct the research, and secure authorizations for an October 1, 2010, start date.
- Submit the proposed FY 2012 SPR, Part II, Program for review and approval to FHWA in August 2011.

MDOT ANNUAL RESEARCH PROGRAM
Fiscal Year 2010 Project Budget and Expenditure Summary Tables

TABLE 1 ADMINISTRATIVE ITEMS (ACTIVE)

Funding	Project No.	FY 2010 Expenditures	Expenditures to Date	Total Budget	Agency	Principal Investigator	Title	Start Date	End Date	End Date(rev)	Pg No.
SPR, Part II	*108257	$15,904.14	$15,904.14	$47,133.73	MTU	Hoy	2010 Newsletter	10/01/2009	09/30/2010		3
		$15,904.14	**$15,904.14**	**$47,133.73**	**TOTAL ADMINISTRATIVE ITEMS (ACTIVE) BUDGET**						

*Project closed in FY 2010

TABLE 2 IN-HOUSE RESEARCH STUDIES (ACTIVE)

Funding	Project No.	FY 2010 Expenditures	Expenditures to Date	Total Budget	Agency	MDOT Project Manager	Title	Start Date	End Date	End Date(rev)	Pg No.
SPR, Part II	*108478	$483.52	$36,755.24	$44,806.00	MDOT	Palmer	Electronic Frost Tube	09/05/2003	09/30/2005	12/31/2009	7
SPR, Part II	108521	$16,933.00	$382,796.00	$450,000.00	MDOT	Krueger	ITS Hardware Laboratory and Equipment	10/01/2005	09/30/2010	09/30/2011	8
SPR, Part II	*108677	$7,703.00	$31,867.00	$32,950.00	MDOT	Kahl	Stainless Reinforcement in Bridge Decks	10/01/2006	09/30/2007	09/30/2010	14
		$25,119.52	**$451,418.24**	**$527,756.00**	**TOTAL IN-HOUSE RESEARCH STUDIES (ACTIVE) BUDGET**						

*Project closed in FY 2010

MDOT ANNUAL RESEARCH PROGRAM
Fiscal Year 2010 Project Budget and Expenditure Summary Tables

TABLE 3 CONTRACT RESEARCH STUDIES (ACTIVE)

Funding	Project No.	FY 2010 Expenditure	Expenditures to Date	Project Total Budget	Agency	Principal Investigator	Title	Start Date	End Date	End Date(rev)	Pg No.
SPR, Part II	107432	$48,673.31	$48,673.31	$149,923.67	CMU	Backs	Improving Driver Safety with Behavioral Countermeasures	10/27/2009	09/30/2011		17
SPR, Part II	107435	$6,886.92	$6,886.92	$262,829.81	WSU	Datta	Impact of Non-Freeway Rumble Strips - Phase I	06/01/2010	06/30/2012		18
SPR, Part II	107451	$41,737.06	$41,737.06	$299,747.00	MSU	Burgueño	Development and Validation of Deterioration Models for Concrete Bridge Decks	10/20/2009	09/30/2011		20
SPR, Part II	107465	$62,265.74	$62,265.74	$199,649.43	WSU	Savolainen	Educating the Public to Negotiate Roundabouts	11/02/2009	03/31/2011		21
SPR, Part II	107468	$41,828.28	$41,828.28	$147,008.49	Applied Research Associates	Von Quintus	Extending Life of Asphalt Pavements	10/07/2009	09/30/2010	12/31/2010	22
SPR, Part II	107472	$147,612.70	$147,612.70	$173,662.00	Cambridge Systematic, Inc.	Hedden	Strategies for Improving Traveler Information	12/18/2009	09/30/2010	01/31/2011	23
SPR, Part II	107473	$90,983.40	$90,983.40	$299,960.16	MTU	You	Alternative Materials for Sustainable Transportation	11/13/2009	09/30/2011		24
SPR, Part II	107476	$90,943.17	$90,943.17	$149,978.00	Applied Pavement Technology	Van Dam	Sustainable Recycled Materials for Concrete Pavements	10/01/2009	03/31/2011		25
SPR, Part II	108344	$148,860.80	$148,860.80	$200,000.84	WSU	Datta	The Effect of Work Zone Steady Burn Warning Lights on Motorist Safety	11/02/2009	11/01/2010	12/01/2010	26
SPR, Part II	108471	$95,520.52	$149,185.07	$157,746.00	MSU	Baladi	Backcalculation of Resilient Modulus Values for Unbound Pavement Materials	11/19/2008	09/30/2010	12/31/2010	28
SPR, Part II	108476	$95,219.44	$95,219.44	$190,001.08	MTU	You	Laboratory Evaluation of Warm Mix Asphalt	11/03/2008	12/31/2010	09/30/2011	29
SPR, Part II	*108479	$97,588.90	$332,075.46	$334,908.00	MSU	Harichandran	ECR Bridge Decks: Damage and Assessment of Remaining Service Life for Various Overlay Repair Options	09/29/2006	03/29/2009	06/30/2010	31
SPR, Part II	108484	$79,483.40	$279,609.51	$304,826.44	MTU	Sutter	Impact of Hydrated Cement Paste Quality and Entrained Air-Void System	07/31/2007	07/31/2010	12/31/2010	33
SPR, Part II	*108485	$11,469.27	$224,516.78	$224,522.00	WMU	Abudayyeh	Health Monitoring and Evaluation of Rapid Bridge Deck Technique	11/30/2005	11/20/2008	01/31/2010	35
SPR, Part II	*108486	$67,932.66	$199,445.93	$199,740.00	MSU	Burgueño	Effects of Debonded Strands on the Production and Performance of Prestressed Concrete Beams	08/02/2007	08/02/2009	08/31/2010	37
SPR, Part II	108487	$69,774.31	$138,083.49	$199,999.49	MTU	Mukherjee	Carbon Footprint for Hot Mix Asphalt and Portland Cement Concrete Pavements	03/18/2009	05/31/2010	05/31/2011	39
SPR, Part II	*108491	$58,526.19	$180,181.41	$180,181.61	MTU	Hiller	Efficient Use of Recycled Concrete in Transportation Infrastructure	09/10/2007	08/31/2009	03/31/2010	40

MDOT ANNUAL RESEARCH PROGRAM
Fiscal Year 2010 Project Budget and Expenditure Summary Tables

TABLE 3 CONTRACT RESEARCH STUDIES (ACTIVE), continued

Funding	Project No.	FY 2010 Expenditure	Expenditures to Date	Project Total Budget	Agency	Principal Investigator	Title	Start Date	End Date	End Date(rev)	Pg No.
SPR, Part II	108493	$19,087.67	$133,822.84	$165,689.05	LTU	Carpenter	A Critical Evaluation of Bridge Scour for Michigan Specific Conditions	06/19/2007	06/19/2010	02/11/2011	42
SPR, Part II	*108494	$12,878.07	$181,925.24	$181,925.24	MTU	You	Development of New Test Procedures for Measuring Fine and Coarse Aggregate Specific Gravities	04/09/2007	04/09/2009	12/31/2009	44
SPR, Part II	108495	$91,509.51	$164,471.82	$265,022.63	WMU	Aktan	High Skew Link Slab Bridge System with Deck Sliding over Backwall or Backwall Sliding over Abutment	11/06/2008	09/30/2010	09/30/2011	45
SPR, Part II	108501	$0.00	$0.00	$215,422.36	Alfred Benesch and Co.	Darwish	Infrastructure Monitoring Data Management	10/01/2009	09/30/2011	05/01/2012	47
SPR, Part II	*108513	$111,444.18	$111,876.12	$119,999.23	WSU	Fu	Reliability Based Evaluation of Loading Configuration for Long-Span Bridges	10/02/2008	09/30/2010		48
SPR, Part II	*108514	$35,711.32	$685,414.89	$723,434.00	UDM	Hanifin	Michigan-Ohio University Transportation Center (MIOH UTC)	05/01/2007	09/30/2009	08/31/2010	50
SPR, Part II	108518	$23,971.14	$118,514.72	$118,514.72	WSU	Miller	A Critical Evaluation of Bridge Scour for Michigan Specific Conditions	03/12/2007	03/12/2010	02/01/2011	53
SPR, Part II	108519	$749,937.56	$3,130,166.43	$3,500,000.00	Mixon-Hill	Mixon	Evaluation of the Usage and Impact of the Michigan Vehicle Infrastructure Integration Program	2/15/2007	12/31/2008	03/31/2011	55
SPR, Part II	108519	$0.00	$0.00	$242,836.00	UM	Robinson	Slippery Road Detection and Evaluation	10/20/2009	06/01/2012		57
SPR, Part II	108522	$44,073.87	$44,073.87	$169,968.00	MSU	Burgueño	Identification of Causes and Solution Strategies for Deck Cracking in Jointless Bridges	10/20/2009	08/15/2011	01/30/2012	59
SPR, Part II	*108523	$7,565.74	$214,975.71	$214,975.71	WSU	Fu	Skewed Bridges	07/12/2007	10/12/2009	09/30/2010	60
SPR, Part II	*108524	$109,880.00	$109,880.00	$109,880.00	Dye Mangt	Shah	Study of Most Effective Practices for Determining Construction Contractor's Eligibility to Bid on Construction Projects	06/16/2009	06/16/2010		61
SPR, Part II	108525	$88,509.48	$750,247.00	$800,000.00	UM	Sweatman	MDOT Vehicle Infrastructure Integration Data Analysis Documentation and Research Support Program	08/30/2006	11/30/2008	06/01/2012	62
SPR, Part II	108621	$119,947.39	$119,947.39	$279,278.78	LTU	Grace	Investigate Causes and Develop Methods for Preventing Falling Concrete from Bridge Decks or Falling Deck Concrete	10/01/2009	09/30/2011		65
SPR, Part II	108624	$170,816.32	$170,816.32	$333,956.31	UM	Hansen	Improved Performance of Concrete Overlays	10/01/2009	05/15/2012		66
SPR, Part II	109028	$57,364.30	$57,364.30	$228,126.20	WMU	Abudayyeh	Development and Validation of a Sensor-Based Health Monitoring Model for Parkview Bridge Deck	01/20/2010	01/31/2012		67
		$2,898,002.63	**$8,271,605.12**	**$11,343,712.25**	**TOTAL CONTRACT RESEARCH STUDIES (ACTIVE) BUDGET**						

*Project closed in FY 2010

TABLE 3A FY 2010 RESEARCH PROGRAM HIGHLIGHTS

During fiscal year 2010, the MDOT SPR, Part II, Program completed nine Contracted Research Studies, with a total current and previous year's expenditure of $2,240,290.54. Projects are classified in the following areas:

PROJECT AREA	NUMBER OF PROJECTS	TOTAL EXPENDITURES	TOTAL EXPENDITURES IN PERCENT
Program/Project Development			
Bridges and Structures	5	$1,082,890.00	48.34%
Design and Geotechnical	0	$0.00	0.00%
Real Estate Services	0	$0.00	0.00%
Urban Corridors	0	$0.00	0.00%
Subtotal	5	$1,082,890.00	48.34%
Delivery and Operations			
Security	0	$0.00	0.00%
System Planning and Strategic Measures	0	$0.00	0.00%
Safety and Systems Operations and Mobility	0	$0.00	0.00%
Pavements, Construction, Materials, and Maintenance	2	$362,106.65	16.16%
Intelligent Traffic Systems	0	$0.00	0.00%
Subtotal	2	$362,106.65	16.16%
Multi-Modal Transportation			
Freight and Logistics	0	$0.00	0.00%
Passenger Transportation	0	$0.00	0.00%
Rail	0	$0.00	0.00%
Aeronautics	0	$0.00	0.00%
Maritime	0	$0.00	0.00%
Subtotal	0	$0.00	0.00%
Planning and Finance			
Strategic Planning and Programs/Programming	1	$685,414.89	30.59%
Geo Services and Transportation Data		$0.00	0.00%
Bike and Pedestrian	0	$0.00	0.00%
Environment		$0.00	0.00%
Workforce Development	0	$0.00	0.00%
Administrative Services	1	$109,880.00	4.90%
Subtotal	2	$795,294.89	35.49%
TOTAL	**9**	**$2,240,291.54**	**100.00%**

MDOT ANNUAL RESEARCH PROGRAM
Fiscal Year 2010 Project Budget and Expenditure Summary Tables

TABLE 4 POOLED FUND STUDIES (ACTIVE)

Funding	Project No.	FY 2010 Expenditure	Expenditures to Date	Project Total Budget	Agency	MDOT Project Manager	Title	Start Date	End Date	End Date(rev)	Pg No.
SPR, Part II	*SPR-3(020)	$25,000.00	$180,000.00	$180,000.00	IA DOT	Nederveld	IVHS Study (ENTERPRISE)	10/01/2004	09/30/2010		71
SPR, Part II	*SPR-3(042)	$25,000.00	$75,000.00	$75,000.00	IA DOT	Gustafson	Aurora Program	10/01/2008	09/30/2010		73
SPR Part II	TPF-5(021)	$25,000.00	$125,000.00	$150,000.00	IN DOT	Barak	Base Funding for the North Central Superpave Center	10/01/2005	09/30/2009	09/30/2011	75
SPR Part II	*TPF-5(068)	$20,000.00	$120,000.00	$120,000.00	IA DOT	Curtis	Long-Term Maintenance of Load and Resistance Factor Design Specifications	10/01/2003	09/30/2010		76
SPR, Part II	*TPF-5(105)	$5,000.00	$20,000.00	$20,000.00	WI DOT	Briseno	Transportation Library Connectivity	10/01/2007	09/30/2009	09/30/2010	77
SPR, Part II	TPF-5(129)	$25,000.00	$75,000.00	$75,000.00	MN DOT	Eacker	Recycled Unbound Pavement Materials (MNROAD Study)	05/01/2007	05/01/2012		81
SPR, Part II	TPF-5(159)	$7,000.00	$21,000.00	$35,000.00	IA DOT	Staton	Technology Transfer Concrete Consortium (TTCC)	10/01/2008	09/30/2012		83
SPR, Part II	TPF-5(174)	$15,000.00	$30,000.00	$70,000.00	KS DOT	Stallard	Construction of Crack-Free Bridge Decks, Phase II	10/01/2008	09/30/2013		84
SPR, Part II	TPF-5 (179)	$25,000.00	$75,000.00	$87,000.00	IN DOT	Sears-Bartz	Evaluation of Test Methods for Permeability (Transport) and Development of Performance Guidelines for Durability	10/01/2008	09/30/2011		85
SPR, Part II	TPF-5(181)	$0.00	$26,000.00	$26,000.00	WA DOT	Nelson	Transportation Research Program Management Database	10/01/2007	09/30/2009	09/30/2011	86
SPR, Part II	TPF-5(183)	$35,000.00	$70,000.00	$175,000.00	IA DOT	Grazioli	Improving the Foundation Layers for Concrete Pavements	10/01/2008	09/30/2013		88
SPR, Part II	TPF-5(185)	$25,000.00	$50,000.00	$75,000.00	FHWA	Staton	Concrete Pavement Road Map Operations Support	10/01/2008	09/30/2011		89
SPR, Part II	TPF-5(205)	$15,000.00	$30,000.00	$45,000.00	IA DOT	Staton	Implementation of Concrete Pavement Mixture Design and Analysis (MDA) Track of Concrete Pavement Road Map	10/01/2008	09/30/2011		91
SPR, Part II	*TPF-5(206)	$50,000.00	$100,000.00	$100,000.00	VA DOT	Cook	Research Program to Support the Research, Development, and Deployment of System Operations Applications of Vehicle Infrastructure Integration (VII)	10/01/2008	09/30/2010		93
SPR, Part II	TPF-5(209)	$20,000.00	$20,000.00	$100,000.00	FHWA	O'Brien	Support of the Transportation Curriculum Coordination Council (TCCC)	10/01/2009	09/30/2014		95
SPR, Part II	TPF-5(215)	$5,000.00	$5,000.00	$25,000.00	MN DOT	Clover	Transportation Engineering and Road Research Alliance (TERRA)	10/01/2009	09/30/2014		96
SPR, Part II	TPF-5(218)	$25,000.00	$25,000.00	$50,000.00	MN DOT	Croze	Clear Roads Winter Highway Operations Pooled Fund	10/01/2009	09/30/2011		98

MDOT ANNUAL RESEARCH PROGRAM
Fiscal Year 2010 Project Budget and Expenditure Summary Tables

TABLE 4 POOLED FUND STUDIES (ACTIVE), continued

Funding	Project No.	FY 2010 Expenditure	Expenditures to Date	Project Total Budget	Agency	MDOT Project Manager	Title	Start Date	End Date	End Date(rev)	Pg No.
SPR, Part II	*TPF-5(223)	$206,710.00	$206,710.00	$206,710.00	FHWA	Roberts	Core Program Services for a Highway RD&T Program (TRB FY 2010) Activities Period Covering (July 1, 2009 – June 30, 2011)	10/01/2009	09/30/2010		100
SPR Part II	TPF-5(224)	$15,000.00	$15,000.00	$60,000.00	IA DOT	Staton	Investigation of Jointed Plain Concrete Pavement Deterioration at Joints and the Potential Contribution of Deicing Chemicals	10/01/2009	09/30/2013		101
SPR, Part II	TPF-5(225)	$25,000.00	$25,000.00	$100,000.00	VA DOT	Bennett	Validation and Implementation of Hot-Poured Crack Sealant	10/01/2009	09/30/2012		103
SPR, Part II	TPF-5(227)	$25,000.00	$25,000.00	$50,000.00	FHWA	Snook	Continued Advancements in Load and Resistance Factor Design (LRFD) Foundations, Substructures, and Other Geotechnical Features	10/01/2009	09/30/2011		104
SPR, Part II	TPF-5(231)	$35,000.00	$35,000.00	$175,000.00	MI DOT	Nederveld	ITS Pooled Fund Program (ENTERPRISE)	10/01/2009	09/30/2014		105
SPR, Part II	*TPF-5(410)	$1,050,000.00	$1,050,000.00	$1,050,000.00	FHWA	Roberts	NCHRP for FY 2010	10/01/2009	09/30/2010		107
		$1,703,710.00	**$2,403,710.00**	**$3,049,710.00**	**TOTAL POOLED FUND STUDIES (ACTIVE) BUDGET**						

*Project closed in FY 2010

MDOT ANNUAL RESEARCH PROGRAM
Fiscal Year 2010 Project Budget and Expenditure Summary Tables

TABLE 5 CONTRACT RESEARCH STUDIES (PROPOSED)

Funding	Project No.	FY 2010 Expenditures	Expenditures to Date	Total Budget	Agency	Principal Investigator	Title	Start Date	End Date	End Date(rev)	Pg No.
SPR, Part II	109095	$0.00	$0.00	$209,405.64	Michael Baker Jr., Inc.	Spangler	Review and Revision of Overload Permit Classification	10/01/2010	09/30/2011		111
SPR, Part II	109198	$0.00	$0.00	$129,707.10	UM	Hryciw	Feasibility of Digital Imaging to Characterize Earth Materials	10/01/2010	09/30/2011		112
SPR, Part II	109207	$0.00	$0.00	$149,944.15	Opus Int'l	Bagdade	Evaluating the Performance and Effectiveness of Roundabouts	10/01/2010	09/30/2011		113
SPR, Part II	109234	$0.00	$0.00	$159,887.20	Opus Int'l	Bagdade	Evaluating the Performance and Making Best Use of Passing Relief Lanes	10/01/2010	09/30/2011		144
SPR, Part II	109235	$0.00	$0.00	$99,818.00	MSU	Korkmaz	Implementation of Sustainable and Green Design and Construction Practices for Bridges	10/01/2010	09/30/2012		115
SPR, Part II	109236	$0.00	$0.00	$149,281.00	MSU	Lyles	Safety Analysis of 4-Lane to 3-Lane Conversions (Road Diets) in Michigan	10/01/2010	09/30/2011		116
SPR, Part II	109239	$0.00	$0.00	$207,500.00	UM	Eby	Low-Cost, High-Impact Measures to Meet the Transportation Needs of Michigan's Aging Population	10/01/2010	09/30/2011		117
SPR, Part II	109241	$0.00	$0.00	$199,999.00	WMU	VanHouten	Evaluating Pedestrian Safety Improvements	10/01/2010	9/30/2012		118
SPR, Part II	109274	$0.00	$0.00	$199,751.95	T.Y. Lin Int'l	LaPlante	Sharing the Road: Optimizing Pedestrian and Bicycle Safety and Vehicle Mobility	10/01/2010	03/31/2012		119
SPR, Part II	109275	$0.00	$0.00	$264,935.62	WMU	Aktan	Improving Bridges With Prefabricated Precast Systems	10/01/2010	09/30/2012		120
SPR, Part II	109276	$0.00	$0.00	$154,580.09	Texas A&M	Crawford	Developing a Congestion Mitigation Toolbox	10/01/2010	09/30/2011		121
SPR, Part II	109277	$0.00	$0.00	$179,989.00	Applied Pavement Technology	Peshkin	Cost-Effectiveness of the MDOT Preventative Maintenance Program	10/01/2010	09/30/2012		122
SPR, Part II	109722	$0.00	$0.00	$249,925.24	Dye Mangt	Die	A Framework for Statewide Roadway Asset Management:	02/01/2011	01/31/2012		123
SPR, Part II	109723	$0.00	$0.00	$230,000.00	TBD	TBD	Evaluating Pavement Marking and Sign Materials in Michigan; Evaluating of Durable Pavement Markings	11/30/2010	11/30/2011		124
		$0.00	**$0.00**	**$2,584,723.99**	**TOTAL CONTRACT RESEARCH STUDIES (PROPOSED) BUDGET**						

Administrative Items (Active)

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: 2010 ORBP Newsletter

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER Calvin Roberts

CONTRACT/AUTHORIZATION NO.	2009-0750 / Z2	PROJECT START DATE	11/13/2009
PROJECT NO.	108257	COMPLETION DATE (Original)	09/30/2010
ORBP NO.	OR10-009	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Michigan Technological University		
PRINCIPAL INVESTIGATOR	Elizabeth Hoy		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$47,133.73	TOTAL COST	(Original)*	$47,133.73
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$15,904.14
SALARIES			% PERCENT COMPLETE (By Budget)		33%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		75%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		Project closed
TOTAL FY EXPENDITURES		$15,904.14			

PURPOSE AND SCOPE

The purpose of this project is to produce newsletters for MDOT's Office of Research and Best Practices. The newsletter research program progress such as research findings, implementation of research results and other important information to research stakeholders. Four newsletters are proposed in the work plan scope.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The following issues of the newsletter were published:

1. The first issue, published in December 2009, outlined ORBP's effort to meet with all its stakeholders at listening sessions with the goal of improving the research program. There is an article comparing the research investments in fiscal years (FYs) 2008 and 2009. Additionally, another story outlines the services of the ORBP library. The final article outlines how the new research process provides opportunity to build relationships with national experts in Michigan to meet MDOT's research needs.
2. The second issue was published January 2010, and included a cover article on program improvements in response to stakeholder listening sessions, an article on a right-turn interaction safety research project, a solicitation requesting that stakeholders submit research ideas, and a preview of the research summit
3. The final issue published in June 2010, included a cover article on the research summit highlights, an article on external research partners responding to call for research ideas, a summery of the MDOT and university research contract negotiations, and a summery of the timeline for the FYs 2012-2013 biennial request for research proposals.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

This publication communicates program information to stakeholders and is a tool for technology transfer.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

In-House Research Studies (Active)

Michigan Department
Of Transportation
5312 (06/09)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2009

PROJECT TITLE: Electronic Frost Tube

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Gregory B. Palmer

CONTRACT/AUTHORIZATION NO.	In-House	PROJECT START DATE	09/05/2003
PROJECT NO.	108478	COMPLETION DATE (Original)	09/60/2005
ORBP NO.	OR03-001	COMPLETION DATE (Revised)	12/31/2009
RESEARCH AGENCY	MDOT		
PRINCIPAL INVESTIGATOR			

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$8,534.28	TOTAL COST	(Original)*	$44,806.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$36,755.24
SALARIES			% PERCENT COMPLETE (By Budget)		82%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		Project closed
TOTAL FY EXPENDITURES		$483.52			

PURPOSE AND SCOPE

Design and test an Electronic Frost Sensor. During the evaluation state it was determined that a standard off the shelf data acquisition system is not the best way to monitor the Electronic Frost Sensor. The Electronic Frost Sensor project has expanded into a four-step process:

1. Design and test electronic frost sensor.
2. Design and test data acquisition system.
3. Research and test data transmission systems.
4. Determine the best software for remote monitoring.

FISCAL YEAR 2008 ACCOMPLISHMENTS

Researched and tested data transmission systems, determined the best software for remote monitoring, modified frost sensor design. Compiled and analyzed data from winter monitoring. Frost is a seasonal thing, in the last quarter only 10 hrs was charged to the project. The reason for the time spent was to load the software in a new computer.

FISCAL YEAR 2009 ACCOMPLISHMENTS

With ground frost being a seasonal event, evaluation can only be performed in late winter, early spring. In spring 2009, we had a couple of freeze thaw cycles, the first one looked good, but there was too much lag time in the second one.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The ground frost was monitored last year with some good and bad results. The frost tube indicated that the frost went in the ground at the proper time but there was a lag time with the frost coming out of the ground. Further testing is required.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

The project started as just a frost depth sensor and then expanded into a four step process. The process is listed above in purpose and scope.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: ITS Hardware Laboratory and Equipment

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Cook / Greg Krueger

CONTRACT/AUTHORIZATION NO.	In-House		PROJECT START DATE	10/01/2006
PROJECT NO.	108521		COMPLETION DATE (Original)	09/30/2010
ORBP NO.	OR07-001		COMPLETION DATE (Revised)	09/30/2011
RESEARCH AGENCY	MDOT			
PRINCIPAL INVESTIGATOR	N/A			

BUDGET STATUS

FY 2010 Budget				Total Budget		
FY FUNDS	(Original)****	$84,137.00		TOTAL COST	(Original)*	$450,000.00
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$382,796.00
SALARIES				% PERCENT COMPLETE (By Budget)		85%
EQUIPMENT	(Expendable)	$16,933.00		% PERCENT COMPLETE (By Work)		80%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$67,204.00
TOTAL FY EXPENDITURES		$16,933.00				

PURPOSE AND SCOPE

This is a multiple phased project that will start with the deployment of multiple video cameras in and around the MDOT Construction and Technology (C&T) building, digital video transmission equipment, video switching and processing equipment and central system equipment. Later phases will include video transmission equipment between the C&T building, city of Lansing, MDOT Headquarters (Van Wagoner Building), and other MDOT facilities. These phases will permit the evaluation of more complex communications methodologies and technologies - the work at then MDOT secondary complex can be performed using low-power, short-haul, "low" bandwidth communications equipment, while the connections between C&T and downtown Lansing (or other locations in Michigan) will be used to evaluate the longer range communications technologies available. The first step in this process, which is the gist of the first phase of the Lansing ITS Laboratory, is the evaluation of the manufacturer claims of their use of standards, and the evaluation of the effectiveness of multiple communications paths. The current video compression standard is MPEG-4 and there are multiple vendors who are claiming that they are MPEG-4 compliant/compatible. The first phase of the ITS laboratory will give MDOT the ability and infrastructure needed to evaluate these claims through an open invitation/Request for Interest (RFI). MDOT will use university support to set up the design of the system and the testing/evaluation of components used, as well as internal staff from MDOT Construction and Technology. The estimated equipment that may be procured for this project includes: 19" EIA Equipment Racks (6), Video Switch and Video Controllers, MPEG-4 Video Compression and Decompression devices (2-4 pair), Video monitors/projectors. All hardware procured will be used specifically for the purposes of the ITS laboratory and not for general MDOT use. MDOT will maintain ownership of all of the hardware/software needed for this project and document the purchase/disposal as required. An inventory of all of this equipment will be kept, pursuant to OPM regulations on equipment procurement, management and disposal.

FISCAL YEAR 2008 ACCOMPLISHMENTS

I-69 Traffic Detector Test Bed

(Quarters 1 and 2) Completed procurement of devices needed to begin testing at the I-69 traffic detection test bed. Devices that have been procurred and delivered to the ITS Lab have begun bench testing before installation. Traffic detection technologies that have been procurred and will be tested include; microwave vehicle detection, video vehicle detection, and point vehicle detection. ITS cabinets that will house the equipment have been delivered to the statewide signals shop and will be installed.

(Quarters 3 and 4) The ITS Cabinets that will house the equipment for the I-69 Traffic Detector Test bed have been delivered, installed, and are functioning properly. Detection and communications devices have been bench tested, configured and will now begin to be installed in the field. The test bed currently has one microwave vehicle detector installed, and the remaining equipment will be installed as weather permits bucket truck usage.

Cut River Bridge Monitoring System

(Quarters 1 and 2) Indentified infrastructure for a bridge monitoring system at the Cut River Bridge in the Upper Peninsula. The ITS Lab worked with MDOT bridge personnel to identify the proper strain gauges needed to monitor strain at the bridge. The strain gauges and data acquisition units have been identified and will be procurred in the next quarter. Upon completion of the Cut River

bridge deck replacement project, the strain gauges will be installed and monitored. Also, included in this project is a long range communications infrastructure that has been designed and will be installed by Motorola. This separate design effort will allow the ITS Lab to study more examples of long range wireless communications.

(Quarters 3 and 4) The layout and design of the Cut River Bridge system was completed during the last two quarters of the year. Included in this design was; determination of structures needed to support the solar power and communications requirements of the site, conduit and foundation design for the solar power and RWIS structures, and site preparation of an area near the bridge where the installation will take place. Fiber optic strain gauges and point vehicle detectors were procured during this timeframe as well. The ITS Lab staff installed a fixed IP camera at a WIM station near the Cut River Bridge. This camera will be triggered by an overweight vehicle crossing the WIM and take a snapshot of the vehicle with a timestamp. This image and WIM data will be then wirelessly transmitted back to the Mackinac Bridge where it may be used in the future to visually verify and enforce violators of seasonal weight restrictions by the Motor Carrier division. Data usage and management of this system is currently being discussed.

Escanaba RWIS Test Bed

(Quarters 1 and 2) Installation of the RWIS test bed infrastructure was completed. Included in the installation was a 40' collapsable tower and large double door ITS cabinet to house devices. Multiple vendors were identified in the previous fiscal year (FY) and expressed interest in allowing MDOT to test the equipment free of charge. Vendors that expressed interest have identified equipment to be installed and will be completed next quarter. The last portion of the installation is the communications infrastructure needed to bring the RWIS information back to the MDOT Superior Region Office and the MDOT ITS Lab for testing and evaluation. The ITS Lab and a Superior Region electrician completed field testing and identified the communications design needs. This equipment has been procurred and will be installed by the ITS Lab and Superior Region personnel upon delivery.

(Quarters 3 and 4) Multiple vendors equipment has been installed at the RWIS test bed as well as the wireless communications infrastructure needed to display this data at the Superior Region Office. RWIS Data is currently being viewed at a local workstation at the region office. To allow viewing of RWIS data by the ITS Lab, vendors monitoring the performance of their devices, and other MDOT personnel, an internet connection is being installed at the Superior Region Office. The ITS Lab has not been authorized to install any devices from this project on the State of Michigan network, so the separate internet connection is necessary for dissemination of RWIS data to the proper stakeholders via a secured Web site.

Bay City Bascule Bridge Management System Test deployment

(Quarters 1 and 2) The Bay City Bascule Bridge Management Test deployment was identified in the MDOT Bay Region ITS Architecture. This deployment will be used as a pilot to identify the feasibility of bridge management throughout the state. The deployment was identified by Bay Region ITS stakeholders as a need to provide better information of bridge status to 911, MDOT, Fire and EMS agencies. The system will include video compression as well as wireless communications technologies that have been tested previously in the lab. This deployment will not only test the interoperability of multiple ITS technologies such as; wireless communications, video compression device interoperability and low speed internet connection (DSL), but will also provide a means of testing this new ITS system. The system and equipment needed have been designed and will be procurred in the next quarter.

(Quarters 3 and 4) Equipment for the Bay City Bascule Bridge Management Test deployment was procured. Included in this procurement were multiple ITS technologies needed for functioning of the system including; 5.2 GHz wireless communications and MPEG4 video compression. The equipment was then bench tested and configured for proper functioning in the field. During the bench testing procedures, ITS Lab staff met with Bay Region electricians to discuss the layout and plans for installation. The Bay Region electricians then installed the infrastructure needed for the system including; mounting poles for additional height needed for wireless communication links as well as CCTV viewing capabilities, wiring and CCTV camera installation. After the physical infrastructure was in place, the ITS Lab staff, in coordination with the Bay Region electricians completed the installation of system components including wireless communication and MPEG4 compression devices. The next step in the system is to complete a wireless link installation between the Veteran's Memorial Bridge (the system's communication hub) and the Bay City - City Hall, which is the location for our internet service provider to disseminate bridge images to multiple stakeholders. The internet service is necessary because the system has not been authorized for deployment on the State of Michigan network at this time.

MPEG4 Video Compression Device (Codec) Interoperability Testing

(Quarters 1 and 2) Upon testing multiple manufacturers of MPEG4 video compression devices (codecs), the ITS Lab identified non-interoperability and non-standards conformance issues between manufacturers. The purpose of this testing is to identify what manufacturers are not using standards based MPEG4 compression techniques. This is important to MDOT in developing a standards based statewide ITS, which will work seamlessly with the soon to come statewide advanced traffic management software (ATMS). Developing a standards based system will protect MDOT from being stuck with devices using proprietary compression techniques.

(Quarters 3 and 4) The ITS Lab is currently working with three manufacturers to verify interoperability and comformance with MPEG4 compression standards. Non-interoperability and non-standards based conformance issues were identified, documented, and addressed with each equipment manufacturer. These issues are currently being worked out between devices manufacturers and MDOT plays a key role in the transmission of information and data between them. Current testing has provided MDOT with hands on experience and will also be crucial when developing specification for future deployments of MPEG4 compression devices. This will include required compatibility with future universal decoding methods that will be deployed such as; 360 surveillance software (MITSC), Delcan ATMS (statewide) and video walls (MITSC and West MI TMC).

VII Model Deployment Test Bed

(Quarters 3 and 4) Equipment was procured for the VII Model Deployment demonstration at the 2008 ITS MI Show at Rock Financial Showplace in Novi, MI. ITS Devices procured for the test bed included; microwave vehicle detectors, ITS cabinets and solar power equipment. The equipment procured was installed in collaboration with the Road Commission for Oakland County (RCOC). This equipment is currently deployed and will be used for future demonstrations of VII in the State of Michigan.

FISCAL YEAR 2009 ACCOMPLISHMENTS

I-69 Traffic Detector Test Bed – Lansing, MI

Bench testing of all traffic detectors procured was completed. Included in this testing was verification of data transmission methods for all detector technologies including point, microwave vehicle, and video detection devices. Configuration of devices in the addressing scheme set-up for the ITS lab was completed and preparations were made for future deployment. Installation of local communications infrastructure was completed including Managed Field Ethernet switches (MFES), and CAT5 Ethernet cable connecting ITS cabinets. Installation of this infrastructure is in preparation of a full deployment in the coming year.

Critical Highway Infrastructure Monitoring Project (CHIMP) - Cut River/Mackinac Bridge, MI

ITS Lab resources were used to fund much for the sensor and infrastructure installations. The ITS Lab staff was also instrumental in providing resources needed to purchase and install equipment and sensors for data collection. Additionally, expertise from the lab was leveraged to place sensors and communication devices, which provided valuable knowledge, skills and abilities to assure connectivity and data transmission. Expertise from the lab is used to ensure connectivity remains constant, and lab staff will continue to perform maintenance on devices as needed.

Infrastructure needed for a bridge monitoring system at the Cut River Bridge in the Upper Peninsula was identified in the first two quarters of the year. The layout and design of the Cut River Bridge system was completed during the last two quarters of the year. Included in this design was; determination of structures needed to support the solar power and communications requirements of the site, conduit and foundation design for the solar power and RWIS structures, and site preparation of an area near the bridge where the installation has taken place. Fiber optic strain gauges and point vehicle detectors were procured during this timeframe as well. Upon completion of the Cut River Bridge deck replacement project, the strain gauges were installed. Also, included in this project, was a long range communications infrastructure that was designed and installed by Motorola with the procurement of contractor services completed by MDOT. This separate design effort has allowed the ITS Lab to study more examples of long range wireless communications.

Also, the ITS Lab staff installed a fixed IP camera at a WIM station near the Cut River Bridge. This camera is triggered by an overweight vehicle crossing the WIM and takes a snapshot of the vehicle with a timestamp. This image and WIM data is then wirelessly transmitted back to the Mackinac Bridge where it may be used to visually verify and enforce violators of seasonal weight restrictions by the Motor Carrier division. Data usage and management of this system is currently being discussed.

Escanaba RWIS Test Bed – Escanaba, MI

Further testing was completed on the installed devices at the test bed. Multiple forms of environmental sensors are being tested currently at the site including; traffic detectors, both intrusive and non-intrusive surface sensors (measuring temperature, surface conditions, freezing temperature, etc.) visibility sensors, snow depth sensors, and more. Ultimately, test results will allow the MDOT ITS Lab, along with the MDOT Superior Region office staff, to make recommendations on the performance of RWIS devices and determine the feasibility of using certain RWIS technologies for future deployments in the field. Also, testing procedures may warrant the modification of currently developed special provisions from test findings.

Bay City Bascule Bridge Management System Test Deployment - Bay City, MI

A 5.2 GHz wireless communications link was installed between the MDOT owned Veteran's Memorial Bridge to the Bay City – City Hall. Here a connection was made to the city's Internet Service Provider (ISP) T1 connection, which allowed for the dissemination of real-time video and bridge closure information to the Regional stakeholders via direct connection to the video server, as well as posting to the MI Drive Web site.

Coordination was completed with the MDIT - MI Drive Team to develop and populate the Web site with bridge icons that change colors to signify the status of the bridge in real-time (i.e. open to traffic, closed to traffic, and status unknown (loss of communication, bridge is not instrumented)). After working with the MI Drive Team, the bridge icons are now posted on the MI Drive Web site and are updated in real-time with bridge closure information. Included in this moveable bridge information is the time of closure and duration. Current testing is being completed with MDOT Bay Region staff and Bay City for verification of closure information for accuracy in closure time and duration.

MPEG4 Video Compression Device (Codec) Interoperability Testing – Statewide

Multiple MPEG4 Video compression device manufacturers worked with the MDOT ITS Lab to determine any compliance and interoperability issues that may become a problem with overall statewide ATMS software functionality in the future. Included in this testing was determination of device setting to allow the interoperability of multiple device manufacturers MPEG4 compression equipment. Setting changes of note were the removal of proprietary headers in the MPEG4 stream to allow for standard MPEG4 decoding with multiple methods. Each device manufacturer was tested against an industry standard software decoder to determine to determine it's compatibility before testing with another manufacturer's hardware decoder.

IntelliDrive[SM] Model Deployment Test Bed – Novi, MI

Multiple demonstrations of the IntelliDrive Model Deployment Test Bed were completed in 2009. These demonstrations included the 2009 ITS MI Annual meeting. Included in this demonstration was an expansion of in-vehicle applications that were tested. Also, infrastructure necessary to create a more permanently functioning system for the test bed was completed, including installation of a permanent ITS cabinet which houses system equipment. This cabinet will be used to house the application server and Traffic Management Center (TMC) server. All demonstrations that were completed, utilized the assistance of the ITS Lab staff in coordination the RCOC to get the system up and functioning properly.

Advanced Traffic Management System (ATMS) Software Test Lab

The MDOT ITS Lab, in coordination with MDIT and the statewide ATMS software developer Delcan, developed a list of devices that needed to be procured for bench testing with the preliminary ATMS software package. After the equipment list was developed, the MDOT ITS lab staff was tasked with the procurement of the devices which will be used for bench testing procedures. The ITS Lab staff has experience with both the procurement and configurations of ITS field devices and was asked to help complete the procurement task and future device set-up. Statewide ITS Program funds were used to purchase the devices for testing.

Michigan State Police (MSP) Precision Driving Facility Test Bed - Lansing, MI

The Michigan State Police (MSP) Precision Driving Facility was supplied with ITS hardware including; codecs, cameras, controllers, monitors and Motorola PTP Wireless Link. Existing towers on the MSP property were utilized for the installation of cameras and communication infrastructure. The installed camera covers the entire practice track for the MSP and ITS lab use. MSP uses these camera images for training purposes, while the ITS Lab uses camera images for evaluation of picture quality and latency of controls utilizing the currently installed ITS infrastructure.

PTP communications devices were installed on C&T and MSP following required power installation. The communications devices are used for testing the performance of wireless communications devices as well as providing images for evaluation to the ITS Lab. This wireless testing is valuable when designing and implementing the future ITS infrastructure. CCTV operational control and image limitations are also being tested. The functionality of blocking CCTV images to the public is also being tested. MSP may desire to block images from MDOT for training and testing purposes. The issue of privacy and media accessibility is also addressed when images are shared between agencies.

Vendor Product Evaluation – Lansing, MI

Products supplied to the ITS Lab for testing were compared to specifications developed by the department. General performance characteristics tested include; speed of device, compatibility with other devices, number of failures documented and customer service. Statewide specifications developed by HNTB were used for this testing.

All equipment was provided to the MDOT ITS lab free of charge for testing and evaluation. Equipment was installed, configured, and tested for functionality and interoperability with current MDOT devices. The ITS lab staff worked with technical support from vendors to set-up the equipment properly and to provide any guidance on troubleshooting issues that occurred during the test procedures.

An evaluation after testing was completed that addressed the test set-up, configuration of devices, positives and negatives of the devices, and operational performance during the testing period in comparison to the statewide specifications developed by HNTB. Each device that was applicable to an MDOT special provision (SP) was then compared with the SP to point out areas where the equipment did not meet the SP. Then the vendor was given an opportunity to provide feedback to MDOT as a recommendation on modifying the SP to create a more industry wide representation of that type of device. All device manufacturer's have multiple opportunities to come to the ITS lab to display products to the lab staff and provide demonstration of device functionality, set-up, etc.

FISCAL YEAR 2010 ACCOMPLISHMENTS

I-69 Traffic Detection Test Bed – Lansing, MI

All activities for this project were put on hold in preparation for coordination with the MDOT Advanced Traffic Management System (ATMS) Software Test Lab. The Traffic Detection Test Bed field sensor installations were postponed to FY 2011 to provide proper equipment configuration in coordination with the Statewide ATMS Software project to leverage its testing capabilities.

Critical Highway Infrastructure Monitoring Project - Cut River/Mackinac Bridge, MI

The ITS Lab staff completed the configuration and final set-up of all devices located within the system. This data is now being provided to the consulting firm under contract with the MDOT ITS Program to provide analysis on the multitude of sensor data being collected including; vehicle data (speed, volume, classification), bridge video images, strain gage data, weigh in motion data, and environmental sensor station data (wind speed and direction, temperature, humidity, etc). To disseminate this data to stakeholders outside of the state of Michigan network, the installation of Internet Service at the MDOT St. Ignace Maintenance Garage was required. This allows for the Consultant completing the data analysis as well as the MDOT Data Use Analysis and Processing (DUAP) project to access the data. The MDOT ITS Lab project is funding the recurring cost for this Internet service.

The Motorola Design team tasked with supplying the equipment and design of the solar power/communications system was unable to correct a problem with intermittent communications between the WIM Station approximately 2 miles to the east of the Cut River Bridge along US-2. After multiple tests were completed, it was determined that the installation of a 125 ft tower at the WIM site was necessary to achieve stable 900 megahertz (MHz) communications between the WIM station and the Cut River site. A security fence was also installed around the foundation of the tower to deter climbing.

Environmental Sensor Station Test Bed – Escanaba, MI

Compilation of feedback to ESS device manufacturers on currently installed equipment performance was started. This includes providing feedback on multiple facets of the equipment performance including but not limited to; meeting MDOT specifications, pros and cons of the devices, and open dialogue on improvements to the equipment. The testing of these devices has allowed MDOT Superior Region Office staff, in coordination with the ITS Lab, to not only identify improvements to device manufacturer's equipment, but has also helped identify required changes to the MDOT Environmental Sensor Station Special Provision. Valuable information gathered during this testing has been used to fine tune the MDOT ESS specifications to the exact needs of the department. These testing activities have also been completed in coordination with the installation of ESS sites throughout the MDOT North and Superior Region. Some lessons learned from testing have already been applied to installations of current ESS sites including the modification of placement of subsurface and surface sensors for optimal performance.

Bay City Bascule Bridge ITS Pilot Project – Bay City, MI

Further testing of the fully operational system has identified some equipment that has and will need reconfiguring to make the system function optimally. During system testing, the ITS Lab Staff has discovered some issues with the equipment performance that need to be resolved including; intermittent communications between the Independence and Veteran's Memorial Bridges due to foliage and obstructions, pixilation of video images over the wireless communications devices, and a telecommunications issue with the city of Bay City IP network. All of the issues have been identified and will be addressed during the next year of optimization. A majority of the solutions can be achieved through configuration of the system to increase its performance, while other issues may require improvements due to limitations of the manufacturer's equipment to increase overall system performance. In all cases, the ITS Lab will identify the solution to optimize the entire system that benefits all stakeholders involved with the project.

Advanced Traffic Management System (ATMS) Software Test Lab – Lansing, MI
Devices necessary for lab testing with the Delcan ATMS software package were delivered to the ITS Lab. Delcan, the ATMS Software developer, has been provided space to complete device testing in the lab utilizing the procured ATMS test equipment. The ITS Lab has assisted with the set-up and installation of ITS test devices in the lab space for Delcan's use. Technical support on devices that the MDOT ITS Lab has familiarity with testing, configuring and troubleshooting has also been provided. The ultimate goal of the ATMS software testing in the MDOT ITS Lab is to have a fully functioning test bed that can simulate the operation of all devices throughout the state of Michigan in any ITS system in the field. Working closely with the ATMS software provider has allowed the ITS Lab to coordinate the installation and configuration of this test lab with the future completion of the MDOT I-69 Traffic Detection Test Bed. Coordination of set-up of both the ATMS Test Lab and the I-69 Traffic Detection test bed will allow MDOT and the ATMS Software provider the ability to test ITS field and communications devices in a real live traffic scenario, without a negative impact to any currently functioning deployed ITS systems.

Vendor Product Evaluation – Lansing, MI
Products supplied to the ITS Lab for testing were compared to specifications developed by the department. General performance characteristics tested include; speed of device, compatibility with other devices, number of failures documented and customer service. Statewide specifications were used for this testing.

All equipment was provided to the MDOT ITS lab free of charge for testing and evaluation. Equipment was installed, configured, and tested for functionality and interoperability with current MDOT devices. The ITS lab staff worked with technical support from vendors to set-up the equipment properly and to provide any guidance on troubleshooting issues that occurred during the test procedures.

An evaluation write-up after testing has been completed on some devices that addressed the test set-up, configuration of devices, positives and negatives of the devices, and operational performance during the testing period in comparison to the statewide specifications. Each device that was applicable to a MDOT SP was then compared with the SP to point out areas where the equipment did not meet the SP. Then the vendor was given an opportunity to provide feedback to MDOT as a recommendation on modifying the SP to create a more industry wide representation of that type of device. All device manufacturer's have multiple opportunities to come to the ITS lab to display products to the lab staff and provide demonstration of device functionality, set-up, etc.

Grand Haven Bascule Bridge ITS Project – Grand Haven, MI
The ITS Lab staff completed installation of the Grand Haven Bascule Bridge ITS System. Similar to the Bay City Bascule Bridge ITS System, the US-131 Grand Haven Bascule bridge was instrumented with equipment to allow for the bridge status to be monitored in real-time and disseminated to stakeholders via the MiDrive Web site. The ITS Lab staff completed the design, procurement and installation of the system, although no lab funding was used to complete the project. This includes working with the Grand Region Electricians and statewide crews to complete a field investigation to determine the proper design elements necessary to complete the project. The ITS Lab procured the designed equipment; bench tested and configured the devices in preparation for installation. The lab staff then coordinated with the Grand Region for necessary lane closures and electricians to complete the installation of the equipment. The system is composed of equipment that; receives the bridge closure information directly from the bridge gate circuit, transmits this bridge status via a point-to-point wireless connection to a nearby ITS Camera pole, and utilizes the existing Wi-Max communications infrastructure to disseminate the bridge status to the proper stakeholders via MiDrive. All field infrastructure has been installed and is functioning as expected.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

I-69 Traffic Detection Test Bed – Lansing, MI
All infrastructure and vehicle detection devices procured will be installed. These devices include; microwave vehicle detection systems (MVDS), point detection systems, video detection systems, wireless communications between the test bed and the ITS Lab, and CCTV cameras. Once a communications link has been established between the test bed and the ITS lab, the installation of all vehicle detection devices will be completed. Once all devices have been installed, and are functioning properly, the accuracy of each different technology will be tested for vehicle counts, speeds, and volume. This testing will be used to provide benefit to studies including, the MDOT TRACK Team which is involved in evaluating traffic control devices including detection, which the ITS Lab will have a member that attends all meetings and participates in activities. Test activities and findings will be used to determine the feasibility of using certain devices on MDOT facilities.

Environmental Sensor Station Test Bed – Escanaba, MI
A Request For Information (RFI) may be developed, and posted on multiple forums including MDOT and National (ITS America, FHWA, etc), allowing the ITS Lab to reach out to multiple vendors providing the opportunity for their devices to be tested free of charge by MDOT. A continued evaluation of currently installed test devices will be completed to determine if the current RWIS test site needs a more robust infrastructure than what is currently deployed to provide for an adequate testing environment for the vendor and the ITS lab. This test location will continue to allow the ITS Lab to test devices in a harsh winter environment, to their operational limits.

Bay City Bascule Bridge ITS Pilot Project – Bay City, MI
The system will be optimized to provide the most useful system possible by working with MDOT, Bay City and local public safety agencies stakeholders. Crucial to the system's reliability for the motoring public and local agencies, will be the accuracy of closure data that is being posted to the MI Drive Web site. This data's accuracy will be cross checked with MDOT and Bay City bridge operators to determine it's accuracy in not only duration, but closure time. The potential for deployments at future bridge locations throughout the state of Michigan will also be evaluated. The pilot project will be used as a demonstration to other areas around the state interested in increasing the robustness of bascule bridge closure data, as well as live streaming video, being transmitted to the public and local agencies via multiple methods of dissemination.

Advanced Traffic Management System (ATMS) Software Test Lab – Lansing, MI
Further testing with the Delcan ATMS software package will be completed at the ITS Lab. Delcan, the ATMS Software developer, will utilize the current space in the lab to complete further device testing. The ITS Lab staff will provide support to Delcan on devices that the MDOT ITS Lab has familiarity with testing, configuring and troubleshooting as needed. The ATMS testing will be completed in coordination with the I-69 traffic detector test bed, to ultimately create a real live testing environment to test not only the functionality of ATMS with specific ITS devices (make, model, firmware) but also device accuracy, interoperability, etc.

Michigan State Police (MSP) Precision Driving Facility Test Bed - Lansing, MI
The currently installed equipment will be used for testing the performance of wireless communications devices as well as providing images for evaluation to the ITS Lab. This wireless testing is valuable when designing and implementing the future ITS infrastructure. CCTV operational control and image limitations may also be tested. The functionality of blocking CCTV images to the public may also be tested. MSP may desire to block images from MDOT for training and testing purposes. The issue of privacy and media accessibility is also addressed when images are shared between agencies.

Vendor Product Evaluation – Lansing, MI
An RFI may be developed for interested vendors and posted on ITS MI and ITS America. This RFI may be used to gauge vendors' interest in supplying new and emerging ITS technologies to the MDOT ITS Lab for testing. A major part of the ITS lab's function is to identify technologies that have not been currently investigated and deployed, and determine their feasibility of usage in future ITS projects throughout the state. The ITS Lab will continue to contact and meet with various ITS device manufacturers to identify newest and highest performing devices being developed.

Grand Haven Bascule Bridge ITS Project – Grand Haven, MI
The currently installed system will be connected via the internet to the MiDriveE Web site to post bridge closure information to the motoring public. This will require the MDOT ITS Lab to coordinate with the DTMB MiDrive development team, to add a bridge icon to the MiDrive Graphical User Interface (GUI) to communicate bascule bridge status to the public.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (06/09)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Stainless Reinforcement in Bridge Decks

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Kahl

CONTRACT/AUTHORIZATION NO.	In-House	PROJECT START DATE	10/01/2006
PROJECT NO.	108677	COMPLETION DATE (Original)	09/30/2009
ORBP NO.		COMPLETION DATE (Revised)	09/30/2010
RESEARCH AGENCY	MDOT		
PRINCIPAL INVESTIGATOR			

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$15,000.00	TOTAL COST	(Original)*	$32,950.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$31,867.00
SALARIES			% PERCENT COMPLETE (By Budget)		97%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)				
TRAVEL			**FY 2011 Budget**		
OTHER			**Total Contract Amount Available**		Project closed
TOTAL FY EXPENDITURES		$7,703.00			

PURPOSE AND SCOPE

Evaluate performance of stainless reinforcement in new and existing bridge decks. Construction methods, type of stainless steel (SS) rebar used, and actual cost of the deck systems will be reviewed. The performance of the deck systems will be monitored by visual inspection, and crack mapping. The frequently used special provision will be updated as necessary. A final report will provide conclusions and provide recommendations for policy and future direction.

FISCAL YEAR 2009 ACCOMPLISHMENTS

As costs decrease, it is anticipated that more decks will be built using stainless. The first SS deck S02 of 63102 was inspected in April 2008. Newer types of austenitic stainless were introduced and come with a potential cost savings of 40% as compared to the traditional stainless reinforcements. A bridge project that was let in March 2008 (I-94 over the Galien River, B01 of 11015, JN 55904A) used solid and clad stainless reinforcement and was inspected in August 2008 (progress schedule indicated reinforcement placement at that time). The bid price for solid stainless was $5.00/lb, and the clad stainless was $1.75/lb.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Another bridge project, I-94 over Riverside Dr (JN 75047) used the newer type of SS (reduced nickel content austenitic type 241), and construction was completed in November 2009. The project used a special provision to modify the FUSP for stainless reinforcement. Although the material cost for the solid stainless reinforcement was estimated at $2.80/lb by the manufacturer, the low bid for reinforcement, SS came in at $3.74/lb. Generally installed costs are between $0.30 to $0.50/lb over the material costs. Compared with $5/lb to $8/lb bids from previous projects, this represents a cost savings in the use of stainless reinforcement. The final report is near completion, which will combine the research work completed for stainless-clad reinforcement, project 101673. The report will recommend using a mix of solid and clad stainless reinforcement to minimize investment cost, but maximize longevity (note the cost savings in JN 55904A above).

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Enhance the use criteria for stainless reinforcement to include the use of stainless clad reinforcement, update the FUSP for stainless to include the clad product, and provide use guidelines for incorporation into the MDOT design manual.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
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*****The revised fiscal year budget amount, if applicable

Contract Research Studies (Active)

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Improving Driver Safety with Behavioral Countermeasures

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Kimberly Lariviere

CONTRACT/AUTHORIZATION NO.	2009-0749 / Z1	PROJECT START DATE	10/27/2009
PROJECT NO.	107432	COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-089	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Central Michigan University		
PRINCIPAL INVESTIGATOR	Dr. Richard Backs		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$74,545.03	TOTAL COST	(Original)*	$149,923.67
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$48,673.31
SALARIES			% PERCENT COMPLETE (By Budget)		32%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		40%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$93,892.44
TOTAL FY 2010 EXPENDITURES		$48,673.31			

PURPOSE AND SCOPE

Where should MDOT invest safety funding aimed at behavioral modification and education of Michigan's drivers? Is it more effective to focus on advance enforcement to prevent problems, educating young people, legal penalties or other actions?

Researchers will investigate the cost and effectiveness of a range of efforts designed to influence driver behavior. The study will examine national guidance and programs in place in Michigan and other states to identify best practices. Study results will help MDOT recommend updates to driver education materials and MDOT's Stategic Highway Safety Plan.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Completed interviews with subject matter experts within the state of Michigan. Analysis of benefits, costs, and implementation issues of the behavioral countermeasures that have been implemented in the state of Michigan. A database of executive summaries of a number of different countermeasure approaches across a number of different traffic safety problem areas has been developed.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Complete the engineering review of the executive summaries for determining which countermeasure to study for the pilot project. Develop and execute the methods of analysis aimed at assessing the effectiveness of the pilot project.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

Original engineering subcontractor ceased business operation in Michigan; therefore a new subcontractor had to be hired, and the cost of the contract decreased. The contract has been approved, with the subcontractor starting work in August 2010 (8-24-2010).

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Impact of Non-Freeway Rumble Strips – Phase I

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Jill Morena

CONTRACT/AUTHORIZATION NO.	2009-0748 / Z3	PROJECT START DATE	06/01/2010
PROJECT NO.	107435	COMPLETION DATE (Original)	06/30/2012
ORBP NO.	OR09-084	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Wayne State University		
PRINCIPAL INVESTIGATOR	Dr. Tapan Datta		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$55,857.06	TOTAL COST	(Original)*	$262,829.81
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$6,886.92
SALARIES			% PERCENT COMPLETE (By Budget)		2%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		5%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$192,547.62
TOTAL FY 2010 EXPENDITURES		$6,886.92			

PURPOSE AND SCOPE

There were 1,084 fatalities, 7,485 severe injuries and a total of 324,174 reported crashes in Michigan in 2007. Lane departure crashes play a large role in the number of crashes and fatalities in Michigan as well as nationwide. To combat this, MDOT has taken on a new, innovative approach to safety by installing centerline and shoulder non-freeway rumble strips across the state in fiscal years (FYs) 2008, 2009, and 2010, in order to lower fatalities and crashes caused by drivers leaving their lane.

MDOT's centerline and shoulder non-freeway rumble strip implementation will cost approximately nine million dollars over the three years. This initiative is the first of its kind in the country - no other state has taken such an aggressive approach to installing rumble strips. As Michigan waits to see the results of their initiative, so do the other states across the country. MDOT needs to evaluate the effectiveness of this initiative in order to merit the continuance of such widespread use, gain public acceptance and pass knowledge to other states considering non-freeway rumble strips as a safety countermeasure. MDOT also needs to evaluate the impacts the centerline and non-freeway rumble strip initiative has on driver behavior, the non-motorized community and nearby residents.

Phase 1 of this multi-phase research project, is a crucial step in evaluating the rumble strip initiative. Phase 1 will be the only research opportunity MDOT will have to gather "before data" from the field as the last group of candidate roads will be milled in 2010.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Task 1: Review Literature
A detailed state-of-the-art literature review has begun. Relevant research literature has been identified and each document is being summarized and critically reviewed.

Task 2: Obtain Office Data and Map Rumble Strip Locations
Data has been obtained related to locations scheduled for milling in FY 2008, 2009, and 2010. Basic inventory data has been obtained from MDOT in the form of sufficiency files. Pavement rehabilitation and maintenance information for each of the rumble strip segments has also been provided by MDOT. MDOT's pavement imagery files from FY 2006-2009, have been obtained. A comprehensive rumble strip database file is being created. ArcMap is being utilized to map all scheduled FY 2008-2010 rumble strip locations.

Task 3: Sampling Strategy
The WSU-TRG conducted field behavioral studies at a sample of locations during summer 2010. These data were utilized to determine the minimum necessary before-and-after sample sizes for each of the driver behavior measure of effectiveness (MOEs). Sampling for the pavement condition data collection is ongoing.

Task 4: Collect and Analyze "Before-and-After" Field Data
"Before" data collection was performed at several non-freeway locations where rumble strip installations were not done at the time of data collection. Driver behavioral data were collected using elevated video cameras temporarily mounted on road signs. The relevant behavioral data (i.e., passing maneuvers, encroachments, etc) are currently being extracted from the videos by trained technicians. Speed data were also measured at each location using a radar gun. Geometric and cross-sectional measurements

were also recorded at each location. Noise measurements were also obtained from the roadside for a sample of locations.

Task 5: Collect and Analyze Data for Bicyclists
No progress to report.

Task 6: Collect and Analyze Pavement Condition Survey Data
A review of the pavement imagery is underway to determine the impacts of the non-freeway rumble strips on pavement performance.

Task 7: Compile Data and Analyze Measures of Effectiveness
Driver behavioral data are being compiled upon extraction from the videos and quality control checks are being performed.

Task 8: Prepare and Submit Deliverables.
No progress to report.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

1. Finish literature review.
2. Complete the map of rumble strip locations.
3. Finish the sampling strategy for pavement condition survey.
4. Finish extraction of behavioral data from the videos.
5. Make substantial progress in the pavement condition survey.
6. Collect and analyze bike information.
7. Collect 'after' field data.
8. Analyze 'before' and 'after' field data.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Development and Validation of Deterioration Models for Concrete Bridge Decks

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Peter Jansson

CONTRACT/AUTHORIZATION NO.	2009-0746 / Z2	PROJECT START DATE	10/20/2009
PROJECT NO.	107451	COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-156	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Michigan State University		
PRINCIPAL INVESTIGATOR	Dr. Rigoberto Burgueño		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$146,293.00	TOTAL COST	(Original)*	$299,747.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$41,737.06
SALARIES			% PERCENT COMPLETE (By Budget)		13%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		22%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$258,009.94
TOTAL FY 2010 EXPENDITURES		$41,737.06			

PURPOSE AND SCOPE

Assess the deterioration mechanisms in concrete decks, develop mechanistic and history based degradation models for concrete decks, develop computer software that integrates the developed degradation models and provide a bridge specific preservation strategy within regions and for design.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Task 1: Assessment of the deterioration mechanisms in reinforced concrete (RC) bridge decks through literature review and evaluation of MDOT inspection and maintenance databases. Task 1 is estimated to be 50% complete.

Task 2: Identification of computational, mechanistic, and phenomenological degradation models. Progress in this task as a whole is in the order of 10%.

Task 3: The NBI database was further refined to reduce bad (i.e., erroneous or meaningless) data that would disturb the training of the artificial intelligence models. Identification of parameters that influence the deterioration of the bridge decks was completed through statistical analyses. These parameters were used to develop and train a multi-layer-perceptron (MLP) artificial neural network (ANN). Degradation curves, which graphically represent the predicted deterioration of a bridge deck, were developed using the best performing MLP model. Degradation models using ensembles of neural networks have been preliminarily developed. As expected, these models are performing better than the single MLP models. Progress in this task as a whole is in the order of 50%.

The PI has dedicated his time in guiding and supervising the graduate students in the above mentioned tasks. The graduate students have been performing assigned tasks and summarizing findings in weekly reports. These reports will become part of the final report for the project.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Task 1: Continue the assessment of the deterioration mechanisms in RC bridge decks through literature review and evaluation of MDOT inspection and maintenance databases.

Task 2: Identify suitable computational models for the simulation of RC deck degradation.

Task 3: Initiate the development of degradation models based on ensembles of neural networks.

Task 4: Implement concepts of life-cycle-cost analysis and asset management to develop a systems-level approach for the management of maintenance interventions on bridge decks.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Educating the Public to Negotiate Roundabouts

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Kimberly Lariviere

CONTRACT/AUTHORIZATION NO.	2009-0748 / Z1	PROJECT START DATE	11/02/2009
PROJECT NO.	107465	COMPLETION DATE (Original)	03/31/2011
ORBP NO.	OR09-098	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Wayne State University		
PRINCIPAL INVESTIGATOR	Dr. Peter Savolainen		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$146,293.00	TOTAL COST	(Original)*	$199,649.43
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$62,265.74
SALARIES			% PERCENT COMPLETE (By Budget)		31%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		30%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$137,383.69
TOTAL FY 2010 EXPENDITURES		$62,265.74			

PURPOSE AND SCOPE

While modern roundabouts are a safe and cost-effective speed-control device for intersections, they are relatively new to U.S. drivers. Because of their relative novelty, many drivers may have limited or no knowledge of how to effectively navigate a roundabout. Educational efforts prior to and after the opening of a roundabout can help the public in making safe and effective use of roundabouts.

Through the application of research findings and feedback from users of Michigan's roundabouts, MDOT will develop pilot educational/marketing strategies to educate the public on the use of roundabouts. After initial testing of the recommended educational/marketing strategy, an implementation plan will be used to encourage effective statewide use of the educational materials.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Survey of public opinion and knowledge of roundabouts has been completed. Crash data analysis has been completed indicating patterns and trends related to the crashes for use in the development of handouts and web page information. Draft handouts have been developed and distributed to the research advisory panel for comments. Video of the selected roundabouts was completed.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Results of the survey will be included in the final report. Finalization of the handouts, materials for inclusion on the Web page, available for handout at public hearings, development of animated informational spots (20 or 30 seconds in length) will be showing different roundabout behaviors both good and bad, if bad is shown, the correct way to drive will be shown also. Development of videos to be shown on Web page.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Extending Life of Asphalt Pavements

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Adnan Iftikhar

CONTRACT/AUTHORIZATION NO.	2009-0670 / Z1	PROJECT START DATE	10/07/2009
PROJECT NO.	107468	COMPLETION DATE (Original)	09/30/2010
ORBP NO.	OR09-086	COMPLETION DATE (Revised)	12/31/2010
RESEARCH AGENCY	Applied Research Associates, Inc.		
PRINCIPAL INVESTIGATOR	Harold L. Von Quintus, P.E.		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$147,008.49	TOTAL COST	(Original)*	$147,008.49
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$41,828.28
SALARIES			% PERCENT COMPLETE (By Budget)		28%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		45%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$105,180.21
TOTAL FY 2010 EXPENDITURES		$41,828.28			

PURPOSE AND SCOPE

MDOT needs to identify pavements that are exceptionally well or poor performers. Identify the factors that are responsible, and recommend future design and maintenance and rehabilitation (MR) activities to reflect these findings.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Tasks 1a, b. Conduct literature review and prepare and submit literature review report.

Tasks 2a. Determine Michigan Department of Transportation (MDOT) performance characteristics of Hot Mix Asphalt (HMA) pavements.

2b. Identify pavement segments with premature aging & extended life.
2c. Contact and interview MDOT and contractor personnel.
2d. Determine reasons for premature aging and extended service life.
2e. Prepare interim task report to document segment performance.

Task 3. Identify and recommend mitigation strategies, 85 % complete.

Task 4. Prepare and submit recommendations for implementation, 60 % complete.

Task 5. Proposal for pilot projects and material testing, 50 % complete.

Task 6. Reports, project documentation, and other deliverables, 25 % complete.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Complete remainder of Tasks 3, 4, 5, 6 by December 1, 2010.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

A 3-month No-Cost Time Extension was awarded to this project effective October 1, 2010.

Reason for No-Cost Time Extension provided by the principal investigator: Data analysis was started later than expected, data provided separately took longer to review than originally envisioned, analysis of the performance data took more time than anticipated, it took more time to identify reasons for the premature distress on some of the preventative maintenance (PM) segments and exceptional performance on other PM segments as a results of some of the anomalies. Analysis of the data is taking longer than expected and is required to produce a meaningful final report.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Strategies for Improving Traveler Information

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Jason Firman

CONTRACT/AUTHORIZATION NO.	2009-0669 / Z1	PROJECT START DATE	12/18/2009
PROJECT NO.	107472	COMPLETION DATE (Original)	09/30/2010
ORBP NO.	OR09-090	COMPLETION DATE (Revised)	01/31/2011
RESEARCH AGENCY	Cambridge Systematics, Inc.		
PRINCIPAL INVESTIGATOR	Christopher Hedden		

BUDGET STATUS

FY 2010 Budget				Total Budget		
FY FUNDS	(Original)****	$173,662.00		TOTAL COST	(Original)*	$173,662.00
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$147,612.70
SALARIES				% PERCENT COMPLETE (By Budget)		85%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		85%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$26,049.30
TOTAL FY 2010 EXPENDITURES		$147,612.70				

PURPOSE AND SCOPE

This study will investigate traveler communication formats not currently in use by MDOT to identify those that are most effective with travelers, looking at both performance and cost. By embracing new technologies and practices, MDOT may be able to save significant time and money for the state and for travelers throughout Michigan.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Cambridge Systematic, Inc., performed a literature review of the initial information provided by MDOT and conducted their own search for additional material. This was used to serve as a reference guide to aid further research by this team and identify several critical guidelines and what gaps of knowledge exist with advanced traveler information systems.

A survey of the general public was performed to identify their requirements and preferences for traveler information. This survey provided a better understanding of how the public uses, understands and value traveler information. This will help MDOT understand how it can leverage stakeholders' goodwill, address current and future user needs and further enhance traveler information services.

Another survey was conducted of other state's department of transportation with regard to their real-time traveler information practices and the advantages and disadvantages of the approaches employed, evaluate existing systems, and judge these systems for applicability to Michigan.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Recommendations will be provided as to the most promising traveler communication formats based on the results of the previous surveys and literature review. This will include system and infrastructure requirements.

An estimate cost and benefit will be provided to show cost of development, deployment, operation and maintenance of an advance traveler information system.

A final report will include the study format and findings as well as recommendations for implementing the results in Michigan.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

Contract was executed December 18, 2009; however, vendor's original work plans start date was October 1, 2009. Due to holidays and winter season, MDOT and vendor calendar conflicts postponed schedule project kick-off meeting to January 20, 2010. This extension provides adequate time for MDOT's technical feedback of the final report.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Alternative Materials for Sustainable Transportation

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Nathan Maack

CONTRACT/AUTHORIZATION NO.	2009-0750 / Z1	PROJECT START DATE	11/13/2009
PROJECT NO.	107473	COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-152	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Michigan Technological University		
PRINCIPAL INVESTIGATOR	Dr. Zhangping You		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$172,936.46	TOTAL COST	(Original)*	$299,960.16
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$90,983.40
SALARIES			% PERCENT COMPLETE (By Budget)		30%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		30%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$208,976.76
TOTAL FY 2010 EXPENDITURES		$90,983.40			

PURPOSE AND SCOPE

Across the country planners, policy makers and engineers are increasingly considering the use of alternative materials to promote sustainable development. With the increase of crude oil prices asphalt producers have shifted production of asphalt to other oil products, creating a shortage of asphalt. This shortage of asphalt, along with a shortage of polymers, motivates engineers to utilize alternative pavement materials.

Bio oil produced from biomass waste from the forest products industry and waste tires are two sustainable alternatives. Bio oil can be used as an asphalt binder that replaces asphalt binder made from crude oil. Bio oil is a sustainable and renewable resource and reduces the use of finite petroleum resources. Bio oil can also be used as a polymer added to the asphalt binder. The use of bio oil as a polymer has shown to retard the aging of asphalt pavements which prolongs the life of the pavement. Waste tires can be used as an asphalt binder and modifiers that solve problems such as rutting and moisture damage. Using waste tires for this purpose will reduce the amount of waste going to landfills, reduce the use of petroleum binders and increase the life of asphalt pavements.

This research will provide the MDOT with short-term and long-term solutions for alternative materials, a technical report, related technical publications, educational materials on the alternative materials and samples of the alternative materials.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Completed the literature review. Based on the literature review an experimental plan was developed. The research team collected woodchips for bio oil production and shipped the samples to Iowa State University (ISU) for processing into bio oil. The research team prepared control asphalt binder to mimic the properties found in typical MDOT Hot Mix Asphalt (HMA) mixes. The team started testing the asphalt binder that will be blended with bio oil to get the starting binder properties.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Have bio oil and tire oil samples prepared as soon as the signing of the ISU subcontract is complete. Test the bio oil, tire oil and three bio oil-asphalt binder blends for six common binder properties. Mix up various HMA mixtures and test for dynamic modulus, rutting using the APA machine, IDT Tensile Strength Ratio and Flow number. Determine the carbon footprint for the production of bio oil and tire oil. Prepare the final report.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Sustainable Recycled Materials for Concrete Pavements

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: John Belcher

CONTRACT/AUTHORIZATION NO.	2009-0663 / Z1		PROJECT START DATE	10/01/2009
PROJECT NO.	107476		COMPLETION DATE (Original)	03/31/2011
ORBP NO.	OR09-154		COMPLETION DATE (Revised)	
RESEARCH AGENCY	Applied Pavement Technology			
PRINCIPAL INVESTIGATOR	Dr. Thomas Van Dam			

BUDGET STATUS

FY 2010 Budget				**Total Budget**		
FY FUNDS	(Original)****	$99,984.00		TOTAL COST	(Original)*	$149,978.00
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$90,943.17
SALARIES				% PERCENT COMPLETE (By Budget)		61%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		60%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$59,034.83
TOTAL FY 2010 EXPENDITURES		$90,943.17				

PURPOSE AND SCOPE

MDOT has used industrial by-products such as fly ash and foundry slag in the construction of Portland Cement Concrete (PCC) pavements. Research by MDOT and others has shown some environmental and performance benefits of these materials under certain conditions. However the department has not examined in a systematic way the comparative benefits and costs of using industrial by-products and other recycled materials in PCC pavement construction in the state of Michigan. A study is needed to provide objective data with which to make policy and specification decisions.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Task 1 (Study Approach), Task 2 (Records Review), and a large majority of Task 3 (Data Collection) have been completed. A portion of Task 4 (Analysis) has been started with a base line Life Cycle Cost Analysis (LCCA) and Life Cycle Assessment (LCA).

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Completion of Task 3 (Data Collection), Task 4 (Analysis), and Task 5 (Final Report) by 03/31/2011. The principal investigator (PI) will deliver an executive summary and article for ORBP newsletter in addition to the final report by 3/31/2011.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

PI will deliver a project implementation plan upon project completion.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: The Effect of Work Zone Steady Burn Warning Lights on Motorist Safety

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Brian Zimmerman/Jason Gutting

CONTRACT/AUTHORIZATION NO.	2009-0748 / Z2	PROJECT START DATE	11/02/2009
PROJECT NO.	108344	COMPLETION DATE (Original)	11/01/2010
ORBP NO.	OR09-159	COMPLETION DATE (Revised)	12/01/2010
RESEARCH AGENCY	Wayne State University		
PRINCIPAL INVESTIGATOR	Dr. Tapan Datta		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$200,000.84	TOTAL COST	(Original)*	$200,000.84
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$148,860.80
SALARIES			% PERCENT COMPLETE (By Budget)		74%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		70%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$51,138.04
TOTAL FY 2010 EXPENDITURES		$148,860.80			

PURPOSE AND SCOPE

MDOT has removed all lights from drums in work zones, effective with the August 6, 2009 letting. Research is requested to determine if the removal of lights will show an impact on the motorist's ability to safely drive through a work zone.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The project started on November 2, 2009, and the kickoff meeting was conducted on November 20, 2009. The activities completed as a part of this project during Fiscal Year 2010 are described below:

Task 1: Literature Review
A detailed state-of-the-art literature review has been completed. All relevant research literature has been identified and each document has been critically reviewed and summarized as a part of this task. The scope of the literature review was expanded to include a greater emphasis on a few additional topics, including research related to older drivers and driver preview distance and time requirement.

Task 2: Current Practices Survey and Benchmark Review
A questionnaire survey was created and sent to MDOT for review in order to assess the use and application of channelizing drums with and without steady-burn warning lights in highway work zones throughout the United States. Upon MDOT review and approval, the survey was sent to all state DOTs and follow-up telephone calls have been made to all state DOTs. The survey responses have been entered and summarized upon receipt. Responses were received from 41 states and have been analyzed.

Task 3: Investigate Crash Trends in Michigan and Other States
Work zone locations, both with and without steady-burn warning lights, were identified with the assistance of MDOT. These work sites were aggregated based on the presence or absence of warning lights and other factors for use in the subsequent crash analysis. Individual UD-10 crash report forms were examined in order to determine which of these crashes are, in fact, related to the work zone drums. Aggregate level data has also been collected from various other states regarding total and work zone related crashes where available, as well as vehicle miles traveled and population data.

Task 4: Field Experiment of Driver Behavior
Field studies have been conducted at various work zone locations with and without steady-burn warning lights. These studies involved the collection of data regarding the condition of the drums/lights and an examination of driver behavior in the work zone environment. Speed data were also collected at a sample of freeway work zones. Approximately 1,300 test vehicle passes through several MDOT work zones have been performed. The field studies were completed during this reporting period and all data has been compiled and analyzed to determine the impacts of steady burn warning lights on drums as they relate to driver behavior and performance.

Task 5: Determine the Impact of the Elimination of Lights on Drums
Based on a synthesis of the results from each of the evaluations, a determination will be made as to the impacts of the elimination of lights on drums. This information is being included in the final report.

Task 6: Conduct a Benefit-Cost Analysis
An economic analysis has been performed. The procedures and results will be included in the final report.

Task 7: Field Experiment of Work Zone Luminance
A luminance measurement study under the controlled environment scenario has been performed for drums with and without steady burn warning lights. In-field studies of luminance have also been completed for a number of work zones to evaluate the adequacy of quantity of luminance the drivers see in nighttime driving.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

The proposed activities for Fiscal Year 2011 are as follows:

Task 8: Prepare Quarterly and Final Project Reports
The draft final report will be completed and submitted to MDOT for review in mid-October 2010. Following internal review by MDOT, a final report will be submitted by December 2010. In addition to the final report, an executive summary and a one-page article for the ORBP newsletter will be prepared as a part of this task.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

The project start date was delayed from October 1 to November 2, 2009, and the project kickoff meeting was held on November 20, 2009. Due to these facts and the internal processing time within the university, the Wayne State University account was also not set up on time, delaying the ability to charge time to the project. In addition, the project scope was expanded after consultation with the Chief Operations Officer, Greg Johnson. This was a no-cost extension of time to account for numerous industry concerns on the research. The project end date was extended to December 1, 2010, and approved on September 15, 2010.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Recommendations will be included in the final report.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

ORBP OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Backcalculation of Resilient Modulus Values for Unbound Pavement Materials

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Mike Eacker

CONTRACT/AUTHORIZATION NO.	2006-0411 / Z15	PROJECT START DATE	11/19/2008
PROJECT NO.	108471	COMPLETION DATE (Original)	09/30/2010
ORBP NO.	OR09-127	COMPLETION DATE (Revised)	12/31/2010
RESEARCH AGENCY	Michigan State University		
PRINCIPAL INVESTIGATOR	Dr. Gilbert Baladi		

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$104,081.45	TOTAL COST	(Original)*	$157,746.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$149,185.07
SALARIES			% PERCENT COMPLETE (By Budget)		85%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		90%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$8,560.93
TOTAL FY 2010 EXPENDITURES		$95,520.52			

PURPOSE AND SCOPE

The purpose of this project is to characterize the resilient moduli of granular base and sub-base materials utilized in MDOT pavement projects. This will be done in the context of how modulus values are used in the existing 1993 American Association of State Highway and Transportation Officials pavement design method, and the new Mechanistic-Empirical pavement design method. The result will be recommended modulus values to use in either pavement design method for the both the base and sub-base layers. This will be accomplished through the following tasks:

- Gather information on typical base and sub-base materials used in MDOT pavement projects.
- Backcalculation of modulus values from the existing database of falling weight deflectometer testing conducted by the MDOT.
- Recommendation of modulus values to use in the two design methods for each of the types of bases (dense-graded, open-graded, and stabilized), and sub-bases.
- Provide a table of typical ranges of modulus values for materials from different sources and different material types (gravel, limestone, etc.).

Report the results.

FISCAL YEAR 2009 ACCOMPLISHMENTS

A list of all falling weight deflectometer test locations was generated and provided to the Michigan DOT project manager. Project level material information was investigated jointly by Michigan DOT and the university research team. Backcalculation of the layer moduli utilizing most of the falling weight deflectometer test data has been completed. Several backcalculation programs were used with the one giving the most accurate results to be used for the final recommendations.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Backcalculation was completed and results analyzed to characterize the various material types used for aggregate base. Coordinated with the MDOT project manager to find out what material type was used under the pavement projects that were being backcalculated. Reviewed results of the Michigan Technological University study, “Resilient Modulus at the Limits of Gradation and Varying Degrees of Saturation” to see how they compare to results of this study. Began writing the draft final report.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Deliver the draft final report and revise based on comments from MDOT.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

ORBP OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Laboratory Evaluation of Warm Mix Asphalt

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: John Barak

CONTRACT/AUTHORIZATION NO.	2006-0414 / Z21	PROJECT START DATE	11/03/2008
PROJECT NO.	108476	COMPLETION DATE (Original)	12/31/2010
ORBP NO.	OR09-134	COMPLETION DATE (Revised)	09/30/2011
RESEARCH AGENCY	Michigan Technological University		
PRINCIPAL INVESTIGATOR	Dr. Zhanping You		

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$93,317.38	TOTAL COST	(Original)*	$190,001.08
	(Revised)*****	$95,219.44		(Revised)**	
			FUNDS EXPENDED TO DATE***		$95,219.44
SALARIES			% PERCENT COMPLETE (By Budget)		50%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		50%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$94,781.64
TOTAL FY 2010 EXPENDITURES		$95,219.44			

PURPOSE AND SCOPE

The scope of this study includes the following: 1) Review and synthesize information on the available warm mix asphalt (WMA) technologies; 2) Measure the complex/dynamic modulus of WMA (made with Aspha-min and Sasobit) and the control mixtures of hot mix asphalt for comparison purposes and for use in mechanistic-empirical design comparison; 3) Assess the rutting and fatigue potential of WMA mixtures; and 4) The overall purpose of the study is to provide recommendations for the proper WMA usage in Michigan considering the aggregate, binder, and climatic factors.

FISCAL YEAR 2009 ACCOMPLISHMENTS

The research team reviewed the current progress in WMA technology. The research team has built very good relationships with the asphalt paving industry to further improve the asphalt pavement technology. Some lab testing has been planned and tested such as the dynamic moduli and resilient moduli of WMA made with Aspha-min. The research team further tested the flow number and rutting resistance of the WMA made with Aspha-min. Other new WMA samples are under preparation and shall be tested fiscal year (FY) 2009. Michigan Technological University provided the research team some cost share funds, therefore MDOT funds have not been used in the third quarter of FY 2009. Starting in third quarter of FY 2009, MDOT funds have been used to test asphalt pavement analyzer rutting potential of WMA. The research team started to prepare a brief report on the work performed for the MDOT review.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The research team completed Task 2 “Development of Detailed Laboratory Testing Plan” and Task 3 “Materials Collection.” Also progress was made on Task 4 “Laboratory Testing” and Task 5 “Analysis of Test Results”. About 65% of the dynamic moduli E* performance test of WMA samples have been completed.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

For FY 2011, the laboratory testing and analysis of the results will be completed. The final report will be prepared and delivered. The report will describe the efforts undertaken to carry out the study and the recommendations regarding the feasibility of using WMA in Michigan.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

Authorization & Revision No. 2006-0414/Z21/R1, Date Executed 8/18/2010: In the above mentioned project, the principal investigator (PI) planned to purchase a piece of minor equipment (pressure distribution analyzer for WMA compactibility study) to conduct tasks in this project. However, the budget for this equipment was misaligned in year three of the project. Michigan Tech policy prohibits the research team from purchasing such equipment until year three. Therefore, the acquisition of this equipment has been delayed.

In December 2009, the PI discussed this issue with MDOT/ORBP and the project manager. The PI has reported the resources targeted for Tasks 2 & 4 in year one in the original proposal and the budget could not be expended due to the lack of the pressure distribution analyzer.

Based upon the discussion with MDOT, a solution is to correct the misaligned budget to the correct year so that the project will not be further delayed. The budget modification includes some shift of year three funding with year two funding. The unused funds, due

to the lack of the pressure distribution analyzer, are shifted to year two so that the project is not delayed further.
Due to this delay, tasks 2 and 4 have been significantly delayed. Therefore a no cost extension is requested at the same time as when the correction is made.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: ECR Bridge Decks: Damage Detection and Assessment of Remaining Service Life for Various Overlay Repair Options

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Kahl

CONTRACT/AUTHORIZATION NO.	2002-0532 / Z19	PROJECT START DATE	09/29/2006
PROJECT NO.	108479	COMPLETION DATE (Original)	03/29/2009
ORBP NO.	OR06-028	COMPLETION DATE (Revised)	06/30/2010
RESEARCH AGENCY	Michigan State University		
PRINCIPAL INVESTIGATOR	Dr. Ron Harichandran		

BUDGET STATUS

FY 2010 Budget			**Total Budget**		
FY FUNDS	(Original)****	$100,421.44	TOTAL COST	(Original)*	$334,908.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$332,075.46
SALARIES			% PERCENT COMPLETE (By Budget)		100%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		Project closed
TOTAL FY 2010 EXPENDITURES		$97,588.90			

PURPOSE AND SCOPE

The main objective of the proposed research is to improve understanding of the degradation and failure mechanisms and improve the determination of repair strategies for epoxy coated reinforced (ECR) concrete bridge decks without overlays, as well as those repaired with shallow and deep overlays. Achieving this objective requires two distinct issues to be addressed. First, the condition of ECR decks with and without overlay repairs needs to be assessed. Second, the remaining service life and failure mechanisms of ECR decks with and without overlay repairs need to be determined. This knowledge should then be integrated to define appropriate repair strategies for ECR decks. The project includes the following tasks:

1. *Concrete Deck Surface Damage Detection*: To develop a technique for enhancing the existing chain-drag damage detection method by using directional microphones and real-time signal processing. Several microphone arrays and signal processing techniques will be used to analyze data collected both in the field and in the laboratory. Existing bridge decks will be selected and scanned with the detection method to improve on the algorithm developed from laboratory work.

2. *Service Life and Failure Mode Determination*: To determine the service-life performance and failure modes of ECR concrete decks with and without repair overlays. Service-loads will be applied through *combined* cyclic mechanical loads and freeze/thaw cycling on small scale prisms featuring different degrees of surface damage and repair options.

3. *Linking Damage Detection Diagnostics to Service Life and Failure Mode*: To correlate damage detection measurements and the known condition and performance of deteriorated/repaired laboratory samples, and thereby to verify the damage detection method and improve repair recommendations. This will be done by using the damaged/repaired small scale prisms cast within large-scale concrete slabs.

4. *Recommendations*: To provide recommendations for updates to the *Bridge Deck Preservation Repair Matrix* applicable to ECR concrete decks.

5. *Final Reporting*: To prepare the final report documenting all findings and recommendations.

FISCAL YEAR 2008 ACCOMPLISHMENTS

An automated bar tapping device was developed and fabricated. Recording and signal processing methods were customized for this device. A second set of specimens to replace the poor specimens prepared in FY 2007 were cast and subjected to freeze-thaw tests. These specimens survived 300 cycles of freeze-thaw and were subjected to accelerated corrosion. A loading fixture to test three specimens simultaneously under fatigue loaded was designed and fabricated. A chamber capable of subjecting specimes to freeze-thaw while they were being cyclically loaded was built.

FISCAL YEAR 2009 ACCOMPLISHMENTS

Software has been written to directly acquire acoustic signals from microphones, process them, and perform damage identification. Field testing of two bridges was performed in September 2009 and produced very good results. The damage detection algorithm is robust and accurate.

Pre-aged specimens were damaged and repaired. With MDOT approval, the originally proposed repair schemes had to be revised based on the type of damage observed in specimens. Specimens are being exposed to combined mechanical, freeze-thaw, and

corrosion loading to assess service life. About 50% of the specimens have been subjected to the combined loading.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The development of the Automated Impact-based Delamination Detection (AIDD) System was completed. The AIDD system consists of a hardware device and accompanying software. The hardware creates acoustic signals from impacts that are recorded by microphones and then processed by the software. The software consists of noise cancelation and classification based on neural network training from previous records. The system was tested in the laboratory and in the field and gave good results. The prototype system was demonstrated to the project manager and other personnel and will be delivered to MDOT.

Following exposure to combined mechanical, freeze-thaw, and corrosion testing, concrete prism specimens with black steel and epoxy coated steel were scanned using X-ray computed tomography. These scans showed the internal cracking generated primarily by corrosion. Damage to each specimen was quantified using the impressed corrosion charge as well as the volume of cracks along four cross sectional slices. The results indicated that in general, epoxy coated steel corroded at a rate that was 2.5-4 times longer compared to black steel. The service life estimate of 60+ years for epoxy coated bridge decks was obtained by conservatively scaling the repair matrix for black steel by 2.5.

The draft report related to the project was submitted to the project manager in two parts. The final report will be finalized when comments on the reports are received.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

Several complications resulted in the requirement for a no-cost extension. The concrete delivered by the ready-mix company for one set of specimens was poor and the specimens had to be recast and freeze-thaw testing had to be redone. It was difficult to schedule field testing of a delaminated bridge deck and the field testing was only completed in September 2009. The time required to induce corrosion damage was significantly longer than anticipated for ECR specimens. It will take about 9 more months to subject all specimens to combined mechanical, freeze-thaw, and corrosion loading. A no-cost extension is required until June 30, 2010, to complete the tests.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

MDOT will be furnished with a pilot automated tapping device/cart that includes microphones and software for processing the signals and performing damage identification. MDOT will need to find a manufacturer to build additional tapping devices/carts for widespread use in bridge deck delamination detection. Having such devices widely available will enable MDOT personnel to sound bridge decks faster and with better accuracy.

Based on the combined mechanical, freeze-thaw, and corrosion testing of ECR and black steel reinforced specimens, revised maintenance schedules and repair procedures will be recommended for use by MDOT for ECR bridge decks. The MDOT bridge committee revised the estimated service life for epoxy coated bridge decks to 60+ years, based on the results of this research, as well as results of an internal performance study.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Impact of Hydrated Cement Paste Quality and Entrained Air-Void System

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: John Staton

CONTRACT/AUTHORIZATION NO.	2006-0414 / Z10	PROJECT START DATE	07/31/2007
PROJECT NO.	108484	COMPLETION DATE (Original)	07/31/2010
ORBP NO.	OR07-016	COMPLETION DATE (Revised)	12/31/2010
RESEARCH AGENCY	Michigan Technological University		
PRINCIPAL INVESTIGATOR	Dr. Larry Sutter		

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$104,869.89	TOTAL COST	(Original)*	$304,826.44
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$279,609.51
SALARIES			% PERCENT COMPLETE (By Budget)		91%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		80%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$25,216.93
TOTAL FY 2010 EXPENDITURES		$79,483.40			

PURPOSE AND SCOPE

The purpose of this study will be to evaluate whether current recognized air-paste parameters for durability are still valid in terms of today's cements and additives. This study will use a rigorous statistically-based experiment to establish a relationship between F-T durability and the characteristics of the hydrated cement paste and air-void system. The scope of this study will focus toward evaluating different cement types, SCMs, and AEAs that would typically be used in Michigan highway concrete mixtures.

FISCAL YEAR 2008 ACCOMPLISHMENTS

- Equipment and Materials Procurement
- Literature Review
- Refine experimental design
- Begin preparing concrete mixtures
- Begin testing

FISCAL YEAR 2009 ACCOMPLISHMENTS

Complete Phase I testing and draft report. Research results to date presented to MDOT personnel in September 2009.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Continued performing tests on the hardened concrete from Phase III. After its completion of Phase III testing in fall 2010, the draft final report writing will commence.

MTU has requested a two month no-cost extension on this project. The reasons for the no-cost extension include:
1) During this year there have been a number of breakdowns of the freeze-thaw test chamber. The testing done with the freeze-thaw test chamber is typically on the order of six weeks per group of samples. Not all samples can be tested at once (i.e. the machine holds 40 and we are testing significantly more than 40). Therefore, as the machine breaks down, testing gets pushed back accordingly.

2) There has been a change of personnel on the project. Dr. Karl Peterson left Michigan Technological University in October, and it is anticipated that this will cause a disruption that will further delay completion of the final report.

The breakdown of the freeze-thaw chamber, which was the primary cause of the delay, occurred at the beginning of Phase II, Task 2 (in April 2010). Task 2 could not be started until the freeze-thaw machine was operable and the down time was six weeks. There were other minor delays associated with the freeze-thaw testing, such as the machine icing up and requiring to be thawed, and these added 1-2 day delays sporadically, but the primary delay occurred at the start of Task 2. Regarding the change of personnel, although Karl Peterson was co-PI, he was the individual that would write the first draft that Dr. Sutter would subsequently final edit and submit. With his departure, Dr. Sutter will be doing the entire report and that will simply require more time on his part.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

A preliminary (abbreviated) draft final report was recently received. The MDOT project manager (PM) will begin reviewing this document in anticipation of the official draft final report, which is expected by the end of December 2010. Reviewing and editing of the draft final report will proceed with anticipated acceptance of the final report by the end of February 2011.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))
PM anticipates a no cost time extension (2 months) will be required to complete reviews of the draft/final reports.
SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Health Monitoring and Evaluation of Rapid Bridge Deck Technique

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Kahl

CONTRACT/AUTHORIZATION NO.	2004-0090 / Z3R1		PROJECT START DATE	11/30/2005
PROJECT NO.	108485		COMPLETION DATE (Original)	11/20/2008
ORBP NO.	OR06-021		COMPLETION DATE (Revised)	01/31/2010
RESEARCH AGENCY	Western Michigan University			
PRINCIPAL INVESTIGATOR	Dr. Osama Abudayyeh			

BUDGET STATUS

FY 2010 Budget				**Total Budget**		
FY FUNDS	(Original)****	$11,474.49		TOTAL COST	(Original)*	$224,522.00
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$224,516.78
SALARIES				% PERCENT COMPLETE (By Budget)		100%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		Project closed
TOTAL FY 2010 EXPENDITURES		$11,469.27				

PURPOSE AND SCOPE

Bridge deck with full depth precast panels is an innovative technique for replacement, which is expected to save construction time. However, this technique needs to be evaluated and performance of the bridge needs to be monitored. This research proposal focuses on the constructability and performance of the rapid bridge replacement technique using full depth precast deck panels at Parkview Bridge in Kalamazoo, MI. The research will cover three phases:

Phase I – Design and Instrumentation Selection
In this phase, the selection of sensors, instrumentation locations, and parameters to include in the study will be accomplished. To achieve this, the research team will:

1. Perform a comprehensive literature search to identify the state-of-the-art instrumentation that can be used for bridge health monitoring;
2. Work closely with MDOT bridge designers to select locations of the instrumentation as well as monitoring parameters; and
3. Develop the specifications and guidelines for the selected instrumentation for the construction phase.

Phase II –Construction and Implementation
1. Instrumentation and material testing: In this task, the research team will work closely with the precast producer and with MDOT personnel to install, during fabrication, all the necessary sensors needed for monitoring the precast panels. In addition, testing of the construction materials will be conducted by MDOT. Additional material testing such as modulus of elasticity of concrete and stress-strain relationship of reinforcing steel will be conducted by WMU. This testing is for research purposes to assist in the evaluation of the bridge performance during the monitoring phase. This testing will not be part of the contract administration of the Parkview bridge construction.

2. Productivity analysis: To assess the effectiveness of the rapid bridge construction technique, the research team will evaluate the Parkview bridge construction schedule and compare it to standard bridge construction methods. The outcome of this investigation is an assessment of the improvement achieved using the rapid bridge construction method. A detailed CPM (critical path method) construction schedule of the Parkview Bridge will be developed and compared to construction schedule of a bridge of similar geometry and location. A detailed time analysis will be performed to evaluate the time savings associated with the innovative technique for rapid bridge deck replacement as compared to conventional bridge construction techniques.

3. Inspection of the bridge deck before opening to traffic: Visual inspection of the bridge deck will be conducted before opening the bridge to traffic. This task will document any sign of cracking, spalling, accidental damage, and other deck surface damage will be conducted.

Phase III – 1-Year Health Monitoring and Inspection
1. Continuous monitoring: In this task, continuous monitoring of the bridge deck precast panels under traffic load will be conducted. Structural behavior, durability, and issues related to the environment are usually examined during the health monitoring of bridges. Parameters such as, displacement, strain in concrete or steel, temperature, forces and vibration will be measured to determine their effects on the structural performance of the precast panels. Several environmental parameters such as air temperature, average daily humidity, and wind average speed, and durability parameters such as corrosion potential, the depth of carbonation, and the chloride

concentration profile in the cover depth will be measured and evaluated. WMU will collect and analyze the bridge health monitoring data for the first year after opening to traffic and will turn over the task to MDOT for subsequent continuous monitoring.

2. Inspection of the bridge deck: This task will be performed once a year. Visual inspection of the bridge deck to document any sign of cracking, spalling, leaching, deflection and vibration, accidental damage, and deck surface damage will be conducted after each winter season. The research team will coordinate with MDOT to provide the needed traffic closure, re-routing, and safe access during the yearly inspection. WMU will perform this inspection before and one year after opening to traffic. MDOT will take over the inspection task afterwards.

3. Load testing: The research team is proposing to conduct a load testing of the Parkview bridge deck before opening to traffic and at the end of the first year after opening to traffic. The applied load will be less or equal to the existing traffic load, providing a safe process with no damage or risk of collapse. This load will be consistent with the vehicular live loading (HL-93, HS20, HS25) on bridges. Several scenarios similar to that considered in the design to simulate the extreme force effect for the vehicular live load will be considered. The research team will arrange for the necessary trucks and loads for the load testing in addition to the traffic closure, and re-routing during testing. Data processing and necessary structural analysis will be conducted to identify structural characteristics of the bridge as measured in the load test.

FISCAL YEAR 2008 ACCOMPLISHMENTS

Selection of sensors, instrumentation locations, and parameters to include in the study was completed. Detailed plans, special provision, and sensors' specification were provided. In addition, a detailed CPM (critical path method) construction schedule of the Parkview Bridge was developed and compared to construction schedule of a bridge of similar geometry and location. The research team installed the sensors during construction of the deck panels at the precast producer plant in Midland, MI. After construction was completed, the bridge was load tested and the sensors data analyzed.

FISCAL YEAR 2009 ACCOMPLISHMENTS

We completed the analysis of the construction schedule to compare between conventional and rapid bridge construction techniques for the Parkview Bridge. We completed the analysis of the pre-opening load testing data. In addition, we performed a second load test on June 2, 2009, and completed the analysis of the data. So far, we have collected and analyzed sensor data for the months of December 2008 through September 2009.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Final report submitted in January 2010.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

This research project will result in (a) the development of specifications and guidelines for the selection of bridge health monitoring instrumentation, which can be readily included in MDOT construction specifications, (b) the evaluation of the construction efficiency of the proposed rapid bridge deck replacement, and (c) recommendations to MDOT regarding state-wide adaptation of the rapid bridge deck replacement technique. These results will be available to MDOT Engineers and consultants for immediate implementation. In addition, the final report will include (i) cost/benefit analysis of implementing the results, (ii) list of barriers to implementation, and (iii) proposed method of implementation.

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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

ORBP OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Effects of Debonded Strands on the Production and Performance of Prestressed Concrete Beams

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Kahl

CONTRACT/AUTHORIZATION NO.	2006-0411 / Z7	PROJECT START DATE	08/02/2007
PROJECT NO.	108486	COMPLETION DATE (Original)	08/02/2009
ORBP NO.	OR07-009	COMPLETION DATE (Revised)	08/31/2010
RESEARCH AGENCY	Michigan State University		
PRINCIPAL INVESTIGATOR	Dr. Rigoberto Burgueño		

BUDGET STATUS

FY 2010 Budget				Total Budget		
FY FUNDS	(Original)****	$68,226.73		TOTAL COST	(Original)*	$199,740.00
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$199,445.93
SALARIES				% PERCENT COMPLETE (By Budget)		99%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		Project closed
TOTAL FY 2010 EXPENDITURES		$67,932.66				

PURPOSE AND SCOPE

The objective of this project is to investigate the effects of debonded strands on the production and performance of pretensioned concrete beams through experimentally calibrated analytical models and to identify and/or develop manufacturing and design recommendations to solve any detrimental effects that this technique may cause. The objectives will be met by completing the five tasks outlined below:

Task 1: Perform a literature review and a survey of other state's recommendations and practice.

Task 2: Three-dimensional nonlinear finite element models will be developed to simulate basic bond behavior and calibrated with the experimental results.

Task 3: Study the stress state of the anchorage zones of pretensioned beams through numerical simulations using nonlinear 3D finite element models. The effect, contribution and relative importance of design/manufacturing issues will be studied.

Task 4: Identify and propose design and production recommendations that rationally take into account the effects of debonded strands and strand release patterns in pretensioned girders.

Task 5: The research project will lead to the development of manufacturing and design recommendations on the implementation of debonded strands in pretensioned girders. The recommendations will be based on sound rational understanding of the effects of debonded strands during production, transfer, and service. The knowledge gained will be of immediate value to MDOT, precast producers, and bridge engineers.

FISCAL YEAR 2008 ACCOMPLISHMENTS

Task 1: Completed. Performed a literature review and survey of other state's recommendations and practices to determine the current state of knowledge on debonded strands in production, design guidelines, and research.

Task 2, Subtask 2.2: Finite Element Models for Strand Bond Simulation. Three-dimensional finite element models to predict bond load-transfer behavior of prestressing strand in concrete beams were developed. Four models, each corresponding to the geometry and reinforcement of the experimental beams, were developed. The models were developed and analyzed using the finite element program ABAQUS. The models account for the initial bond between the strand and the concrete, the interface friction characteristics of the embedded strand, the inelastic behavior and failure of the concrete, and the sequential release sequence of the strands. The models were preliminarily assessed against code values and principles of prestressed concrete by comparing the model's prediction of transfer length. Full calibration of the models will be done after acquisition of the experimental data in Subtask 2.1. Finite element models for the pull-out tests were also developed.

Task 3: Simulation Studies on Pretensioned Anchorage Zones. Three-dimensional finite element models to study the stress state of the anchorage zone of pretensioned beams were initially developed for (1) AASHTO Type IV I-beam and (2) a 39"x48" box beam. The I-beam model is 110--2" in length and based on documented studies on the effects of strand release. The model has been preliminarily validated by comparing against published results. The box beams are 117' in length with no end skew. Only half of the beam was modeled by using symmetry.

FISCAL YEAR 2009 ACCOMPLISHMENTS

Task 2, Subtask 2.1: Experimental Investigation on Strand Bond Transfer. The investigation of bond stress transfer behavior under bonded/unbonded end conditions, release conditions and transverse (or confinement) reinforcement was initiated during this quarter. The design of the test units and test setup was finalized and all materials ordered. Casting of anchorage blocks for test setup and strand verification tests has been completed. Strand pullout test setups have been completed and the casting of test beams has been initiated.

Task 2, Subtask 2.2: Finite Element Models for Strand Bond Simulation. Models for the simulation of pullout tests were developed and evaluated with nonlinear concrete behavior. The modeling of reinforcement (confinement) in the experimental beam models has been preliminarily evaluated. The steel reinforcement is being modeled through the "smeared reinforcement" option in ABAQUS. Intial results indicate that this option adequately adds stiffness to the solid concrete elements but its ability to adequately capture nonlinear reinforced concrete behavior is under current evaluation.

Task 3: Simulation Studies on Pretensioned Anchored Zones. The 3D FE models for anchorage regions in AASHTO Type IV and Box beams continued development to obtain stable behavior. Due to the the high computational demand, the models are being run at MSU's High Performance Computer Center. The models are now in the calibration stage to introduce nonlinear material properties.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Task 2, Subtask 2.2: Further work was done on the calibration of the FE models with experimental data. Results are being used to draft findings and recommendations.

Task 3: Further work was done on the calibration of the 3D FE models for anchorage regions in Box beams using calibrated bond models were implemented.

Task 4: Recommendations and findings were drafted.

Task 5: Preparation of the final report is being finalized.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

The final report will document the primary causes leading to cracking at the ends of pretensioned beams as well as solutions to minimize or eliminate this problem. Design and production recommendations will be developed to assist design engineers as well as prestressed concrete fabricators. The report will be summarized and proposed as updates to the design manual as appropriate. It is expected that by identifying the primary causes leading to cracking at beam ends and the role of strand debonding and strand release, MDOT and the precast concrete industry will benefit by obtaining better quality and better performing structural elements as well as reducing costs incurred by repairs or unit disposals.

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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Carbon Footprint for Hot Mix Asphalt and Portland Cement Concrete Pavements

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Curtis Bleech

CONTRACT/AUTHORIZATION NO.	2006-0414 / Z22	PROJECT START DATE	03/18/2009
PROJECT NO.	108487	COMPLETION DATE (Original)	05/31/2010
ORBP NO.	OR09-135	COMPLETION DATE (Revised)	05/31/2011
RESEARCH AGENCY	Michigan Technological University		
PRINCIPAL INVESTIGATOR	Dr. Amlan Mukherjee		

BUDGET STATUS

FY 2009 Budget			**Total Budget**		
FY FUNDS	(Original)****	$131,690.31	TOTAL COST	(Original)*	$199,999.49
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$138,083.49
SALARIES			% PERCENT COMPLETE (By Budget)		69%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		70%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$61,916.00
TOTAL FY 2010 EXPENDITURES		$69,774.31			

PURPOSE AND SCOPE

This study aims to establish a carbon footprint for Hot Mix Asphalt (HMA) and Portland Cement Concrete (PCC) Pavements for reconstruction, rehabilitation and Capital Preventive Maintenance (CPM) projects. The study will consider emissions of greenhouse gases due to energy consumption and material wastage during the material acquisition and manufacturing and construction phases (primary impacts) as well as those due to maintenance during the serviceable life of the assets (secondary impacts). Carbon dioxide emissions for different design types will be determined and categorized for application to various reconstruction, rehabilitation and preventive maintenance projects.

FISCAL YEAR 2009 ACCOMPLISHMENTS

In 2009, Phase I, Data collection phase, was completed. Data was collected from ongoing pavement construction and maintenance sites. Equipment and energy use during active construction was obtained along with material wastage vs. pay quantities. All onsite data collection has been conducted and completed as scheduled. Data is being organized and prelimianry runs have occurred in order to verify that the data is sufficient to complete the analysis. The mock runs have shown that the the researchers have obtained most of the information that is required to complete the analysis.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

In fiscal year (FY) 2010 Phase II completed and Phase III continuing.

Phase II consisted of developing inventories from the collected data for HMA and PPC pavement sections and the involved construction and maintenance operations. This information was categorized and the established carbon footprints by primary and secondary impacts, life-cycle phase, by process and operations involved, and by considering the use of alternative materials such as fly ash and slag were formulated.

Phase III consisted of conducting an assessment of construction operations and methods. The possible use of alternative designs and materials was run through the model with long-term pavement performance being considered in order to identify ways of developing standards that help reduce greenhouse gas emissions during the life-cycle of HMA and PCC pavements. Data base inventory complete. Final report being drafted.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

In FY 2011, completion of the data inventory with the data being run through the analysis tool and outcomes of carbon footprint will be analyzed and reported out. Recommendations for standard green pavement construction will be made. The final report will be drafted and finalized.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

The time extension will allow for completion of data collection that couldn't fully be obtained in the 2010 construction season. There is no change is scope to the project. The additional data allows for completing data as required under the original proposal. The additional data acquisition will also enhance the quality of the research and thus aid in ensuring the validity of the methodology and findings. Approved May 18, 2010.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Efficient Use of Recycled Concrete in Transportation Infrastructure

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: John Staton

CONTRACT/AUTHORIZATION NO.	2006-0414 / Z12	PROJECT START DATE	09/10/2007
PROJECT NO.	108491	COMPLETION DATE (Original)	08/31/2009
ORBP NO.	OR07-017	COMPLETION DATE (Revised)	03/31/2010
RESEARCH AGENCY	Michigan Technological University		
PRINCIPAL INVESTIGATOR	Dr. Jacob Hiller		

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$58,526.39	TOTAL COST	(Original)*	$180,181.61
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$180,181.41
SALARIES			% PERCENT COMPLETE (By Budget)		100%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		Project closed
TOTAL FY 2010 EXPENDITURES		$58,526.19			

PURPOSE AND SCOPE

The central purpose of this study is to provide the necessary tools in efforts to minimize risks inherent in using recycled concrete aggregates (RCA) as an engineered material in the transportation industry and thus increase the use of this resource. The scope of this project will focus its efforts on literature review, laboratory studies, life-cycle cost analysis and development of a manual of practice to guide the use of RCA in transportation applications.

FISCAL YEAR 2008 ACCOMPLISHMENTS

Principal investigator (PI) change from Tom Van Dam to Jacob Hiller

New PI has initiated the literature review on the subject and outlined a plan for the laboratory study. Much of the work that has been conducted so far has included literature review of research in this area, state and international practices, and RCA project performances RCA characterzation using AASHTO T85, M43, and other methods have been conducted. Grading of the RCA has also been accomplished to fit MDOT specifications. In addition, aggregates are being characterized using helium pycnometry to assess absorption capacity and pore structure as typical methods have overestimated absorption capacity, thereby leading to poor concrete mixes. An in-depth study on volumetric stability (free, sealed, and restrained shrinkage testing) and mechanical properties of concrete made from RCA is currently underway.

FISCAL YEAR 2009 ACCOMPLISHMENTS

The laboratory investigation continues this last quarter characterizing the recycled aggregates (absorption, sp grav, gradation, etc.) and utilizing RCA in new concrete to assess free shrinkage, restrained shrinkage, compressive strength, flexural strength, rapid chloride permeability, hardened air content, as well as fresh properties. We are comparing these RCA concrete against some virgin aggregate sources (gravel and trap rock and hope to do some Presque Isle agg this summer). We will also be doing some petrographic analyses of both aggregates and RCA in new concrete this summer. We would like to add some more recycled aggregate to this laboratory study and plan to contact K&R in Grand Rapids about getting some more recycled concrete aggregates to do so.

The literature review and manual of practice are being worked on, but a behind schedule in terms of the original proposed schedule.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The first draft of the final report was submitted to MDOT by the PI. Editorial comments made by the MDOT project manager (PM) were returned to MTU in September. The first draft of the manual or practice was also submitted to MDOT for review and comment. It is currently being reviewed by the MDOT PM.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

The change of PI from T. Van Dam to J. Hiller (approved 4/22/08) as well as personnel issues have put the project behind schedule. It is anticipated at this point that the new PI will request a no-cost time extension until 12/31/09, to complete the project in full. This extension has been approved by the Ad Board.
A no-cost time extension was submitted to extend the completion date to 3/31/10, in order to conduct additional laboratory mortar bar testing as decribed in task 3 of the work plan. This request was approved by the Ad Board.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)
The manual of practice will give MDOT a look at best practices for use of recycled concrete in terms of use as supporting material as well as aggregate in new concrete. The laboratory study will also give MDOT an idea of some of the challenges that they should be aware of for implementing recyced conccrete as aggregate in new PCC, especially in terms of volumetric stability issues.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: A Critical Evaluation of Bridge Scour for Michigan Specific Conditions

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Dave Juntunen

CONTRACT/AUTHORIZATION NO.	2007-0436 / Z1	PROJECT START DATE	06/19/2007
PROJECT NO.	108493	COMPLETION DATE (Original)	06/19/2010
ORBP NO.	OR08-002	COMPLETION DATE (Revised)	02/01/2011
RESEARCH AGENCY	Lawrence Technological University		
PRINCIPAL INVESTIGATOR	Dr. Donald Carpenter		

BUDGET STATUS

FY 2010 Budget			**Total Budget**		
FY FUNDS	(Original)****	$50,953.88	TOTAL COST	(Original)*	$165,689.05
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$133,822.84
SALARIES			% PERCENT COMPLETE (By Budget)		80%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		85%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$31,866.21
TOTAL FY 2010 EXPENDITURES		$19,087.67			

PURPOSE AND SCOPE

The purpose of this research is to improve the MDOT bridge scour prediction capability. This will be accomplished by performing the following four tasks.

Task 1: An extensive literature review including existing USGS, FHWA, and ASCE reports and a detailed review of electronic databases. Other state DOTs to identify research not included in the other sources.
Task 2: Evaluate MDOT's current scour evaluation procedures.
Task 3: Review scour evaluation methods used by other states.
Task 4: Calibrate Level 2 (HEC-18) scour prediction equations for Michigan specific conditions.

FISCAL YEAR 2008 ACCOMPLISHMENTS

The following tasks were initiated and/or completed through the fourth quarter of fiscal year (FY) 2008:

- Contacted state DOTs to identify non peer reviewed publications (LTU)
- Reviewed and evaluated pre-existing engineering data for bridge scour evaluation (LTU & WSU)
- Reviewed and evaluated existing databases and database management techniques (LTU & WSU)
- Review, summarize, and critique other state DOT methodologies for scour evaluation (LTU)
- Contacted appropriate departments within each DOT for bridge scour information (LTU)
- Determined bridge scour information available through public accessible Web sites (LTU)
- Visited scour critical bridges throughout the lower peninsula of Michigan as identified through meetings with MDOT (LTU & WSU)
- Final selection of scour critical bridges across the lower peninsula for episodic monitoring (LTU & WSU)
- Final selection scour critical bridges for continuous monitoring of scour (LTU & WSU)
- Collected field data and soil samples at selected scour critical bridges (LTU&WSU)
- Collected Level 2 field data at several selected bridges (LTU&WSU)
- Installed continuous meters at the Flint River site to pilot test equipment capabilities (LTU& WSU)
- Collected continuous data at Flint River site (WSU)
- Collected episodic data at several selected scour critical bridges (LTU & WSU)
- Performed jet device testing at three appropriate selected scour critical bridges (LTU & WSU)
- Initiated geotechnical laboratory investigation of soil samples to evaluate geotechnical properties at nine sites (LTU)

FISCAL YEAR 2009 ACCOMPLISHMENTS

The following tasks were initated and/or completed through the fourth quarter of FY 2009.

- Collected Level 2 field data and low flow cross-sectional profiles at several selected bridges (LTU&WSU)
- Installed continuous monitoring equipment and collected continuous scour data at the PawPaw River, Grand River, and Flint River locations (LTU&WSU)
- Collected episodic data at six selected scour critical bridges {Grand, Flint, Rogue, Raisin, Pigeon, Thornapple, Pine, and Cass} (LTU & WSU)

- Finalized soil characterization of bed samples at all selected bridge sites to evaluate geotechnical properties of soil (LTU)
- Initiated HEC-RAS computer simulations for selected sites (WSU)
- Finalized laboratory jet test device protocols and tested several field samples for soil erodibility (LTU)
- Presented scour equation adjustement procedure at a national conference. Two other national conference publications have been submitted (LTU & WSU).
- Purchased ADCP and conducted velocity contours at selected piers (LTU & WSU)

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The following tasks were initated and/or completed through the fourth quarter of FY 2010:

- Collected continuous scour data at the PawPaw River, Grand River, and Flint River locations (LTU&WSU)
- Collected episodic data at six selected scour critical bridges {Grand, Flint, Rogue, Raisin, Pigeon, Thornapple, Pine, and Cass} (LTU & WSU)
- Collected cross-sectional profiles at all selected bridges (LTU&WSU)
- Continued HEC-RAS computer simulations for selected sites (WSU&LTU)
- Revised a draft version of the parametric evaluations of HEC-18 scour prediction equation based on the NBSD. Revisions were based on comments by MDOT TAG Team and Dr. Peggy Johnson of Penn State (WSU&LTU)
- Met with MDOT TAG for Bridge Scour Project (LTU&WSU)
- Revised Table of Contents for the final report and drafted multiple chapters (LTU & WSU)
- Provided progress reports and met with research avisory panel

FISCAL YEAR 2011 PROPOSED ACTIVITIES

- Finalize HEC-RAS computer simulations for nine (9) selected sites as necessary (WSU & LTU)
- Finalize the parametric evaluation of HEC-18 Scour Prediction Equations based on existing and, if available, project collected scour data (LTU & WSU)
- Develop a draft of the final report (LTU & WSU)
- Present project results at a Bridge Scour Technical Meeting (LTU & WSU)

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

The selection of bridge scour monitoring locations and the installation of continuous monitoring equipment took longer than anticipated. In addition, the past year has seen relatively few flood events in the state that registered any measureable sour. An additional six months would improve/increase the chances of scour data collection from established continuous and episodic monitoring locations to enrich the dataset on Michigan specific scour measurements. If additional scour data is collected, the process of HEC-18 Equation calibration could be improved.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Continue collection of episodic data and continuous scour data collection for bridges included in the project. During the time frame of the project, no major flood events occurred.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Development of New Test Procedures for Measuring Fine and Coarse Aggregate Specific Gravities

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: John Barak

CONTRACT/AUTHORIZATION NO.	2006-0414 / Z8	PROJECT START DATE	04/09/2007
PROJECT NO.	108494	COMPLETION DATE (Original)	04/09/2009
ORBP NO.	OR07-015	COMPLETION DATE (Revised)	12/31/2009
RESEARCH AGENCY	Michigan Technological University		
PRINCIPAL INVESTIGATOR	Dr. Zhanping You		

FY 2010 Budget			**Total Budget**		
FY FUNDS	(Original)****	$12,878.07	TOTAL COST	(Original)*	$181,925.24
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$181,925.24
SALARIES			% PERCENT COMPLETE (By Budget)		100%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		Project closed
TOTAL FY 2010 EXPENDITURES		$12,878.07			

PURPOSE AND SCOPE

The purpose of this study is to develop quicker methods of determining the specific gravity and absorption of fine and coarse aggregates. The scope includes two objectives. The first objective of this study is to use the SSDetect to evaluate the specific gravity and evaluate the feasibility of varying gradation of aggregate in Michigan. The second objective is to determine if vacuum saturating coarse aggregate in lieu of a 24 hour soak period for AASHTO T85 (Specific Gravity and Absorption of Coarse Aggregate) can provide similar specific gravity values.

FISCAL YEAR 2008 ACCOMPLISHMENTS

Collected more samples such as sand/gravels and limestone to evaluate the fine and coarse aggregate specific gravity and absorption. The research team tested a large number of coarse aggregates using the AASHTO T85 (Specific Gravity and Absorption of Coarse Aggregate) and the new method (modified Rice test) and compared with the vacuum saturated method. It was found that the steel slag is very porous and traditional AASHTO method is not providing good results.

FISCAL YEAR 2009 ACCOMPLISHMENTS

The research team has validated the fine aggregate for gravel and sand used in pavements. The research team has also started to collect samples to verify the steel slags and crushed concrete. The research team has successfully completed the new procedure to significantly reduce testing time for coarse aggregates on regular hot mix asphalt aggregates. The team also started to test the new samples from down state. The research team started to prepare draft report to discuss with the Michigan Department of Transportation project manager. The research team has conducted tests of some aggregates with various soaking time such as one day, two days, and seven days to verify the specific gravity of coarse aggregates. The resesarch team has completed a draft report submitted to MDOT for comments and also plan to verify a few tests in order to complete the project.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The remaining tests were completed and verified. A final report has been approved by the project manager and the final deliverables were shipped to MDOT.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

12/31/09--The researchers have found it necessary to validate the new specific gravity test procedures on highly absorptive aggregates and on materials with high specific gravities, such as steel slag so that the work is truly useful for MDOT. The sampling and testing work on these types of aggregate were delayed, and this time extension would provide sufficient time to conclude these procedures.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Introduce the proposed trial specification criteria as a potential agenda item for the Hot Mix Asphalt Technical Subcommittee. Review the implementation of the trial specification for the SSDirect method and trial vacuum saturation (modified rice) method. Determine the effectiveness of introducing these trial methods into MDOT's current mix design verification procedures. The reduction in testing time that coincides with these trial specifications could result in quicker reporting of the verification results.

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

ORBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: High Skew Link Slab Bridge System with Deck Sliding over Backwall or Backwall Sliding over Abutment

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Kahl

CONTRACT/AUTHORIZATION NO.	2006-0415 / Z3	PROJECT START DATE	11/06/2008
PROJECT NO.	108495	COMPLETION DATE (Original)	09/30/2010
ORBP NO.	OR09-136	COMPLETION DATE (Revised)	09/30/2011
RESEARCH AGENCY	Western Michigan University		
PRINCIPAL INVESTIGATOR	Dr. Haluk Aktan		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$192,060.32	TOTAL COST	(Original)*	$265,022.63
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$164,471.82
SALARIES			% PERCENT COMPLETE (By Budget)		62%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		66%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$100,550.81
TOTAL FY 2010 EXPENDITURES		$91,509.51			

PURPOSE AND SCOPE

The research assesses performance of high skew bridge structural systems with link slabs and sliding deck over backwall or backwall sliding over abutment by field assessment, instrumentation and load testing, and analytical modeling and analysis. The project will propose fine-tuning of the design assumption and design details for the design of high skew jointless bridges with link slabs. Tasks are:

1. Literature review. Special attention will be paid on the high skew jointless bridge behavior, performance, and analysis. The literature will be instrumental in identifying the design and performance issues related to the system.

2. Field investigation. Jointless bridges with skew greater than 30 degrees that may utilize the link slabs as well as the sliding deck over backwall or sliding backwall over the abutment wall will be identified and inspected.

3. Instrumentation and monitoring. A high skew link slab bridge will be instrumented for quantification of girder end rotations and translations.

4. Analytical modeling. Three dimensional refined finite element analysis models will be developed, one representing the link slab region and the other representing the abutment with the approach slab region. Geometry and configuration of FE models will represent a bridge that will be selected for field inspection.

5. Submittal of quarterly, interim, annual, and final reports. Quarterly SPR report forms will be submitted to document quarterly activities, as well as quarterly spending. Interim reports will be submitted to document the efforts of specific project phases. The first interim report will be submitted upon completing the preliminary analysis using the analytical model. The second interim report will be submitted upon the completion of field inspection. A final report will be submitted inclusive of the work performed in all of the tasks, recommendations and implementation plans.

FISCAL YEAR 2008 ACCOMPLISHMENTS

Selected key literature studies on skew bridge behavior. Studied the behavior of simple and continuous skew bridges.

FISCAL YEAR 2009 ACCOMPLISHMENTS

Modeling and analysis of simple and continuous skew bridge configurations was completed. State-of-the-art bridge deflection measurement procedures/equipments/technology were reviewed. Laser equipment for bridge deflection measurement during static load testing was selected and purchased - Laser Tracker AT901B. We learned how to use the equipment and software. The latest version of ABAQUS (v. 6.9.1) was evaluated for features that best represent the structural system behavior of high-skew link slab bridge.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Literature review included bearing selection and design for skew bridge and semi-integral abutment design details.

The non contact Laser Tracker deformation measurement system was calibrated through field assessment of laser measurements on a calibrated beam in the field. The specific bridge for instrumentation and monitoring was identified.

Analytical modeling task activities included numerical simulations of selected high-skew bridge and verification against analytically

simulated load test data, and development of design recommendations and implementations for link-slabs.

Modeling parameters of high skew semi-integral abutments including approach and sleeper slab has been completed and numerical simulation of various cases is being performed.

Numerical simulation of high skew bridge that is selected for load testing is being modeled.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Continue with literature review.

Perform detailed inspection of S12 of 03035 and S08 0f 03035, with 39 and 42 degree skew respectively.

Perform baseline field measurements of high-skew single span bridge (S12 of 03035) and deflections under rating truck load.

Complete finite element modeling and analysis of skew spans at various skew angles and with boundary conditions. Continue with the finite element analysis of semi-integral abutment and approach slab assemblages.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

The anticipated product of this research is recommendations on refinement and modifications or clarifications to the current design procedures for link slab, sliding deck over backwall, backwall sliding over abutment (semi-integral), wing-walls, and bearings of bridges with skew > 30 degrees. The expected outcome will be design detail standard plans of the high-skew link slab and the high skew abutment region for inclusion in the MDOT Bridge Design Manual upon review and adoption by the Bridge Committee.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Infrastructure Monitoring Data Management

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Cook

CONTRACT/AUTHORIZATION NO.	2009-0642 / Z1	PROJECT START DATE	10/01/2009
PROJECT NO.	108501	COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-148	COMPLETION DATE (Revised)	05/01/2012
RESEARCH AGENCY	Alfred Benesch and Company		
PRINCIPAL INVESTIGATOR	Ihab Darwish		

BUDGET STATUS

FY 2010 Budget			**Total Budget**		
FY FUNDS	(Original)****	Milestone Payments	TOTAL COST	(Original)*	$215,422.36
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$0.00
SALARIES			% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		15%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$215,422.36
TOTAL FY 2010 EXPENDITURES		$0.00			

PURPOSE AND SCOPE

To evaluate the ability to collect vehicle probe data from specially equipped vehicles. Also, to use a telecommunication backhaul that allows the collection of the data to be analyzed and evaluated for road surface and road quality conditions.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Completed Milestone 1, which includes design and coordination of hardware/software needs.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Complete Milestones 2 and 3, which include commence data collection to service and evaluation and analysis of data received.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

This project depends solely on the instrumentation of the Cut River and Mackinaw Bridge and the communication systems that link the two together. Data collection delays have been caused by both a two-month contract award delay (start date October 1, 2010) and several networking issues and equipment related failures at the site. Now because of weather related issues, we can't complete some sensor connectivity until spring (five months delay). It is anticipated that the system will be fully operational by June 1, 2010. That's when data retrieval will commence. We then need two years of data collection for analysis and processing.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Reliability Based Evaluation of Loading Configuration for Long-Span Bridges

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Beckie Curtis

CONTRACT/AUTHORIZATION NO.	2006-0413 / Z5	PROJECT START DATE	10/02/2008
PROJECT NO.	108513	COMPLETION DATE (Original)	09/30/2010
ORBP NO.	OR09-130	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Wayne State University		
PRINCIPAL INVESTIGATOR	Dr. Gongkang Fu		

BUDGET STATUS

FY 2010 Budget			**Total Budget**		
FY FUNDS	(Original)****	$119,567.29	TOTAL COST	(Original)*	$119,999.23
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$111,876.12
SALARIES			% PERCENT COMPLETE (By Budget)		99%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		Project closed
TOTAL FY 2010 EXPENDITURES		$111,444.18			

PURPOSE AND SCOPE

The National Bridge Inspection Standards (NBIS) requires analyzing all highway bridges to determine safe load capacity and load posting or restriction of bridges when the maximum legal loads or permit loads exceed that safe capacity. FHWA requires that analyses use the Load Factor Rating (LFR) or Load and Resistance Factor Rating (LRFR) methods for those items reported to FHWA, those being the Inventory Rating and Federal Operating Rating. The MDOT requires that bridges be analyzed at an operating level for the ability to carry the unique legal loads in Michigan, and this analysis may be done using any accepted methodology (LFR, WS, or LRFR) according to the 2005 Bridge Analysis Guide with Interims. In the application of these standards, little attention has been paid to long spans. However, the bridges that span long distances are often critical from an analysis standpoint as well as an economic impact to the community. The purpose of this research will be to evaluate loading scenarios for long span bridges in order to maintain appropriate levels of reliability without unduly impact commerce and the transportation of goods and people.

The following tasks are included in the scope:

- Prepare and issue a questionnaire other state DOTs
- Complete literature review
- Obtain MDOT weigh-in-motion (WIM) data from other states
- Analyze WIM data
- Develop strategies of using Michigan WIM data
- Perform calibration using Michigan data and bridge spans
- Develop recommendations
- Write final report

FISCAL YEAR 2009 ACCOMPLISHMENTS

A questionnaire was prepared and issued to other state DOTs. The literature review was completed. MDOT weigh-in-motion (WIM) data were requested. WIM data from a few other states have been gathered, with 0.01-second time stamp resolution. Analysis of WIM data started. Preliminary results show that the 1/15 probability for side-by-side truck papperance used in the LRFD code calibration is not realistic.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The remaining tasks were completed and the report was finalized.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

None

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

The project manager does not recommend the recommendations of this report to be implemented. The research was reviewed by Tom Saad of the FHWA Resource Center who identified inconsistencies with the statistical analysis based on national standards. The project manager questions the underlying assumption of acceptable reliability.

*The original authorized total budget amount of the project
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*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Michigan-Ohio University Transportation Center (MIOH UTC)

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Niles Annelin

CONTRACT/AUTHORIZATION NO.	2007-0538	PROJECT START DATE	05/01/2007
PROJECT NO.	108514	COMPLETION DATE (Original)	09/30/2009
ORBP NO.	OR07-019	COMPLETION DATE (Revised)	08/31/2010
RESEARCH AGENCY	University of Detroit Mercy		
PRINCIPAL INVESTIGATOR	Dr. Leo Hanifin		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$23,971.14	TOTAL COST	(Original)*	$250,000.00
	(Revised)*****			(Revised)**	$723,434.00
			FUNDS EXPENDED TO DATE***		$685,414.89
SALARIES			% PERCENT COMPLETE (By Budget)		94%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		Project closed
TOTAL FY 2010 EXPENDITURES		$35,711.32			

PURPOSE AND SCOPE

The MIOH-UTC is a critical project which will enable MDOT and the state of Michigan economy to benefit from research focused on improving transportation efficiencies, supply chain management and alternative fuels. The scope is to award and fund research projects and report on the research progress. This research is being conducted at local universities in Michigan and Ohio which will benefit our region. The partnering Michigan universities are University of Detroit Mercy (lead), Wayne State University and Grand Valley State University.

FISCAL YEAR 2008 ACCOMPLISHMENTS

During the Spring of 2008, researchers at the partner universities of the MIOH UTC presented status reports on all MIOH projects to members of the Operating Committee and select members of partner organizations including MDOT. The purpose of these meetings was to share general information about the work in progress and to solicit professional feedback and insights.

On May 14, 2008, seven research projects and two K-12 outreach projects were presented during a site visit of representatives of US DOT RITA. The presentations at UDM were made by partner universities UDM, WSU, GVSU and the UT. Invited guests and corporate partners attended. Additionally, the DOT representatives toured the biodiesel research project's lab at NextEnergy.

Following are the urls for two newsletter of the MIOH UTC published in 2008:

mioh-utc.udmercy.edu/MIOH_UTC_Newsletter_Winter_2008.pdf

mioh-utc.udmercy.edu/MIOH_UTC_newsletter_Summer_2008.pdf

Several projects will be drawing to a close in August 2008, or shortly thereafter (numbers 1, 2, 5, 7 and 9 below). Others will continue new phases in the coming year.

1. "Evaluation of SCATS Control System" TS4,p2: This University of Detroit Mercy project has received approval from MDOT of the draft final report. The final report is being produced summer 2008. Research was conducted to determine the effectiveness of the SCATS (Sydney Coordinated Adaptive Traffic System) signal system as compared to a pre-timed signal system in terms of traffic flow, delay and other selected measures of effectiveness.
2. "Congestion Relief by Travel Time Minimization in Near Real Time" TS1,p2 & P3: This GVSU and WSU project developed a hardware based (analog) solver providing very rapid determination of an "optimal" route solution for sending vehicles around congestion.
3. "Enabling Congestion Avoidance and Reduction in the Michigan-Ohio Transportation Network to Improve Supply Chain Efficiency: Freight ATIS" SC2,p2 & p3: This project at WSU and UDM in cooperation with industry partners such as Ford, is developing efficient dynamic routing algorithms to react to both recurring and non-recurring incidents by using real-time ITS traffic information and non-recurrent congestion modeling for reactive and anticipatory routing decisions based on networks of alternative routes for freight. One of the key aspects of this work is that its scalability enables implementation in real highway systems for dynamic rerouting of freight.
4. "Improved Oxidative Stability of Biodiesel Fuels: Antioxidant Research and Development" AF4,p2 & p3: This WSU project, located in laboratories at NextEnergy, investigates the effect of antioxidants on the stability of different types of biodiesel; additionally, it is studying the long-term stability of biodiesel with synthetic/natural antioxidants. Results indicate that the effect of different antioxidants on biodiesel varies significantly depending on biodiesel feedstock and content of minor components. A goal is to

develop/evaluate commercial antioxidants to improve the oxidative stability of biodiesel and thus make it a viable alternative fuel. Additional phases of this research are anticiated to continue through 2010.
5. "Multipurpose Educational Modules to Teach Hydraulic Hybrid Vehicle Technologies" AF1,p2 & p3: A research team at the UDM is creating a virtual replica of a physical test stand. The project is to develop education modules for use in courses to enhance students' understanding of the performance of a hydraulic pump or a hydraulic motor through its complete rang of operation. The main components of the modules will be laboratory experiments based on the hydraulic hybrid vehicle components. The developed experiments can be used to facilitate students' understanding of engineering principals in fluid dynamics, hydraulics, energy systems, vibrations, mechatronics and controls.
6. In July 2008, the second annual Transit Camp (funded by US DOT and UDM) was conducted to introduce high school students to careers in transportation related fields. This involved participation, lectures and demonstrations by personnel from partner organizations such as: MDOT, SEMCOG, RCOC. The 2008 student group was composed of nine males and eight females. Additionally, the group was approximately 82% ethnic minority.
7. "K-12 Ford PAS Alternative Fuels Curriculum Module" and "Pilot Testing" K-12-1,p2 & p3: The K-12 Outreach course materials developed in K-12-1,p2 and provided to high school teachers are being enhanced based on the feedback from HS teachers who piloted the teaching modules in the past academic year. The improved modules developed in project K-12-1,p3 will be disseminated on a broader scale in fall 2008, including through the Ford Partnership for Advanced Studies Program. Ford PAS is a partnership between Ford Motor Company, leading universities (i.e. UDM, U. of California-Berkeley, U. of New Mexico,…) and well over 100 high schools across the nation.
8. "New Approach to Enhance and Evaluate the Performance of VII & ITS Communication Systems" TS15,p1: Begun in Spring 2008, this project undertakes development of a test bed that allows for testing different inter-vehicle communication protocols. The test bed will provide a tool to evaluate message delay and channel throughput. Additionally, it will facilitate investigation of real-world inter-vehicle communication scenarios with actual vehicles. This is a UDM research project partnering with the Center for Advanced Research (CAR). This project anticipates completion fall 2008, with the next phase begun thereafter.
9. "Modeling Metropolitan Detroit Transit" TS14,p1: In response to transit issues in Metro Detroit, WSU and UDM researchers undertook a project to develop a quick response, computer based model that will efficiently analyze and capture the effect of transit vehicular changes (speed, capacity, acceleration, deceleration, etc.) and corridor/station parameters (BRT, LRT, station-spacing, station-length, etc.) upon the operation and cost of the system. The project has two components: model development and model demonstration. The proposed model is intended for planners and engineers for testing the operating and cost implication of changes in parameters in transit vehicles, transit corridors and stations. This project is projected to be completed December 2008.
10. "The Woodward Transit Catalyst Project" TS19,p1: With support solely from private sources, the MIOH UTC managed a UDM-DeLoitte team that developed a plan for a light rail system in Detroit. This plan has been further developed and the acquisition of private funding has proceeded during the 4th quarter of FY 2008. Director Hanifin continues to advise the project on a pro bono basis.

FISCAL YEAR 2009 ACCOMPLISHMENTS TO DATE

The MIOH UTC selected four continuing projects and two new projects to receive funding in Fiscal 2009. Both new projects are outgrowths of previously funded projects that are planned come to closure in December 2008. In addition to these six research initiatives, three additional projects are being funded to start January 2009. Two of which will be particially supported by MDOT funds. In the area of K-12 Outreach, the editing of the alternative fuels teaching modules initially scheduled for fall 2008 completion will be complete in spring 2009

Following are project titles were selected for fiscal 2009:
1. TS22,project 1: "Crash Benefits of SCATS Control System" new at UDM. The purpose of this research is to determine the effectiveness of the Sydney Coordinated Adaptive Traffic System (SCATS) in reducing traffic hazard by examining crash rate as Measure of Effectiveness (MOE). The performance of a test corridor (a corridor that has been converted to the SCATS system) and a control corridor (a corridor that has not been converted to the SCATS system and operates under conventional signal control) will be compared for various measures of effectiveness. In addition, a cost-benefit analysis of the SCATS system will be performed by considering congestion and crash benefits, installation/maintenance cost and life span.
2. TS21,project 1: "Management and Analysis of Michigan Intelligent Transportation Systems Center Data with Application to the Detroit Area I-75 Corridor". Researchers at GVSU and WSU are developing the methods necessary to systematically describe, explain, and predict the flow of traffic with respect to time and space. The utility of this knowledge will be demonstrated in routing voluminous traffic.
3. SC2,project 4: "Enabling Congestion Avoidance and Reduction in the Michigan-Ohio Transportation Network to Improve Supply Chain Efficiency: Freight ATIS." Continuing at Wayne State University and UDM in cooperation with industry partners, phases of this research will be completed over the next two years. The Researchers have been working on building the business case for their collaborator Ford to use the models. Also, they have been developing multi-stop (milk-run) delivery models/algorithms using real-time ITS information.
4. AF4,project 4: "Improved Oxidative Stability of Biodiesel Fuels: Antioxidant Research and Development." Continuing as a WSU project, located in laboratories at NextEnergy, phases of this research are anticipated to continue through 2010. The long-term stability for soybean based biodiesel with or without 1000 ppm synthetic/natural antioxidants stored at room temperature has now been extended for 30 months. Results indicate that the oxidative stability of untreated SBO-based biodiesel significantly decreases as a function of time, while the addition of the antioxidant TBHQ can improve and maintain oxidative stability up to 30 months. These results are consistent with previous results.
5. AF1,project 3: "Multipurpose Educational Modules to Teach Hydraulic Hybrid Vehicle Technology." The virtual laboratory software and associated lab handouts are complete. The simulation was validated with data from the EPA. One conference paper and an oral presentation (Spring 2009) have contributed to dissemination of the work. The only remaining task is make the virtual lab software and handout available on the MIOH-UTC Web site for download by high school teachers.
The virtual lab software and lab handouts are available at http://mioh-utc.udmercy.edu/education/index.htm.
6. AF12,project 2: "Improving the Energy Density of Hydraulic Hybrid Vehicles (HHVs) and Evaluating Plug-In HHVs." A continuing UDM project in collaboration with UT is proceeding into a second year of research. The researchers will continue working on the model to incorporate control algorithms during this second year. The UT Simulink model has been developed with UDM researchers'

input and reviewed by the faculty team. The air system as designed was determined to be unfeasible. In Winter 2008-09, the researchers evaluated the viability of a “plug-in” feature for the air system. The final report is expected to be completed by December 2009.
7. K-12-1,project 4: "K-12 Ford PAS Alternative Fuels Curriculum Module." The educational modules for use by high school teachers developed on the previous projects are being professionally edited for consistency and implementability. Completion expected Spring 2009.
8. TS15,project 2: "New Approach to Enhance and Evaluate the Performance of VII & ITS Communication Systems." A UDM project in collaboration with Center for Automotive Research. Researchers at UDM are addressing the challenge of developing a test bed that allows for testing different inter-vehicle communication protocols while keeping the cost at a reasonable level. The proposed test bed provides a tool to investigate minimizing message delay, obtaining sufficient channel throughput, and evaluating real world inter-vehicle communication scenarios with actual vehicles.
9. TS14,project 1: "Modeling Metropolitan Detroit Transit." Moving this project forward, the research team at WSU and UDM concentrated on the travel demand data for the proposed LRT system along Woodward Corridor in the Detroit metro area and worked with SEMCOG to develop a procedure for ridership estimation. Additionally, work on station identification was started during Winter 2009.
10. TS18,project 2: "Transportation Informatics: Advanced Image Processing Techniques for Automated Pavement Distress Evaluation" begun Jan 2009. UDM researchers join a team of UT researchers focusing on innovative information technologies to make gathering, processing and exchanging of information more effective, thus, reducing unnecessary delays due to accidents or break-downs. Overall transportation costs may be significantly reduced, making the area an even more competitive regional transportation hub. Researchers at UDM began this work by analyzing data on Southeast Michigan roads using methods developed by researchers at UT.
11. TS23,project 1: "Transit Oriented Development at selected LRT Stations in the Detroit Metropolitan Area" begun Jan 2009. A team led by WSU researchers with partners at UDM are conducting a study to develop programs for Transit Oriented Development (TOD) at two potential station sites along the Woodward Avenue planned LRT route in the Detroit metropolitan region. This study proposes to develop different TOD packages for these sites and to identify planning, economic and institutional mechanisms for their effective implementation.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

1. TS22,project 1: "Crash Benefits of SCATS Control System" -- The findings of this study have been submitted as a draft final report to MDOT for edits and permission to publish.
2. TS21,project 1: "Management and Analysis of Michigan Intelligent Transportation Systems Center Data with Application to the Detroit Area I-75 Corridor" -- The GVSU portion of this project is completed. The WSU portion of this research is complete. The draft final report for the first of two projects in this series is in final revision prior to submittal.
3. SC2,project 4: "Enabling Congestion Avoidance and Reduction in the Michigan-Ohio Transportation Network to Improve Supply Chain Efficiency: Freight ATIS" -- The research team is developing the draft final report for this series of projects.
4. AF4,project 4: "Improved Oxidative Stability of Biodiesel Fuels: Antioxidant Research and Development" -- The WSU research team is working toward the final report for this series of projects.
5. AF1,project 3: "Multipurpose Educational Modules to Teach Hydraulic Hybrid Vehicle Technology" --The virtual lab software and lab handouts are available at http://mioh-utc.udmercy.edu/education/index.htm. This is the final product of this project.
6. AF12,project 2: "Improving the Energy Density of Hydraulic Hybrid Vehicles (HHVs) and Evalluating Plug-In HHVs" -- The draft of the final report has been submitted to MDOT for review and permission to publish.
7. K-12-1,project 4: "K-12 Ford PAS Alternative Fuels Curriculum Module" -- The educational modules for use by high school teachers are complete and have been disseminated. The education modules are available for free download through the MIOH UTC and the UDM Web sites at http://eng-sci.udmercy.edu/pre-college/alt_fuel_curriculum/ . The electronic format educational modules are the final product of this project.
8. TS15,project 1 and 2: "New Approach to Enhance and Evaluate the Performance of VII & ITS Communication Systems" -- The team has developed a final draft report and submitted it to MDOT for permission to publish and edits before putting the report in publication format.
9. TS14,project 1: "Modeling Metropolitan Detroit Transit" -- The draft final report has been reviewed by MDOT, edits incorporated, and formating for printing is in process.
10. TS18,project 2: "Transportation Informatics: Advanced Image Processing Techniques for Automated Pavement Distress Evaluation" -- The software interface has been completed, including the ability to search and update records. The researchers have used the “interface” developed at UDM to evaluate pavement sections for comparison to evaluation results that have been published. The results of the UDM interface evaluation correlate well with the published results. The researchers have also developed tutorial information and help files to aid future users of the interface. The writing of the final report is in process.
11. TS23,project 1: "Transit Oriented Development at selected LRT Stations in the Detroit Metropolitan Area" -- This study proposes to develop transit oriented development (TOD) packages for two station areas in the Detroit metro region and to identify appropriate institutional mechanism for their implementation. The draft final report has been submitted to MDOT for review and permission to publish.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Investigate the usefulness of the numerous case studies and optimization procedures that were identified in the research especially those from 2008, projects 1, 2, and 3. Utilize the modeling and design work conducted in 2008, projects 9 and 10, as we pursue improving the transit service in SE Michigan.

*The original authorized total budget amount of the project

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: A Critical Evaluation of Bridge Scour for Michigan Specific Conditions

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Dave Juntunen

CONTRACT/AUTHORIZATION NO.	2006-0413 / Z3	PROJECT START DATE	03/12/2007
PROJECT NO.	108518	COMPLETION DATE (Original)	03/12/2010
ORBP NO.	OR07-028	COMPLETION DATE (Revised)	02/01/2011
RESEARCH AGENCY	Wayne State University		
PRINCIPAL INVESTIGATOR	Dr. Carol Miller		

BUDGET STATUS

FY 2010 Budget			**Total Budget**		
FY FUNDS	(Original)****	$23,971.14	TOTAL COST	(Original)*	$118,514.72
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$118,514.72
SALARIES			% PERCENT COMPLETE (By Budget)		100%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		85%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		Project closed
TOTAL FY 2010 EXPENDITURES		$23,971.14			

PURPOSE AND SCOPE

The purpose of this research is to improve the MDOT bridge scour prediction capability. This will be accomplished by performing the following four tasks.

Task 1: An extensive literature review including existing USGS, FHWA, and ASCE reports and a detailed review of electronic databases. Other state DOTs to identify research not included in the other sources.
Task 2: Evaluate MDOT's current scour evaluation procedures.
Task 3: Review scour evaluation methods used by other states.
Task 4: Calibrate Level 2 (HEC-18) scour prediction equations for Michigan specific conditions.

FISCAL YEAR 2008 ACCOMPLISHMENTS

The following tasks were initiated and/or completed through the fourth quarter of fiscal year (FY) 2008:

- Contacted state DOTs to identify non peer reviewed publications (LTU)
- Reviewed and evaluated pre-existing engineering data for bridge scour evaluation (LTU & WSU)
- Reviewed and evaluated existing databases and database management techniques (LTU & WSU)
- Review, summarize, and critique other state DOT methodologies for scour evaluation (LTU)
- Contacted appropriate departments within each DOT for bridge scour information (LTU)
- Determined bridge scour information available through public accessible Web sites (LTU)
- Visited scour critical bridges throughout the lower peninsula of Michigan as identified through meetings with MDOT (LTU & WSU)
- Final selection of scour critical bridges across the lower peninsula for episodic monitoring (LTU & WSU)
- Final selection scour critical bridges for continuous monitoring of scour (LTU & WSU)
- Collected field data and soil samples at selected scour critical bridges (LTU&WSU)
- Collected Level 2 field data at several selected bridges (LTU&WSU)
- Installed continuous meters at the Flint River site to pilot test equipment capabilities (LTU& WSU)
- Collected continuous data at Flint River site (WSU)
- Collected episodic data at several selected scour critical bridges (LTU & WSU)
- Performed jet device testing at three appropriate selected scour critical bridges (LTU & WSU)
- Initiated geotechnical laboratory investigation of soil samples to evaluate geotechnical properties at nine sites (LTU)

FISCAL YEAR 2009 ACCOMPLISHMENTS

The following tasks were initated and/or completed through the 4th Q of 2009 FY:

- Collected Level 2 field data and low flow cross-sectional profiles at several selected bridges (LTU&WSU)
- Installed continuous monitoring equipment and collected continuous scour data at the PawPaw River, Grand River, and Flint River locations (LTU&WSU)
- Collected episodic data at six (8) selected scour critical bridges {Grand, Flint, Rogue, Raisin, Pigeon, Thornapple, Pine, and Cass} (LTU & WSU)
- Finalized soil characterization of bed samples at all selected bridge sites to evaluate geotechnical properties of soil (LTU)

- Initiated HEC-RAS computer simulations for selected sites (WSU)
- Finalized laboratory jet test device protocols and tested several field samples for soil erodibility (LTU)
- Presented scour equation adjustement procedure at a national conference. Two other national conference publications have been submitted (LTU & WSU).
- Purchased ADCP and conducted velocity contours at selected piers (LTU & WSU)

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The following tasks were initated and/or completed through the fourth quarter of FY 2010:

- Collected continuous scour data at the PawPaw River, Grand River, and Flint River locations (LTU&WSU)
- Collected episodic data at six selected scour critical bridges {Grand, Flint, Rogue, Raisin, Pigeon, Thornapple, Pine, and Cass} (LTU & WSU)
- Collected cross-sectional profiles at all selected bridges (LTU&WSU)
- Continued HEC-RAS computer simulations for selected sites (WSU&LTU)
- Revised a draft version of the parametric evaluations of HEC-18 scour prediction equation based on the NBSD. Revisions were based on comments by MDOT TAG Team and Dr. Peggy Johnson of Penn State (WSU&LTU)
- Met with MDOT TAG for Bridge Scour Project (LTU&WSU)
- Revised Table of Contents for the final report and drafted multiple chapters (LTU & WSU)
- Provided progress reports and met with research avisory panel

FISCAL YEAR 2011 PROPOSED ACTIVITIES

- Finalize HEC-RAS computer simulations for nine (9) selected sites as necessary (WSU & LTU)
- Finalize the parametric evaluation of HEC-18 Scour Prediction Equations based on existing and, if available, project collected scour data (LTU & WSU)
- Develop a draft of the final report (LTU & WSU)
- Present project results at a Bridge Scour Technical Meeting (LTU & WSU)

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

The selection of bridge scour monitoring locations and the installation of continuous monitoring equipment took longer than anticipated. In addition, the past year has seen relatively few flood events in the state that registered any measureable sour. An additional six months would improve/increase the chances of scour data collection from established continuous and episodic monitoring locations to enrich the dataset on Michigan specific scour measurements. If additional scour data is collected, the process of HEC-18 Equation calibration could be improved.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Continue collection of episodic data and continuous scour data collection for bridges included in the project. During the time frame of the project, no major flood events occurred.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Evaluation of the Usage and Impact of the Michigan Vehicle Infrastructure Integration Program

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Kurt Coduti / Greg Krueger

CONTRACT/AUTHORIZATION NO.	2007-0371	PROJECT START DATE	02/15/2007
PROJECT NO.	108519	COMPLETION DATE (Original)	12/31/2008
ORBP NO.	OR07-002	COMPLETION DATE (Revised)	03/31/2011
RESEARCH AGENCY	Mixon-Hill		
PRINCIPAL INVESTIGATOR	Lee Mixon		

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$888,994.64	TOTAL COST	(Original)*	$3,500,000.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$3,130,166.43
SALARIES			% PERCENT COMPLETE (By Budget)		89%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		89%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$204,012.79
TOTAL FY 2010 EXPENDITURES		$749,937.56			

PURPOSE AND SCOPE

To support MDOT and its partners in the evaluation of the uses and benefits of Vehicle Infrastructure Integration (VII)-related data. Evaluate and determine how the VII program will impact how state and local departments of transportation do business as a result of the significant quantity of additional data collected on all major (and eventually minor) roads.

FISCAL YEAR 2008 ACCOMPLISHMENTS

-Procured, configured, and installed the computing hardware and software for Data Use Analysis Processing (DUAP) project development and deployment.

-Completed, reviewed, and issued the Systems Architecture Description (frame work of hardware to software). The document has been posted to the MDOT VII Web site for stakeholders' general use.

-Completed, reviewed, and issued the System Requirements Specification, building on the needs expressed in the Concept of Operations and the framework described in the System Architecture Description. The document has been posted to the MDOT VII Web site for stakeholders' general use.

-Completed development to gather data from the Chrysler FastFeedback vehicle fleet and the Michigan ITS Center freeway vehicle detectors.

-Completed development of Prototype 1 of the DUAP Web site (http://duap.mixonhill.com), which allows users to select particular Chrysler vehicle fleet probe data and MITS Center traffic data from the DUAP archives to be displayed on maps.

-Pursued fleet probe data hardware, software, and services to supplement existing data sources.

FISCAL YEAR 2009 ACCOMPLISHMENTS TO DATE

-Completed connection to and import of archived vehicle probe data from the USDOT VII Proof-of-Concept demonstration on the Michigan VII testbed. Updated Prototype 1 of the DUAP Web site to accommodate display of the additional data.

-Completed the draft System Design Description based on the System Requirements Specification.

-Started drafts of System Test Scripts based on the System Requirements Specification and System Design Description.

-Completed development of enhancements (Prototype 2) for the DUAP Web site (http://duap.mixonhill.com) to increase system performance, create a more efficient user interface, and display average speed along road segments.

-Implemented tabular data output feature for Prototype 2 of DUAP.

-Pursued fleet probe data hardware, software, and services to supplement existing data sources. Evaluated potential providers of on-board data acquisition devices.

-Provided support for DUAP-related presentations at ITS World Congress.

-Provided DUAP data to the USDOT/FHWA VII Road Weather Management Program for assessing the use of vehicle probe data in weather applications.

-Reviewed the draft System Design Description.

-Evaluated and implemented a DUAP connection to the Teletrac XML gateway to collect data from 20 MDOT vehicles previously instrumented by Teletrac.

-Supported MDOT DUAP presentations at ITS MIchigan 2009.

-Worked for MDOT with Motorola and its team of subcontractors (IOSiX, TeleRad) to identify and implement the means of equipping 70 MDOT vehicles with vehicle telematics equipment for IntelliDrive probe data collection.

-Met with MDOT and Michigan International Speedway (MIS) to assess use of MIS facilities as an IntelliDrive test bed.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

-Continued to collect data from multiple sources into DUAP data repository.

-Worked with MDOT in deploying data collection from 70 MDOT vehicles.

-Developed methodology for analyzing new data, including accelerometry, from MDOT fleet.

-Standardized processing and presentation of fleet probe data in DUAP user interface.

-Performed initial structured testing of pavement data acquisition and analysis from MDOT vehicles.

-Supported MDOT DUAP presentations at ITS Michigan 2010, with potential data partners and with other agencies.

-Developed and demonstrated methods of determining potential pothole locations and relative pavement condition measures from probe vehicle accelerometry.

-Developed and demonstrated data acquisition from third-party Android phone application.

-Started development of collector for demonstration of OnStar probe data collection.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

-Continue to collect data from multiple sources into DUAP data repository.

-Work with MDOT to integrate new data sources into DUAP.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Slippery Road Detection and Evaluation

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Cook

CONTRACT/AUTHORIZATION NO.	2009-0747 / Z1	PROJECT START DATE	10/20/2009
PROJECT NO.	108519	COMPLETION DATE (Original)	06/01/2012
ORBP NO.	OR09-119	COMPLETION DATE (Revised)	
RESEARCH AGENCY	The Regents of the University of Michigan		
PRINCIPAL INVESTIGATOR	Dr. Ralph Robinson		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	Milestone Payments	TOTAL COST	(Original)*	$242,836.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$0.00
SALARIES			% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		21%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$242,836.00
TOTAL FY 2010 EXPENDITURES		$0.00			

PURPOSE AND SCOPE

The purpose of this project is to evaluate the ability to detect slippery road conditions using a data collection and evaluation application on vehicles equipped with wireless on-board telemetry systems.

This project seeks more specifically to:

- Demonstrate that the above scenario is practical using real test vehicles
- Demonstrate that slippery conditions can be reliably detected using probe data and
- Assess the potential cost-benefit of a full deployment

The project will equip two vehicles with telemetry equipment to monitor driving conditions while operating on winter roads and other potentially slippery situations. Evaluations will be conducted over two full winter driving seasons. Additional equipment for more vehicles will be made available for purchase as needed. While the focus is on slippery road detection, the system will be configured to provide segment by segment travel time data in real time to monitor the impacts of weather conditions on normal roadway trip times.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Quarter 1: Work was temporarily suspended during the quarter. The initial project schedule was based on an expected approval to start work in July 2009, at which time equipment would have been purchased and modified for the 2009/2010 winter season. Unfortunately, the start of work authorization only came in September 2009. This left insufficient time for vehicle instrumentation design and build before the 2009/2010 winter season. UMTRI discussed this issue with MDOT's Project Manager and a mutual agreement was reached to extend the program (at no cost) one year to accomplish the intended two winter year drive cycles.

Quarter 2: Work began on system design, architecture and vehicle configuration assumptions. A draft version of the slippery road system Requirements document was completed, along with a draft Statement of Work to solicit a software developer. Both of these documents were sent to and discussed with MDOT's project manager (PM). An investigation into available CAN interfaces was also initiated with the intent to find vehicles with ABS status messages.

Quarter 3: The Droid Data Collection Description and Requirements document was completed and refined to accommodate the Motorola Droid Smartphone and sensor interfaces needed. An RFQ was distributed to multiple software contractors with the requirements document. A survey of outside vendors found four suppliers, from which Intersog was chosen as the most capable, with the best resources. A sample software algorithm was generated to validate the accelerometer functionality. Vehicle data was collected showing the three axis accelerometer working as expected. Investigation into available CAN interfaces continued, still with the intent to find vehicles with ABS status messages that could be used as test vehicles. This investigation led UMTRI to contact Ford Motor Company with a request to provide CAN data, which required the signing of a Non-Disclosure Agreement (NDA).

Quarter 4: A NDA with Ford was approved August 3. A 2010 Fusion data set was then obtained and filtered for the CAN messages needed. The format and constructs were extracted and sent to the contracted software developer for integration into the CAN OBDKey interface. Surface temperature sensor and interface module were received July 26, 2010, from the supplier, three months

after the order was placed. The unit is now in a bench setup for testing and software development, as it requires a conversion from a standard serial output to a USB interface to allow communication with the Droid Smartphone. Framework of the software application has also been delivered and tested in several phases over the quarter.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Planned activities for fiscal year (FY) 2011 include:

1) Completion of development of the data acquisition software, followed by some testing efforts.

2) Leasing, fitting and testing of two data collection vehicles.

3) Allocation of test vehicles to MDOT employees, in consultation with MDOT's PM.

4) Start of data collection during the 2010/2011 winter period.

Following significant delays in project activities during the last two quarters of FY 2010, a full recovery of the time lost with respect to the initial project schedule is not possible. Requirement for operation before winter weather begins is important. If no additional delays occur, the project should be able meet this timing requirement. However, risks for additional delays are possible due to the technical challenges of interfacing to proprietary sensing systems, including the CAN interface, with little documentation.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Identification of Causes and Solution Strategies for Deck Cracking in Jointless Bridges

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Eric Burns

CONTRACT/AUTHORIZATION NO.	2009-0746 / Z1	PROJECT START DATE	10/20/2009
PROJECT NO.	108522	COMPLETION DATE (Original)	08/15/2011
ORBP NO.	OR09-150	COMPLETION DATE (Revised)	01/30/2012
RESEARCH AGENCY	Michigan State University		
PRINCIPAL INVESTIGATOR	Dr. Rigoberto Burgueño		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$106,572.00	TOTAL COST	(Original)*	$169,968.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$44,073.87
SALARIES			% PERCENT COMPLETE (By Budget)		26%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		29%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$125,894.13
TOTAL FY 2010 EXPENDITURES		$44,073.87			

PURPOSE AND SCOPE

MDOT has experienced cracking of bridge decks designed and constructed continuous for live load and without expansion joints on the bridges but located on the bridge approaches. The causes of these cracks are not clearly known. The expansion joints allow for the thermal expansion and contraction based on temperatures. Moving the expansion joints to the approaches reduces future maintenance costs for expansion joint replacement and beam end repair. This project will review how the jointless bridge decks are designed and seek to identify causes of the bridge deck cracking without expansion joints on the bridges but located on the bridge approaches.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Task 1: The findings of the literature review indicated key parameters controlling the behavior of jointless bridges, along with the sources that contribute to deck cracking. The most dominant source appears to be restrained concrete shrinkage, which has become the focus of this research. Task 1 is estimated to be 95% complete.

Task 2: Additionally, MDOT has provided information on prototype jointless bridge systems that are candidates to be studied for the field investigation. The information has been studied and a prototype continuous steel bridge has been selected for the computer modeling and first test experimental test unit. Task 2 is estimated to be 70% complete.

Task 3: Extensive work has been completed on the computer modeling task. The finite-element program ABAQUS has been used to model shrinkage. Verification models have been created to compare with results from the literature. A full bridge system has been created based on a prototype bridge. Further work has been completed on the global bridge model to accurately simulate soil-structure interaction and temperature has been induced to simulate concrete shrinkage. Task 3 is estimated to be 35% complete.

Task 4: The initial design for the experimental studies on a continuous steel bridge system has been completed. The test unit is a 1/3 scale model of a local bridge identified with the assistance of MDOT. Task 4 is estimated to be 10% complete.

The PI has dedicated his time in guiding and supervising the graduate student in the above mentioned tasks. The graduate student has been performing assigned tasks and summarizing findings in weekly reports. These reports will become part of the final report for the project.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Task 2: Conduct field inspections of candidate bridges for detailed study and summarize the information provided by MDOT into a matrix of deck cracking cases.

Task 3: Improve the computational simulation of shrinkage effects by introducing material nonlinearity. In addition, the simulation will focus on the simulation of the prototype bridge and support analyses for the design of the experimental investigation.

Task 4: Finalize the design of the first test unit and initiate construction**.**

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

ORBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Skewed Bridges

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Peter Jansson

CONTRACT/AUTHORIZATION NO.	2006-0413 / Z4		PROJECT START DATE	07/12/2007
PROJECT NO.	108523		COMPLETION DATE (Original)	10/12/2009
ORBP NO.	OR08-016		COMPLETION DATE (Revised)	09/30/2010
RESEARCH AGENCY	Wayne State University			
PRINCIPAL INVESTIGATOR	Dr. Gongkang Fu			

BUDGET STATUS

FY 2010 Budget				Total Budget		
FY FUNDS	(Original)****	$7,565.74		TOTAL COST	(Original)*	$214,975.71
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$214,975.71
SALARIES				% PERCENT COMPLETE (By Budget)		100%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		Project closed
TOTAL FY 2010 EXPENDITURES		$7,565.74				

PURPOSE AND SCOPE

The objective of this research project is to simplify the design for skewed bridges that are commonly used in Michigan, by developing design tools. The simplified design methods should maximize the durability of skewed bridges in Michigan. The scope includes literature review, finite element modeling, field testing, calibration of models, and design recommendations.

FISCAL YEAR 2008 ACCOMPLISHMENTS

Literature review was completed. Two bridges were selected for field testing, one with concrete beams and one with steel beams. Instrumentaiton for the two bridges was preliminarily planned. Initial finite element modeling performed.

FISCAL YEAR 2009 ACCOMPLISHMENTS

Calibration for sensors used in bridge instrumentation was completed. Refinement of the test bridge models was completed. The Woodruff Road bridge (steel beams) was instrumented during the concrete bridge deck pour and load tested with truck live load after the bridge deck concrete cured. Calibration of the finite element model using the test data was performed. Development of additional finite models for steel beam bridges with varying skews, span lengths, and beam spacings was begun.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Concluded development and refinement of finite element models for typical MDOT concrete I-beam and steel beam bridges. Developed design recommendations and tools for designers. Submitted and revised draft final report, currently awaiting approval of final report.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

Due to delays in the letting of the second bridge selected for instrumentation and load testing, a no-cost time extension was submitted and approved on 9/24/2009. The revised completion date is 9/30/2010.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Once report is approved, findings will be presented to the MDOT bridge committee for discussion and department wide implementation.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Study of Most Effective Practices for Determining Construction Contractor's Eligibility to Bid on Construction Projects

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Wayne Roe, Jr.

CONTRACT/AUTHORIZATION NO.	2009-0463	PROJECT START DATE	06/16/2009
PROJECT NO.	108524	COMPLETION DATE (Original)	06/16/2010
ORBP NO.	OR09-113	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Dye Management Group, Inc.		
PRINCIPAL INVESTIGATOR	Keyur Shah		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$109,880.00	TOTAL COST	(Original)*	$109,880.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$109,880.00
SALARIES			% PERCENT COMPLETE (By Budget)		100%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		100%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		Project closed
TOTAL FY 2010 EXPENDITURES		$109,880.00			

PURPOSE AND SCOPE

Determine the most efficient and effective way to ensure that only capable contractors are eligible to bid on and perform work on MDOT construction projects that are delivered through low bid awards under the design-bid-build delivery method. The contractor's eligibility could be determined in multiple ways (including ratings from bonding companies). MDOT does not intend to limit the scope to identify improvements solely to the use of the current prequalification process, but wishes to consider whether a different process would better serve Michigan's citizens. Currently, MDOT evaluates contractor's performance. An audit report of MDOT's Contract Services Division (CSD), issued by the Office of Commission Audits recommended a study to determine whether there is a more cost-effective way to meet the objectives behind the current prequalification process.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The study has been completed, and the recommendations in the study have been considered by the department and the State Transportation Commission. The open audit of the CSD, which contained the recommendation for the study, has now been closed. The recommendation made by the Dye Management Group to revise the department's construction performance evaluation system has been considered and was accepted with the modification that it will not be strictly a performance based process that will lead to prequalification of the evaluated contractor. The department has agreed to review the current evaluation process, but will continue to use the contractor performance evaluations as a part of the overall assessment for a contractor's prequalification.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

None

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

The department considered all five recommendations included in the final report of the study. As a result of discussions at the Executive level, including with the Commission Auditor and the State Transportation Commission, one recommendation from the study, in part, was adopted (see accomplishments to date for details). The study by Dye Management Group has been completed, the deliverables expected by the department have been received, and the final payment for the remaining amount due, by contract, has been paid. No further action is necessary.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

ORBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: MDOT Vehicle Infrastructure Integration Data Analysis Documentation and Research Support Program

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Cook

CONTRACT/AUTHORIZATION NO.	2003-0026 / Z12	PROJECT START DATE	08/30/2006
PROJECT NO.	108525	COMPLETION DATE (Original)	11/30/2008
ORBP NO..	OR07-020	COMPLETION DATE (Revised)	06/01/2012
RESEARCH AGENCY	The Regents of the University of Michigan		
PRINCIPAL INVESTIGATOR	Dr. Peter Sweatman		

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$138,262.48	TOTAL COST	(Original)*	$800,000.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$750,247.00
SALARIES			% PERCENT COMPLETE (By Budget)		94%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		94%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$49,753.00
TOTAL FY 2010 EXPENDITURES		$88,509.48			

PURPOSE AND SCOPE

The primary purpose of MDOT's Data Use and Analysis Processing (DUAP) project is the study of new Vehicle Infrastructure Integration (VII) applications based on the availability of VII-related data and how these would directly impact MDOT current methods and processes if deployed. The original scope of this project was the analysis of VII prototype applications as they are available from the VII POC and Mixon-Hill data aggregation database. The originally planned access to data has not materialized as of the second quarter of fiscal year (FY) 2009, resulting in a rescoping of the project for the remainder of the project to encompass simulated application analysis.

FISCAL YEAR 2008 ACCOMPLISHMENTS

Loaned five vehicles to VII-C POC fleet containing UMTRI data acquisition systems to gather Probe Data; Evaluated POC requirements and design documents; Developed probe data simulator to evaluate and confirm POC probe data protocol; downloaded and evaluated POC data from Booz Allen Hamilton; Probe data volume and quality sensitive measured for RSE range, VII population density and buffer sizes.

FISCAL YEAR 2009 ACCOMPLISHMENTS TO DATE

1st Quarter: 1) Developed link travel time database requirements and format to support route-based application evaluations. 2) Evaluated perfomance measure requirements and vehicle traceability.

2nd Quarter: 1) Developed algorithms for re-routing vehicles around travel delays (work zones, incidents, etc.). 2) Explored the development of feedback and feed forward travel time estimation strategies. 3) Explored methods for aggregating from probe vehicle data on link-by-link basis the average travel times and delays incurred by vehicles. 4) Adjusted the application development work plan to reflect the latest projection of available DUAP data.

3rd Quarter: 1) Rescoped of project plan to consider the need to change the project's scope as a result of not receiving data from initially anticipated sources (VIIC POC probe vehicle data that was expected to be collected by Mixon Hill; data from Chrysler's Management Test Bed). 2) Continued application development work based on the developed re-prioritized set of reference applications. 3) Continued the assessment of the general useability of probe data generated according to current protocols using UMTRI's Paramics Virtual IntelliDrive^{SM} Simulator.

4th Quarter: 1) Completed the analysis of the USDOT's Vehicle-Infrastructure Integration Proof-of-Concept data and data collection protocols. 2) Completed the development of performance metrics requirements; evaluated the suitability of probe data to support key performance metrics and, where application, the ability to convert raw data into relevant performance metrics. 3) Updated UMTRI's Paramics IntelliDrive Simulator with remaining snapshot generation protocol details. 4) Used the updated simulator to initiate evaluations of potential data loss over the USDOT's Proof-of-Concept Test Bed due to privacy policy rules. 5) Completed the description of the set of reference applications. 6) Issued Phase I project report in September 30, 2009.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

1st Quarter. Activities executed during this quarter include: 1) Completed the mapping of data collection needs requirements for the calculation of relevant performance metrics. 2) Revised the modeling of data collection protocols in UMTRI's Paramics Virtual IntelliDrive Simulator to enable the simulation of alternative vehicle-RSE interactions. 3) Completed evaluations of the potential

data losses that may occur across the USDOT's Vehicle-Infrastructure Integration Proof-of-Concept Test Bed due to privacy policy rules. 4) Conducted evaluations, through simulations and technical evaluations, on the suitability of current data collection protocols to support the calculation of basic traffic flow performance measures (flow rates, flow density, travel speed, delays, number of stops, occupancy). 5) Revised the project's draft report to incorporate the results of the analyses conducted during the quarter.

2nd Quarter. Activities executed during this quarter include: 1) Characterized the various sensing technologies that are currently available to collect traffic data. 2) Inventoried sources of data within MDOT and from local transportation agencies and private enterprises that could be used by a DUAP system. 3) Revised the list of IntelliDrive applications of interest to the DUAP program to better reflect the range of activities performed by MDOT and public transportation agencies in general. 4) Incrementally modified the project's draft report to reflect the results of the above activities. 5) Distributed a copy of the project's latest draft report to MDOT's project manager (PM) in mid-March.

3rd Quarter. Activities executed during this quarter include: 1) Developed a concept of operations for a traffic monitoring system using probe vehicle data and data from other sources to supply key basic performance metrics to various MDOT operations. 2) Identified potential operational constraints to probe vehicle data collection and uses in applications of interest. 3) Expanded the analysis of probe vehicle data collection processes. 4) Modified the project's interim report to incorporate the latest findings and add a summary section. 5) Distributed a copy of the revised Interim Report to MDOT's PM in late June.

4th Quarter. Activities executed during this quarter include: 1) Evaluated general issues that may affect the deployment of "Day One" applications. 2) Evaluated the potential effects of partial probe vehicle market deployments on the ability to estimate traffic flow performance measures. 3) Updated the summary of main findings from the project activities. 4) Updated the set of lessons learned derived from project activities. 5) Developed recommendations for future work. 6) Finalized the project's final report. 7) Distributed draft of final report to MDOT's PM on October 11, 2010.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Production of IntelliDrive Newsletters, as defined in the project's proposal. No other specific research activity is planned for FY 2011, other than potential revisions to the final report upon request from MDOT.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

09/30/2009 – Extension of project one year due to the lateness in obtaining data that was expected to be generated by the UDSOT's Vehicle-Infrastructure Integration Proof-of-Concept Test Program. Change approved by the Michigan Administrive Board on 11/05/2008. When it became clear that the expected external data would not become available, a rescoping of the project was suggested by MDOT. A rescoping plan was submitted and approved in June 2009.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

It is recommended that MDOT moves past IntelliDrive demonstrations and test beds and initiates the development and deployment of a real IntelliDrive system. For instance, a data collection system using commercial off-the-shelf (COTS) components can be deployed across the state without requiring significant new infrastructure. With the proper incentives, participants from across the state could join the effort, particularly if there are perceived benefits from using the applications being deployed. In addition, to directly supporting MDOT's and possibly other stockholder's data collection needs, the proposed data collection system would provide a unique environment to address data collection issues and refine proposed applications. While there are risks associated with being the first at attempting such a development, this effort, combined with other on-going research activities being executed in the Detroit area, would assure that MDOT and Michigan would remain the nationwide leaders in IntelliDrive application development.

To assure maximum compatibility with other development efforts and facilitate later upgrades, it is further recommended that any new system or application respect the design objectives and standards defined within the envisioned nationwide IntelliDrive architecture. The needs for potential system upgrades should also be included in the proposed business plans. Over the next 20 to 40 years, many architecture and system design changes will likely be made on the road to full market penetration. It should therefore be assumed that the first deployed applications would likely require some changes at some point in the future to accommodate new functions not currently possible with today's technology.

Additional studies regarding the collection and use of IntelliDrive probe data that will eventually need to be executed include:

- For each application selected for deployment, there is a need to define exactly what data should be collected, what are appropriate sampling rates, and which performance metrics must be calculated to support adequately the application's operational needs
- What volume of data will initially need to be processed by the server to satisfy the aggregate application needs and how these volumes are expected to grow over the years
- How collected data will be validated
- Development of data collection methods enabling the collection of origin-destination trip data or the tracking of vehicles over sufficiently long distances to support various system needs

To promote the development of IntelliDrive systems supporting MDOT operations, it is further recommended to design and build a system supporting the following four key applications:

- Road surface condition monitoring
- Road surface weather monitoring with slippery road detection
- Traffic incident detection
- Road traffic condition monitoring

While the road surface condition monitoring application could be deployed by equipping only MDOT service vehicles, all other applications will typically seek to collect data from a fleet of probe vehicles as large as possible. To promote participation from other governmental agencies and the public, a program to incentivize installation of the appropriate equipment in vehicles will need to be developed. The above applications could further be developed by collaborating with a telecom service provider such as Verizon or AT&T to get the wireless resources needed while minimizing infrastructure investments. MDOT may initially

subsidize the cost of equipment or service fees to help launch the system and build some market penetration, but most of the cost burden should eventually be assigned to drivers and travelers, unless alternate financing means are developed. In all cases, care would need to be exercised to ensure that drivers perceive that they are obtaining something of value in return for the data they are providing. This may be the only approach to ensure win-win outcomes for MDOT, its customers, and the IntelliDrive initiative.

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**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Investigating Causes and Develop Methods for Preventing Falling Concrete from Bridge Decks or Falling Deck Concrete

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Kahl

CONTRACT/AUTHORIZATION NO.	2009-0428 / Z1	PROJECT START DATE	10/01/2009
PROJECT NO.	108621	COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-149	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Lawrence Technological University		
PRINCIPAL INVESTIGATOR	Dr. Nabil Grace		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$148,043.15	TOTAL COST	(Original)*	$279,278.78
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$119,947.39
SALARIES			% PERCENT COMPLETE (By Budget)		42%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		46%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$159,331.39
TOTAL FY 2010 EXPENDITURES		$119,947.39			

PURPOSE AND SCOPE

A comprehensive two-year study to investigate and develop practical and adaptable methods for preventing falling concrete from bridge overpasses onto roadways. The study includes detailed field exploratory work, aided with analytical and experimental work on bridge deck concrete. The combined outcome of these investigations will identify the problem attributes, identify potential problem sites, and suggest a permanent repair solution.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The field investigations were delayed in part due to scheduling conflicts with traffic control. The laboratory investigations progressed as planned. Three bridges were tested and full depth concrete cores were removed for forensic analysis. The inspections and testing consisted of evaluating the deterioration on the top and bottom deck surfaces, visual crack mapping, presence of rust stains, salt efflorescence, and/or exposed reinforcement. Grids were drawn on the deck bottom surface in three locations to facilitate the non destructive corrosion testing. Schmidt hammer testing was used to determine compressive strength. Mortar drill bits were used to sample concrete powder from the deck bottom to test for chloride (salt) content and correlate with the corrosion measurements taken. A trend was observed in the correlation between high corrosion activity and the visual appearance of rust stains, and spalling.

The lab investigation is ongoing, with 300 cycles of freeze-thaw exposure, salt water ponding, fatigue and ultimate strength testing completed on concrete block specimens embedded with uncoated reinforcement.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Task 2: Continue field investigation of sites -at least 2 bridges will be completed by summer.

Task 3, b & c: Continue laboratory investigation and analysis of results

Task 5: Develop draft for Chapter 4, Results and Discussion of Laboratory Investigations

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
***The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Improved Performance of Concrete Overlays

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Ben Krom

CONTRACT/AUTHORIZATION NO.	2009-0747 / Z4	PROJECT START DATE	10/01/2009
PROJECT NO.	108624	COMPLETION DATE (Original)	05/15/2012
ORBP NO.	OR09-141	COMPLETION DATE (Revised)	
RESEARCH AGENCY	The Regents of the University of Michigan		
PRINCIPAL INVESTIGATOR	Dr. Will Hansen		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$170,816.32	TOTAL COST	(Original)*	$333,956.31
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$170,816.32
SALARIES			% PERCENT COMPLETE (By Budget)		51%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		50%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$163,139.99
TOTAL FY 2010 EXPENDITURES		$170,816.32			

PURPOSE AND SCOPE

Conduct a comprehensive performance evaluation of concrete overlays used as a major rehabilitation treatment for severely distressed concrete and flexible pavements. The primary study objectives are: (1) Conduct a comprehensive field investigation of representative overlay projects, including a five-year review of the overlay demonstration project on I-75, near West Branch, which has unique design features, to find relationships of their design features and a tendency for early cracking. (2) From modeling and data analysis of field results, develop new or modified overlay designs and their related construction practices that can prevent the formation of premature distress cost-effectively. (3) Estimate the respective life/cycle costs and any likely time savings in construction for these modifications.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

A field investigation of six in-service overlays has been completed. Lab testing (air void analysis, etc.) of field collected concrete cores has been completed for several locations. Major findings from the field testing were presented to the Research Advisory Panel (RAP) for the I-75 West Branch demonstration project. A SurPRO 2000 rolling surface profiler was purchased to measure the change is slab surface elevations for pavements that were field tested. Wireless temperature sensors were installed in two concrete overlays that were constructed this season (US-10 EB in Midland, and M-1/Woodward Ave in Detroit). A workshop with the principle investigator and the RAP for the use of the Multi-Layer System (MLS) software for overlay analysis was held in March with Dr. Schlangen. Some initial analysis and models of unbonded concrete overlay systems has been conducted using the MLS software.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Perform field investigation of approximately two additional in-service concrete overlays, and complete the lab testing of the concrete cores. Download and analyze wireless temperature sensor data. Continue the analysis of unbonded concrete overlay systems using the MLS software, inputting temperature data collected from the wireless sensors. Also scheduled to begin this year: present the major findings to the RAP, provide recommendations for new overlay designs and construction features, and begin work on the draft final report.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
***The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Development and Validation of a Sensor-Based Health Monitoring Model for Parkview Bridge Deck

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Kahl

CONTRACT/AUTHORIZATION NO.	2009-0433 / Z1	PROJECT START DATE	01/20/2010
PROJECT NO.	109028	COMPLETION DATE (Original)	01/31/2012
ORBP NO.	OR09-151	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Western Michigan University		
PRINCIPAL INVESTIGATOR	Dr. Osama Abudayyeh		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$92,837.33	TOTAL COST	(Original)*	$228,126.20
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$57,364.30
SALARIES			% PERCENT COMPLETE (By Budget)		25%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		32%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$170,761.90
TOTAL FY 2010 EXPENDITURES		$57,364.30			

PURPOSE AND SCOPE

This project will focus on the continuous monitoring and evaluation of the structural behavior of the Parkview Bridge deck panels under traffic loads using the sensor network installed during Phase I of this project. The bridge is located on Parkview Avenue over US-131 in Kalamazoo, Michigan, and was recently replaced using precast technology. All components above ground were prefabricated off site, shipped to the location, assembled, and grouted (connected), for minimal disruption to highway traffic. The most unique aspect of the prefabricated bridge was the use of a post-tensioned precast deck panel system. The deck was made entirely of 52 individual panels fabricated off site, placed on the bridge, and transversely post-tensioned to connect them. A hot mix asphalt wearing surface was used to seal the deck panels and provide ride quality. Selected panels were embedded with electronic gauges to measure strains due to traffic, self weight, and post tensioning forces. The gauges provide information on the structure response, which is collected and analyzed, then compared to finite element (FE) models to predict behavioral response. This process, called structural health monitoring, will be continued for an additional two years after construction. The main objectives are:

1. Evaluate the structural response and behavior of the Parkview Bridge under loads for an extended period of time (two years) beginning in February 2010. This will be accomplished using the data collected by the sensor network that was installed in the previous phase of this project.

2. Structural performance assessment and validation (reality check) of design assumptions using finite element (FE) models verified against sensor data. Primary purpose is the assessment of precast component joint performance.

3. Develop a deterioration prediction model for the precast deck system of the Parkview Bridge that is based on a three-year health monitoring data and FE analysis data.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Task 1: Perform a comprehensive literature survey to identify bridge deck deterioration models that can be used for bridge health monitoring. The task has been completed.

Task 2: Health Monitoring of the Parkview Bridge Deck. Ongoing, using the sensor network that is already installed in the deck to accomplish this task. The monitoring is divided into following four categories:
– Monitor longitudinal strains/stresses at critical sections in the composite bridge deck at mid span and over the pier.
– Monitor stresses/strains at both sides of the closure grout section between the north and south panels to evaluate the integrity of this part of the deck with time.
– Monitor and compare the stresses/strain generated at the joints between adjacent panels to evaluate the composite action and connectivity of the various deck panels.
– Monitor transverse strains/stresses at selected locations at mid span and over the pier.

Task 3: Finite Element Modeling of the Parkview Bridge. The following subtasks are continuing:
– Evaluation of the sensor data to learn in detail the behavior of the deck under the different load conditions (dead and live loads, including temperature and traffic). This task requires implementation of signal processing techniques, including detailed statistical analyses to analyze load patterns.
– Development of the FE models continues, specifically investigating the parameters controlling post-tension stress distribution at

deck panel joints.

Task 4: Develop Deterioration Prediction Model for Precast Deck System of Parkview Bridge. We are continuing to collect the sensor data for the four categories listed above. We will be using the data to develop stress envelopes.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Assessment of precast component joint/connectivity performance; perform FE analysis under post tension forces, and intrinsic and highway loads to document structural response; continuation of data collection and processing; complete the final report.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Development of deterioration prediction model for the precast deck system for use by bridge scoping and inspection engineers. Disseminate information regarding the performance of the structure and joint connectivity through proposed design changes.

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Pooled Fund Studies (Active)

Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: IVHS Study (ENTERPRISE)

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	SPR-3(020)		MDOT START DATE	10/01/2004
PROJECT NO.			MDOT COMPLETION DATE (Original)	09/30/2010
			COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Sinclair Stolle, sinclair.stolle@dot.iowa.gov, 515-239-1933			
LEAD AGENCY	Iowa Department of Transportation			
PROJECT MANAGER	Lee Nederveld			
CONTRACTOR				

BUDGET STATUS

FY 2010 MDOT Budget				MDOT Total Budget		
FY FUNDS	(Original)****	$25,000.00		TOTAL BUDGET	(Original)*	$180,000.00
	(Revised)*****				(Revised)**	
TOTAL FY EXPENDITURES		$25,000.00		EXPENDED FUNDS TO DATE***		$180,000.00
				% PERCENT COMPLETE (By Budget)		100%
TOTAL FUNDS REMAINING		$0.00		% PERCENT COMPLETE (By Work)		100%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

AZ, CO, IA, KS, MI, MN, MC, VA, WA

PURPOSE AND SCOPE

To investigate and promote IVHS approaches and technologies that is compatible with other national and international IVHS initiatives.

FISCAL YEAR 2009 ACCOMPLISHMENTS

Program Administration

A transition of the administration for ENTERPRISE was needed for the program to continue. The Michigan DOT agreed at the March 2009 ENTERPRISE Board Meeting to take over the administration of the program. The Iowa DOT and the Michigan DOT began working on details to start the transition process.

Meetings

The ENTERPRISE Executive Board held two meetings during FY 2009.

- December 11 and 12, 2008 in Olympia, Washington. The participants discussed transitioning the administration of the ENTERPRISE Pooled Fund from the Iowa DOT to another ENTERPRISE member state. The primary focus of the meeting was to review project proposals for the FY2009 Work Plan.
- March 19 and 20, 2009 in Phoenix, Arizona. The attendees provided updates on the approved FY 2009 projects as well as previous on-going projects. The group also started to suggest project ideas for FY 2010.

On-going Projects

The ENTERPRISE Executive Board continued work on the following projects that were approved in previous fiscal years and had not yet been completed.

- Intersection Collision Avoidance Phase II. (Note: Project withdrawn due to state funds available.)
- Development and Field Evaluation of Renewable Electric Power Station for Rural ITS Applications. Analysis, development, design, installation, and evaluation of a prototype power station.
    - Project completed.
- Nationwide Advanced Traveler Information System (ATIS). Preliminary analysis and recommendation for a nationwide ATIS.
    - Continued preliminary analysis for a nationwide ATIS and recommend the best approach for implementing the system
- Autonomous Monitoring Station Phase 2. Phase 1 - Demonstrated that the next generation of PCS data networks (1xRTT) could be cost effectively utilized to deploy Total Monitoring Stations operating as autonomous systems along rural highways. Phase 2 - Updated the hardware and software configuration of Phase 1 and conducted an evaluation.
    - Project completed. Final Report submitted.
- IP Cameras. Demonstrated the ITS application of using low-cost satellite communication and renewable solar power to

capture real-time video data of interest to both traffic managers and interested parties.
    - Project completed in February 2009.

FY 2009 Projects

The ENTERPRISE Executive Board reviewed and approved four new projects for inclusion in the FY 2009 Work Plan.

- ITS Warrants Phase 2. To develop warrants for additional technology devices to guide the initial decision of whether or not to deploy a device at a specific location or to validate existing device deployments as a continuation of the four devices (DMS, CCTV, HAR, and RWIS) developed in Phase 1.
    - The group agreed to develop warrants for the following five devices: Curve Warning System, Dynamic Speed Display Sign, Ramp Meter, Variable Speed Sign, and Intelligent Work Zones.
- Mobile Advanced Traveler Information Systems. Pilot deployment of a Mobile ATMS/ATIS application and develop interface control documents.
    - Initial project work began with researching the difference in how internet browsers display information on mobile devices.
- Creating Partnerships with Third-Party Mapping Providers. (Note: Project withdrawn due to other similar efforts.)

Feasibility Study Intelligent Highways. (Note: Project withdrawn due to other similar efforts.)

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Program Management and Administration

Michigan DOT received official approval from FHWA and a TPF number to accept SP&R funds for the ENTERPRISE Pooled Fund to complete the transition of the administration of the program from the Iowa DOT to the Michigan DOT. Michigan DOT began to receive funds from member states for FY2010.

A Request for Proposal (RFP) was distributed from Michigan to solicit a program management consultant for the ENTERPRISE Program. Athey Creek Consultants was selected to provide administrative and technical project support and authorized to start work on September 10, 2010.

New Members

Four new members joined the ENTEPRISE Program (Oklahoma, Idaho, Illinois, and Texas).

Meetings

The ENTERPRISE Executive Board held three meetings during FY 2010.

- **May 21, 2010 in Detroit, Michigan.** The group approved based on research and recommendations to move the hosting of the ENTERPRISE program Web site to Media Temple Grid Service. Project updates were provided on the three FY 2009 projects and the group reviewed and approved the project proposals for FY 2010.
- **June 23, 2010 Conference Call.** The primary focus of the conference call was to review project ideas for FY 2011.
- **August 1, 2010 in Huntington, West Virginia.** The group voted on the FY2011 project ideas and based on the available budget agreed to develop full project proposals for the top seven projects.

On-going Projects

The ENTERPRISE Executive Board continued work on the following projects that were approved in previous fiscal years.

- Intersection Collision Avoidance Phase II
- Development and Field Evaluation of Renewable Electric Power Station for RUal ITS Applications
- Nationwide Advanced Traveler Information System (ATIS)
- Autonomous Monitoring Station Phase 2
- IP Cameras

FY 2009 Project Updates

- **ITS Warrants Phase 2.** Developed warrants for five additional technology devices to guide the initial decision of whether or not to deploy a device at a specific location or to validate existing device deployments as a continuation of the four devices focused on during Phase I.
    - Project completed. Final Report submitted in May 2010.
- **Mobile Advanced Traveler Information Systems.** Pilot deployment of a Mobile ATMS/ATIS application and develop interface control documents.

Project completed. Final Draft Report submitted.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

This project was completed at the end of FY 2010. With the transition of program management from Iowa to Michigan, a new TPF number was created. Future ENTERPRISE updates will appear in the report for TPF-5(231).

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

*The original authorized total budget amount of the study
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Aurora Program

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	SPR-3(042)	MDOT START DATE	10/01/2008
PROJECT NO.	OR08-017	MDOT COMPLETION DATE (Original)	09/30/2010
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Carol Culver, carol.culver@dot.iowa.gov, 515-239-1208		
LEAD AGENCY	Iowa Department of Transportation		
PROJECT MANAGER	Dawn Gustafson		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$25,000.00	TOTAL BUDGET	(Original)*	$75,000.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$25,000.00	EXPENDED FUNDS TO DATE***		$75,000.00
			% PERCENT COMPLETE (By Budget)		100%
TOTAL FUNDS REMAINING		$0.00	% PERCENT COMPLETE (By Work)		100%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

AK, IA, IL, IN, MI, MN, NY, OH, ONTARIO MOT, PA, QUEBEC MOT, SD, SWEDEN NRA, TN UT, VA, WI

PURPOSE AND SCOPE

Aurora is an international program collaborative research, development and deployment in the field of road and weather information systems (RWIS). Commitment of funds received is $3,122,500.00.

FISCAL YEAR 2009 ACCOMPLISHMENTS

In September 2008, the Aurora board approved seven new projects for 2009. Many of the projects correspond with research initiatives identified at the 2007 National Winter Maintenance Peer Exchange.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

2005-05 Using RWIS to Trigger Spring Load Restrictions
This project investigated the use of Road Weather Information Systems (RWIS) to trigger spring load restrictions in Ontario.
2006-04 Evaluation of Vaisala Spectro Pavement Sensor
The objective of this project was to study the accuracy and usefulness of the new Vaisala Spectro sensor performed under real-world highway conditions.
2006-07 Road Weather Information Outreach / National Conference
The project involved funding and conducting a national winter maintenance meeting for Aurora,
Clear Roads, and the FHWA to share research results, solicit research needs, and get updates from each snow-belt state.

MDOT's funding commitment of $75K over FY 2008 – FY 2010 was pooled with partner funds to support approximately $564,000 in contract work underway in this pooled fund study project.

2008	2009	2010
$11,000	$20,000	$50,000
$25,000	$20,000	$25,000
$55,000	$83,000	$120,000
	$50,000	$100,000
		$5,000
$91,000	$173,000	$300,000
	GRAND TOTAL	**$564,000**

FISCAL YEAR 2011 PROPOSED ACTIVITIES

- **2006-05 Technology Transfer of Alternative Inexpensive RWIS**

The purpose of this project is to research, through a proof of concept test, the ability to integrate pavement thermistors to existing atmospheric weather stations and document the application of this new RWIS concept for pavement management and to develop

urban sighting guidelines for the addition of pavement sensors to existing infrastructure. Michigan Department of Transportation is team member.

- **Multiple-Use Intelligent Transportation System Data Collection Sites**

The objective of this project is to integrate, through a proof-of-concept, non-obtrusive traffic data collection technology at road weather information system (RWIS) sites in an arctic environment. Michigan Department of Transportation is a team member.

- **2009-04 Road Weather Education Enhancements and Dissemination**

The objective of this project is to develop methods and/or materials to disseminate existing road weather and RWIS educational materials. Michigan Department of Transportation is the team champion.

Aurora has also approved 10 new projects for fiscal year 2010. Among them is a project to hold a third peer exchange with winter states, organizations and vendors to address industry needs.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

Regional demonstration of RWIS concepts to support FHWA's goals of Safety, Mobility and Operations.

MDOT has benefited through Aurora participation in many ways. The members of Aurora have provided an excellent network for MDOT to utilize during the development and deployment of a RWIS in the state. Technologies such as those involved in RWIS are fast changing with new developments. The Aurora team allows states to work together and obtain a larger benefit for the group. MDOT is the champion on a project that will help to compile and consolidate training for RWIS. This will be a direct benefit to MDOT as RWIS is implemented. Other projects will provide information on new sensors, utilizing sensor data to completed analyses and evaluations, and deployment of RWIS into other traffic hardware such as dynamic message signs and traffic control signals.

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Base Funding for the North Central Superpave Center

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(021)	MDOT START DATE	10/01/2005
PROJECT NO.		MDOT COMPLETION DATE (Original)	09/30/2009
		COMPLETION DATE (Revised)	09/30/2011
TECHNICAL CONTACT	Tommy Nantung, tnantung@indot.in.gov, 765-463-1521 ext 248		
LEAD AGENCY	Indiana Department of Transportation		
PROJECT MANAGER	John Barak		
CONTRACTOR	Purdue University		

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$25,000.00	TOTAL BUDGET	(Original)*	$100,000.00
	(Revised)*****			(Revised)**	$150,000.00
TOTAL FY EXPENDITURES		$25,000.00	EXPENDED FUNDS TO DATE***		$125,000.00
			% PERCENT COMPLETE (By Budget)		83%
TOTAL FUNDS REMAINING		$25,000.00	% PERCENT COMPLETE (By Work)		85%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

IA, IL, IN, KS, MI, MO, WI

PURPOSE AND SCOPE

The North Central Superpave Center serves nine states and two Canadian provinces by acting as a Superpave and hot mix asphalt information clearinghouse; performing test equipment and protocol evaluations, ruggedness, precision and bias testing; conducting research of local, regional, national and international interest; planning and presenting training programs; and more. This pooled fund project will provide for continued operation of the North Central Superpave Center to assist agencies and industry with Superpave implementation and hot mix asphalt issues. Contract Amount is $125,000. The commitment received is $800,000.

FISCAL YEAR 2009 ACCOMPLISHMENTS

Continued work in the areas listed above, as well as interaction with other Superpave centers and transportation agencies. The North Central Superpave Center participated in putting on the 2009 North Central Asphalt User/Producer Group's Annual Hot Mix Asphalt Technical Conference in Madison, Wisconsin. The Superpave Center provided funding for a representative from the Michigan Department of Transportation to attend this conference. The topics of the conference included, "Asphalt Cost and Supply Issues", "Binder Modification and Alternatives" and "Environmental and Sustainable Technologies. These are all currently topics of interest for the Michigan Department of Transportation and the conference proved to be an opportunity for the transfer of technology.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The Superpave Center kept MDOT informed of current issues in the hot mix asphalt arena using e-mailed surveys. This allows MDOT to not only request information from other participating states but also to contribute information to other states. The North Central Superpave Center's Web site has also been a valuable source of information.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Continue using the resources described in the "Fiscal Year 2010 Accomplishments to Date" section.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Long-Term Maintenance of Load and Resistance Factor Design Specifications

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(068)	MDOT START DATE	10/01/2003
PROJECT NO.	OR03-003	MDOT COMPLETION DATE (Original)	09/30/2010
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Carol Culver, carol.culver@dot.iowa.gov, Phone 515-239-1208, Fax 515-239-1766		
LEAD AGENCY	Iowa Department of Transportation		
PROJECT MANAGER	Rebecca Curtis		
CONTRACTOR	Modjeski and Masters, Inc.		

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$20,000.00	TOTAL BUDGET	Orig. Fund. - FY03 & FY05 @ $40k ea.	$120,000.00
	(Revised)*****			Added FY08 & FY10 @ $20k ea.	
TOTAL FY EXPENDITURES		$20,000.00	EXPENDED FUNDS TO DATE***		$120,000.00
			% PERCENT COMPLETE (By Budget)		100%
TOTAL FUNDS REMAINING		$0.00	% PERCENT COMPLETE (By Work)		100%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

AK, AL, AR, CA, CO, CT, DE,FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NV, NY, OH, OK, OR, PA, PR, SC, SD, TN, TX, UT, UV, VT, WA, WI, WV, WY

PURPOSE AND SCOPE

To provide timely assistance to the AASHTO Highway Subcommittee on Bridges and Structures (SCOBS) in interpreting, implementing, revising, and refining the AASHTO load and resistance factor documents.

FISCAL YEAR 2009 ACCOMPLISHMENTS

MDOT funding commitment was in 2008 and 2010; following is a summary of what the contractor reported on the TPF program Web site: From September 1, 2008 to August 31, 2009, the contractor prepared agenda, table of contents, and other documents for the 2009 SCOBS annual meeting. The Contractor participated in technical meetings of the T-5, T-10, and T-14, as well as attended/participated in the 2009 SCOBS meeting.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

As reported by the contractor on the TPF program Web site; activities during this period included preparation of the agenda for the 2010 SCOBS annual meeting, attendance at meetings of the T-10 and T-14 (including prep. agenda). Upon request the contract vendor prepared Interims for many of the Bridge specifications and Manuals for 2010. Additionally, a “practice run” was prepared, by developing the 2009 Interims for the Seismic Guide Specifications, MBE and CoRe document. This project is scheduled to close in 2010.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

Specification changes are incorporated as guide specifications and later made part of the LRFD Specifications, based on the approval and voting by the State Bridge Engineers at their annual meetings.

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Transportation Library Connectivity

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(105)	MDOT START DATE	10/01/2008
PROJECT NO.	OR08-019	MDOT COMPLETION DATE (Original)	09/30/2009
		COMPLETION DATE (Revised)	09/30/2010
TECHNICAL CONTACT	Ann Pahnke, ann.pahnke@dot.state.wi.us, 608-267-2294		
LEAD AGENCY	Wisconsin Department of Transportation		
PROJECT MANAGER	Alexandra Briseno		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$5,000.00	TOTAL BUDGET	(Original)*	$10,000.00
	(Revised)*****			(Revised)**	$20,000.00
TOTAL FY EXPENDITURES		$5,000.00	EXPENDED FUNDS TO DATE***		$20,000.00
			% PERCENT COMPLETE (By Budget)		100%
TOTAL FUNDS REMAINING		$0.00	% PERCENT COMPLETE (By Work)		100%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

AZ, CA, CT, MN, IA, ID, KS, LA, MN, MO, MS, MT, NM, NY, OH, OR, PA, TN, WA, WI

PURPOSE AND SCOPE

The Transportation Library Connectivity Pooled Fund Study was instrumental in improving access to transportation information and building awareness of the importance of library services and Transportation Knowledge Networks.
Through the work of the pooled fund members, both individually and collectively, and the work of the pooled fund consultants, there has been much progress:
• Increased cooperation among member libraries in the collection, cataloguing and sharing of transportation resources.
• Widening participation by state DOT libraries in the Online Computer Library Center and the Transportation Libraries Catalog.
• A growing awareness among state DOT managers of the value of transportation libraries and information services to safety, planning, design, construction, operations and maintenance functions as well as to research.
• Momentum toward the formation of additional regional Transportation Knowledge Networks.
• Increased awareness of and participation in the activities of the National Transportation Library, regional Transportation Knowledge Networks and NCHRP project 20-75 on implementing TKNs.
• Creation of a task group on TKNs within the AASHTO Research Advisory Committee, which will provide a forum for ongoing dialogue between the transportation library/information community and state DOT research managers.
• Creation of the Transportation Librarian's Toolkit, a vital education and training tool that will be of immediate value to transportation librarians and other information professionals and managers.

FISCAL YEAR 2009 ACCOMPLISHMENTS

TAC members worked closely with the pooled fund consultants to arrive at the following objectives for 2009. They are aimed at helping members raise the level of service they provide to their DOT customers and at communicating to top management the value of information services and the highly trained professionals who provide them.
1. Technical guidance and support to members, focused on the smaller libraries and solo librarians. Support activities will include such things as site visits, advice on cataloging, interlibrary loan procedures, integrated library systems and library Web presence (Internet and Intranet).
2. Quarterly topic oriented teleconferences of pooled fund members to enable sharing of best practices and new ideas.
3. Promotion of the value and importance of transportation library and information services to top-level transportation administrators throughout the country through targeted activities, such as:

- Feature articles that vividly tell the stories of library and information professionals helping agencies save time, money and lives. (See TRNews March/April, No. 261)
- Presentations to gatherings of top-level DOT administrators, such as meetings of AASHTO committees (Highways, Planning, Environment, Highway Traffic Safety).
- Poster session for the TRB 2009 Annual Meeting that features top-level transportation administrators pointing to the value of their libraries in critical endeavors at the heart of their agencies' missions.

4. Second edition of the Transportation Librarian's Toolkit and a workshop emphasizing how it can be used with top-level administrators to demonstrate the range and value of library and information services.
5. Annual meeting to conduct pooled fund business and prepare for FFY2010.
6. Continued enhancement of the project Web site as a one-stop shop for pooled fund resources and business, including the tracking and reporting of relevant state, regional and national efforts.
7. Support of members in their efforts to strengthen regional Transportation Knowledge Networks.
8. Collaboration with the National Transportation Library, the new AASHTO RAC Task Group on TKNs, TRB LIST and others, including retired transportation librarians, to enhance communication between transportation librarians and the transportation research community and to build broader support for and funding of a national network of transportation libraries among top-level transportation administrators at the state and federal level.
9. Facilitation of payment of OCLC and TLCat subscriptions for eligible pooled fund members.
10. Implementation of focused research and technology projects, as proposed by members, on specific topics, such as: increased sharing of resources through the TKN Resource Sharing Pilot Project, Expansion of the California LTAP G3 program to other states, Preservation and transfer of historic ASTM standards 1935-1999, and others.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

TAC members worked closely with the pooled fund consultants to arrive at the following objectives for 2010. They are aimed at helping members raise the level of service they provide to their DOT customers and at communicating to top management the value of information services and the highly trained professionals who provide them.
1. Technical guidance and support to members, focused on the smaller libraries and solo librarians. Support activities will include such things as site visits, advice on cataloging, interlibrary loan procedures, integrated library systems and library Web presence (Internet and Intranet).
2. Quarterly topic oriented teleconferences of pooled fund members to enable sharing of best practices and new ideas.
3. Promotion of the value and importance of transportation library and information services to top-level transportation administrators throughout the country through targeted activities, such as:

- Presentations to gatherings of top-level DOT administrators, such as meetings of AASHTO committees (Highways, Planning, Environment, Highway Traffic Safety).
- Poster session for the TRB 2010 Annual Meeting that features top-level transportation administrators pointing to the value of their libraries in critical endeavors at the heart of their agencies' missions.

4. Second edition of the Transportation Librarian's Toolkit and a workshop emphasizing how it can be used with top-level administrators to demonstrate the range and value of library and information services was distributed.
5. Annual meeting to conduct pooled fund business and prepare for the end of the TPF-5(105) project and ideas for a new TPF project starting FY2011.
6. Continued enhancement of the project Web site as a one-stop shop for pooled fund resources and business, including the tracking and reporting of relevant state, regional and national efforts.
7. Support of members in their efforts to strengthen regional Transportation Knowledge Networks.
8. Collaboration with the National Transportation Library, the new AASHTO RAC Task Group on TKNs, TRB LIST and others, including retired transportation librarians, to enhance communication between transportation librarians and the transportation research community and to build broader support for and funding of a national network of transportation libraries among top-level transportation administrators at the state and federal level.
9. Facilitation of payment of OCLC and TLCat subscriptions for eligible pooled fund members.
10. Completion of focused research and technology projects: increased sharing of resources through the TKN Resource Sharing Pilot Project, Expansion of the California LTAP G3 program to other states, Preservation and transfer of historic ASTM standards 1935-1999, and others.
11. Two additional states joined the TPF-5(105) project: Illinois & New Jersey DOT.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Project completed on September 30, 2010

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

Results

The transportation library landscape has undergone significant changes since the study began its work in 2005. Many positive developments have been due at least in part to the work of TPF-5(105). The following timeline of important events and publications prior to and during the time of the Library Connectivity study gives a perspective from which to review the accomplishments below.
June 1998 NTL created in U.S. DOT by the Transportation Equity Act for the 21st Century
Oct 1998 Value of Information and Information Services, U.S. DOT
June 1999 First meeting of the TRB LIST Committee
Dec 2001 MTKN formed with NTL support
Aug 2002 Midwest Conference on Library and Information Resources for Transportation, Madison, WI
June 2003 Scoping Study for a National Strategic Plan for Transportation Information Management, NCHRP
April 2004 TLC at launched by OCLC with NTL support
Oct 2004 TPF-5(105) Transportation Library Connectivity Pooled Fund Study launched
Feb 2005 Transportation in the Information Age: The Leadership & Investment Challenge, brochure and video, Wisconsin DOT
Aug 2005 NTL reauthorized by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
Jan 2006 Transportation Knowledge Networks: A Management Strategy for the 21st Century, TRB Special Report 284
Aug 2007 WTKN formed
Dec 2007 Transportation Librarian's Toolkit, TPF-5(105)

Mar 2008 AASHTO RAC TKN Task Force formed with TPF-5(105) support
Nov 2008 ETKN formed
Jun 2009 1st Annual National TKN Meeting, Washington, D.C.
Sep 2009 Implementing Transportation Knowledge Networks, NCHRP 643
Sep 2009 Transportation Librarian's Toolkit, Second Edition, TPF-5(105)
Jun 2010 2nd Annual National TKN Meeting, New Orleans, La.

Creation of a National Infrastructure

Study members used their resources to become a prototype national TKN, as proposed in TRB Special Report 284. Features of this infrastructure included providing coordinated communication, sharing of best practices, leveraging resources to help study members, and developing products and projects to benefit the entire transportation library community. Throughout the study, the consultant and study members cultivated a close working relationship with NTL to ensure that activities complemented NTL's strategic goals for a national network.

With staffing and financial support of the pooled fund study and the leadership and initiatives of individual study members, the following positive developments have occurred:

• Formation of regional TKNs encompassing all four AASHTO regions. When the study began, there was only one regional network: MTKN. Through the leadership of study members and services provided through the study, two additional regional networks were formed: WTKN and ETKN.

• Formation of the AASHTO RAC TKN Task Force. Study members helped initiate formation of the task force through conversations with RAC members, drafting of initial organizational documents, and facilitating and underwriting the initial teleconferences.

• Enhanced resource sharing arrangements between state, national and academic transportation libraries.

• National TKN coordination meetings funded by the study and organized in part with study resources. See information on NTL's Web site.

• Participation of non-state DOT libraries, such as those within university transportation centers and county government.

Increased Awareness of the Value of Library and Information Services

The study raised awareness among transportation officials, decision makers and practitioners of the value of robust transportation libraries and the services they provide. Through cooperative partnerships with NTL, AASHTO, TRB and SLA, the study engaged in targeted outreach activities designed to reach stakeholders at the state and national levels. Without the leadership and resources of the study, the broad support for libraries and TKNs outside the library community would not have developed as quickly or to the same extent. Examples include the following:

• Communication and partnerships grew between study member states and national organizations and large universities such as NTL, AASHTO, the TRB LIST Committee, Northwestern University and the University of California at Berkeley, resulting in beneficial projects.

• Struggling libraries are now participating at the regional and national level. Two DOT libraries that were previously eliminated were reinstated by their agencies and are now study members.

• Sponsorship opportunities offered by the study enabled continued participation by two DOT libraries that would not have had the budget on their own.

• Support for a national TKN continues to grow. The study worked to build a relationship with NTL from the very beginning and has maintained a closely coordinated agenda with NTL to help make the national TKN concept a reality. There now appears to be broad support within U.S. DOT's Research and Innovative Technology Administration for a national network. The study helped create the AASHTO RAC TKN Task Force, which has established an open line of communication between state research directors and the library and information community.

• The Transportation Librarian's Toolkit developed through the study served a dual purpose: a roadmap for librarians to streamlined, high-impact library services and an effective outreach tool for use with those outside the library community. The Toolkit raised awareness of the highly specialized nature of transportation library services and the professional competencies vital to delivering them.

• Study members and consultants contributed several articles to the March/April 2009 issue of TR News that underscored the value of library and information services to DOT decision makers.

• Study members and consultants organized and contributed to outreach activities at the TRB annual meetings in 2007, 2009 and 2010 with sponsorship from the TRB LIST Committee. The 2007 panel session, Transportation Information Revolution: The World at Your Doorstep, presented perspectives from decision makers, practitioners and librarians on the value of improved access to relevant information and on early efforts to create a national TKN. Poster sessions in 2009 on Developments and Innovations in Transportation Libraries and Information Services and in 2010 on Innovative Applications of Social Media and Web 2.0 Technologies in Transportation Research and Communication highlighted innovative research tools and social media for transportation information professionals.

Library Connectivity and Increased Access to Information Resources

The resources and leadership of the study have led to a systematic increase in connectivity among transportation libraries across the country. This has resulted in increased sharing of best practices among study members and the greater transportation library community. Opportunities included:

• Technology-focused teleconferences highlighting tools and services used in transportation libraries, such as digitization, Web 2.0 and federated search.

• Participation in and topical input to NTL's Transportation Librarians Roundtable series.

• Webinars from Outsell, Inc. about vital library practices such as outreach and marketing of services, strategic planning and return on investment strategies.

• Library Peer Exchange with study members from Michigan DOT, Minnesota DOT, Ohio DOT, Louisiana DOT and Wisconsin DOT. The exchange centered on the challenge of delivering better services with fewer resources in difficult economic times. Topics included access to online resources, IT challenges, core serials subscriptions, maximizing access and use of free resources.

Resource sharing has increased while costs have been lowered. The study provided a mechanism for interested members to obtain subscriptions to key library catalogs using their 100 percent federal funds.

• Subscription fees were paid on member request to OCLC's WorldCat, the largest library catalog with more than 27,000 member

libraries and 1 billion holdings worldwide. The result was the addition of several new OCLC subscribers and the continued participation of several existing subscribers, enabling access to the catalog and streamlined cataloging, borrowing and lending among members.

• Subscription fees were also paid on member request to OCLC's TLCat, a transportation subset of WorldCat that was launched in 2004 as a cooperative project of NTL, MTKN and OCLC. Currently TLCat has holdings from 36 transportation libraries. This group catalog allows researchers and librarians to conduct targeted searching of transportation materials and streamlines the borrowing and lending processes.

The study provided funding for a FedEx shipping account for use by TKN members to offset the cost of sending physical materials to borrowing libraries. Projects funded through this account are listed below. Final reports are included in Appendix B.

• National TKN Resource Sharing Pilot. OCLC Resource Sharing subscriptions and FedEx shipping costs were covered for TKN libraries. Metrics on lending and borrowing were compiled for the first time on a national scale, and the University of California at Berkeley and Northwestern University discontinued their previous lending charges to TKN libraries. The project's success has led to the proposed continuation and expansion of the program by Northwestern, UC Berkeley and the Virginia Transportation Research Council.

• Pilot Expansion of the California Going, Going, Gone … Program. G3 is a program of the California Local Technical Assistance Program, administered by the University of California at Berkeley Institute of Transportation Studies, to distribute surplus copies of printed publications to public employees on request. The study funded a pilot project to expand the G3 program to all 50 states by covering shipping costs of materials sent to participants outside California. It is indicative of the challenges involved, including funding, that the G3 pilot served as the closest thing to a true clearinghouse that the transportation library community has seen.

• Historic ASTM Transfer. A complete set of historic ASTM standards was rescued from destruction by Washington State DOT Library in cooperation with the Washington State Library and the Federal Highway Administration Turner-Fairbank Highway Research Center Library. The study provided funds to pack and ship the set of standards from 1933 to 1999 from Washington state to a permanent home in the library collection at FHWA in Washington, D.C.

Networking and Professional Development for Member Librarians

Participation in key transportation library meetings greatly enhanced professional development opportunities for study members:

• SLA annual meeting and conference for five consecutive years, resulting in record numbers of DOT librarians present at the annual SLA Government Transportation Research Information Committee meeting. Several study members as well as the consultant librarian were active participants in the programming each year.

• Annual meetings of the pooled fund study with programming of national interest. Highlights included a workshop on strategic planning, presentations by members on innovative library services, and exchanges of outreach and marketing materials.

• National TKN meetings in 2009 and 2010. The study worked closely with NTL to plan and execute these meetings. The programs included strategic planning and project brainstorming sessions, updates on reauthorization from RITA administrators and discussion of NCHRP Report 643, Implementing Transportation Knowledge Networks.

• The Transportation Librarian's Toolkit. Two editions of this handbook, available on the Resources page of the study Web site, were developed as a collaborative effort of the study consultant and member librarians. The Toolkit was designed as a guide for transportation librarians of all experience levels to provide quality library services using the best practices of study member libraries.

• Educational webinars. The study contracted with Outsell, Inc. and Bates Information Services to present topics selected by members. Webinars by Outsell gave practical advice on calculating and presenting the ROI of library services, writing and presenting reports to stakeholders, strategic planning and marketing, and outreach to decision makers. Copyrighted materials from Outsell were made available on the members-only section of the study Web site. Mary Ellen Bates' presentation on Librarians as Change Agents introduced many innovative ways to incorporate value-added library services, including syntheses and trend spotting. A Transportation Librarian's Toolkit webinar presented information on space planning, collecting and reporting customer metrics, outreach and delivering essential library services.

Technical Assistance

The consultant librarian provided study members with customized technical assistance throughout the five-year study. The results were higher quality bibliographic records, improved local workflows, placement of qualified librarians, selection of suitable integrated library systems and increased ability to deal with technical library challenges. Highlights of successes resulting from technical assistance activities include:

• The consultant served as liaison with OCLC and oversaw the often complex subscription process. OCLC agreed to hold pricing at the level of the federal libraries group, FEDLINK, with minimal annual cost increases and no increase for 2009-2010. Many libraries were able to participate in OCLC subscription services that would otherwise not have been able to do so.

• The consultant conducted 19 site visits during the course of the study. Site visit reports document the size, holdings, staffing, organizational placement and other characteristics of the libraries, providing a comprehensive look at a significant number of state DOT libraries across the country. The visits also enabled the consultant librarian to provide more individualized technical assistance and resulted in greater familiarity and understanding among study members and in the larger transportation library community.

• The consultant helped draft librarian position descriptions for Tennessee DOT and the Louisiana Transportation Resource Center and also assisted in screening interview candidates at LTRC.

• Consultation was provided to the Mississippi DOT on the selection of a new integrated library system. The consultant librarian reviewed software options, clarified the technical language of the Request for Proposal and consulted throughout the implementation process.

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Recycled Unbound Pavement Materials

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(129)		MDOT START DATE	05/01/2007
PROJECT NO.	OR07-030		MDOT COMPLETION DATE (Original)	05/01/2012
			COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Andrew Eller, andrew.eller@state.mn.us, 651-366-5524			
LEAD AGENCY	Minnesota Department of Transportation			
PROJECT MANAGER	Mike Eacker			
CONTRACTOR	University of Wisconsin – Madison (Prof. Tuncer Edil)			

BUDGET STATUS

FY 2010 MDOT Budget				**MDOT Total Budget**		
FY FUNDS	(Original)****	$25,000.00		TOTAL BUDGET	(Original)*	$75,000.00
	(Revised)*****				(Revised)**	
TOTAL FY EXPENDITURES		$25,000.00		EXPENDED FUNDS TO DATE***		$75,000.00
				% PERCENT COMPLETE (By Budget)		100%
TOTAL FUNDS REMAINING		$0.00		% PERCENT COMPLETE (By Work)		70%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

CA, MI, MN, OH, TX, WI

PURPOSE AND SCOPE

The purpose of this project is to investigate the use of recycled materials as pavement base layers. The project will try to characterize the physical properties of the recycled materials and ascertain what properties contribute to good pavement performance. Environmental concerns with recycled materials will also be investigated. The recycled materials to be investigated will be:

1. 100% crushed concrete
2. 50/50 blend of crushed concrete and virgin aggregate
3. Recycled asphalt pavement (RAP)

The following tasks will be conducted in this project:

- Construct test sections at the MnROAD research test track using the three materials listed above plus a standard aggregate as the base layer for a common surface type
- Monitor the performance of the MnROAD test sections utilizing in-place instrumentation and periodic testing
- Laboratory testing of the materials used in the MnROAD test sections. Testing to include, but not limited to, resilient modulus testing, material composition analysis, and leaching characteristics
- Laboratory testing of recycled materials sampled from participating state's projects

Reporting of results and any recommendations.

FISCAL YEAR 2009 ACCOMPLISHMENTS

A literature search was conducted and a report on the findings was delivered. Samples of recycled materials for laboratory testing were acquired from participating states. This is being augmented with samples from a couple of other states that are not participating in this pooled fund project. Dr. Edil's team has set up a full-scale test in his laboratories to simulate field conditions. This will used to conduct modulus testing that will help create a link between laboratory-based and field-based resilient modulus results. Monitoring and data collection on the MnROAD test sections is on-going.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Testing of climatic effects on resilient modulus of the various laboratory samples has begun. Testing of the effects of compactive effort on resilient modulus of the various laboratory samples continued. Annual falling weight deflectometer data was collected from the field test sections at the MnROAD test track. The falling weight deflectometer test data was analyzed by the contractor and a report for that task was issued. Leaching characteristics of the laboratory samples continue to be tested. In addition, water samples from drainage through the field test sections at MnROAD are being collected for additional leaching characteristic information.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Resilient modulus testing and leaching characteristic monitoring will continue in the laboratory. Leaching characteristic monitoring, pavement evaluation, and falling weight deflectometer testing will continue on the MnROAD test sections. Abrasion testing of laboratory samples will be conducted. Final report is due November 30, 2011 so there may be some work on that at the end of fiscal year 2011.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Technology Transfer Concrete Consortium

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(159)	MDOT START DATE	10/01/2008
PROJECT NO.	OR08-020	MDOT COMPLETION DATE (Original)	09/30/2012
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Carol Culver, carol.culver@dot.iowa.gov, 515-239-1208		
LEAD AGENCY	Iowa Department of Transportation		
PROJECT MANAGER	John Staton		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$7,000.00	TOTAL BUDGET	(Original)*	$29,000.00
	(Revised)*****			(Revised)**	$35,000.00
TOTAL FY EXPENDITURES		$7,000.00	EXPENDED FUNDS TO DATE***		$21,000.00
			% PERCENT COMPLETE (By Budget)		60%
TOTAL FUNDS REMAINING		$14,000.00	% PERCENT COMPLETE (By Work)		60%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

AL, CA, GA, IA, IL, IN, KS, LA, MI, MN, MO, NC, ND, NY, OH, OK, PA, SD, TX, WI

PURPOSE AND SCOPE

The purpose of this pooled fund project is to identify, support, facilitate and fund concrete research and technology transfer initiatives.

FISCAL YEAR 2009 ACCOMPLISHMENTS

The Spring 2009 meeting of the NCC was held in San Antonio, Texas. The theme for this meeting was ride quality for bridges. Approximately 90 experts attended this meeting from government, industry, and academia. The Fall 2008 meeting was held in St. Louis, MO. The theme for this meeting was Portland Cement which was followed up by a tour of the new Holcim cement plant. Approximately 80 experts attended this meeting.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The Fall 2009 meeting of the NCC was held in St Louis, MO. The theme for this meeting was Cement Standards and Technology for Sustainable Concrete Paving and included a tour of the new Holcim cement plant. Approximately 80 participants from government agencies, industry and academia, including 20 different state DOT representatives. The Spring 2010 workshop was held in Savannah, GA with 85 participants. The theme for this meeting was overlays, including state reports on overlays and the new roller compacted concrete guide.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

The Fall 2010 NCC meeting was held in Sacramento, CA with representatives from 20 states as part of the 72 registrants. The theme of the meeting was advancements in pavement technologies with state reports on the future direction of surface smoothness requirements. The International Conference on Sustainability in Concrete Pavements followed the NCC meeting. The Spring 2011 workshop will be held in April 2011, in Indianapolis, IN.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

MDOT increased its SPR, Part II funding commitment by $2,000.00 for each of the next three years; starting in FY2010. This increase will allow MDOT to retain two representatives during this study.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

This consortium is the national forum for state involvement in the technical exchange needed for collaboration and new initiatives, and be part of the CP Road Map Mix Design and Analysis Track team. The dynamic nature of this group provides continual technology transfer on a variety of topics that are important to the concrete construction community.

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Construction of Crack-Free Bridge Decks, Phase II

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(174)	MDOT START DATE	10/01/2008
PROJECT NO.	OR09-142	MDOT COMPLETION DATE (Original)	09/30/2013
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Rodney Montney, rodney@ksdot.org, 785-291-3844		
LEAD AGENCY	Kansas Department of Transportation		
PROJECT MANAGER	Tim Stallard		
CONTRACTOR	University of Kansas		

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$15,000.00	TOTAL BUDGET	(Original)*	$70,000.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$15,000.00	EXPENDED FUNDS TO DATE***		$30,000.00
			% PERCENT COMPLETE (By Budget)		50%
TOTAL FUNDS REMAINING		$40,000.00	% PERCENT COMPLETE (By Work)		45%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

CO, ID, IN, KS, MI, MN, MS, ND, NH, NY, OH, OK, TX, WI

PURPOSE AND SCOPE

The purpose of this project is to study the causes of, and possible solutions for, cracking in bridge decks. An important component of the project is to assist with implementation of the findings into the ongoing design and construction of bridge decks.

FISCAL YEAR 2009 ACCOMPLISHMENTS

The TPF-5(174) Web page quarterly report for 9-30-2009 notes the project work completed is approximately 25% and that the project is on schedule.

The project is continuing with knowledge/technology transfer and looking for additional methods to reduce early age cracking. Additional bridges are being built by state DOT's involved with the project. The latest attempts to reduce early age cracking include extending the wet cure duration, "light" use of shrinkage reducing admixtures, supplemental cementitious materials, and lightweight aggregate for internal curing.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Knowledge/technology transfer continues. The constructions of two new LC-HPC bridge decks were completed in October and November 2010, using the latest recommendations. Evaluation of shrinkage reducing admixtures continues and evaluation of their impact on long term durability has begun. Base parameters have been measured, and the use of cementitious replacements is now being explored. The annual deck crack surveys were completed.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Long term durability tests will continue with shrinkage reducing admixtures, cementitious replacements, and lightweight aggregates. The effects of viscosity modifying admixtures will be evaluated. Field support and construction of further bridges will continue. Evaluation of Tough Air admixture will begin.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Evaluation of Test Methods for Permeability (Transport) and Development of Performance Guidelines for Durability

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(179)	MDOT START DATE	10/1/2008
PROJECT NO.	OR08-021	MDOT COMPLETION DATE (Original)	9/30/2011
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Tommy Nantung, tnantung@indot.in.gov, 765-463-1521 ext 248		
LEAD AGENCY	Indiana Department of Transportation		
PROJECT MANAGER	Samara Sears-Bartz		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$25,000.00	TOTAL BUDGET	(Original)*	$87,000.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$25,000.00	EXPENDED FUNDS TO DATE***		$75,000.00
			% PERCENT COMPLETE (By Budget)		86%
TOTAL FUNDS REMAINING		$12,000.00	% PERCENT COMPLETE (By Work)		86%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

CO, IA, IL, IN, KS, MI, MN, MT, NY, PA, WI

PURPOSE AND SCOPE

The Evaluation of Test Methods for Permeability (Transport) and Development of Performance Guidelines for Durability will study/improve current test methods as well as develop new tests or procedures to evaluate the permeability of concrete and relate to anticipated performance with the use of exposure conditions.

FISCAL YEAR 2009 ACCOMPLISHMENTS

Continued development of new test procedures and protocol. Continued correlation of new test procedures with existing test methods. The research team is completing the literature review and providing a draft to the stakeholders for review and discussion.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Continued development of new test procedures and protocol. Continued correlation of new test procedures with existing test methods. The research team has completed the literature review.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

- Results from literature review are to be reported this Spring during face to face meeting
- The development of new test procedures and protocol are anticipated to be complete in Phase V - expected month 39 (currently month 27)
- Conclusions will be drawn regarding correlation of new vs existing methods in Phase IV - expected month 36 (currently month 27)

The main goal is to find a performance based criteria to develop a spec for permeability. On a side note, they are testing the draft ASTM for chloride permeability-(alternate for the RCP Testing we currently do, it's a 3 day planned test)-which is a much shorter procedure (hours vs days) and has less steps that could possibly let human error into the procedure. We are interested in possibly replacing the RCP testing we currently do with the new procedure, and their correlation data between the two tests would help us make that decision. The implementation plan has not been developed, as the results are not in, this will be addressed in future Phases V, and the final tasks of 2, 3, and 4. I have included the updated timetables and goals.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Transportation Research Program Management Database

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(181)		MDOT START DATE	10/01/2007
PROJECT NO.	OR08-022		MDOT COMPLETION DATE (Original)	09/30/2009
			COMPLETION DATE (Revised)	09/30/2011
TECHNICAL CONTACT	Tim Carlile, carlilt@wsdot.wa.gov, 360-705-7975			
LEAD AGENCY	Washington Department of Transportation			
PROJECT MANAGER	Calvin Roberts/Angela Nelson			
CONTRACTOR	Cambria Solutions, Inc.; The MARRS Building; 1050 20th Street, Ste. 275; Sacramento, CA 95811			

BUDGET STATUS

FY 2010 MDOT Budget				MDOT Total Budget		
FY FUNDS	(Original)****	$0.00		TOTAL BUDGET	(Original)*	$26,000.00
	(Revised)*****				(Revised)**	
TOTAL FY EXPENDITURES		$0.00		EXPENDED FUNDS TO DATE***		$26,000.00
				% PERCENT COMPLETE (By Budget)		100%
TOTAL FUNDS REMAINING		$0.00		% PERCENT COMPLETE (By Work)		25%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

AK, CA, IN, MI, NE, NY, WA,

PURPOSE AND SCOPE

There is no standard database among state transportation departments to track and monitor research projects. Many states use electronic spreadsheets and other manual systems to meet these needs with varying degrees of success. A few states, including California Department of Transportation (Caltrans), have developed fairly sophisticated databases to manage their research projects. Some states are interested in adopting an existing database. Caltrans is willing to make their research program maintenance database (RPMD) database available for this purpose.

State research program business needs vary. Some business needs are consistent across the country but others, while similar, differ due to accounting structure, reporting needs or other factors. To use the Caltrans RPMD, some modification will be required. In addition, a module will be developed to manage information for the TPF projects. Other modifications will also be considered but will require additional funding.

Scope of work:

Identify the research program management database needs of the states partnering in this TPF project, accommodate the system modifications needed for implementation by the Washington State Department of Transportation (WSDOT), and enhance the RPMD to add new functions to meet additional research program management business needs of participating states including management of the Transportation Pooled Fund Module (TPF). It is intended that this work will be contracted through the University of California, Berkeley. Tasks in the study will be to:

1) Review the RPMD and identify general modifications needed by participating states to use the RPMD as currently developed in FileMakerPro.

2) Develop modified RPMD System based on needed modifications identified by Washington State and consideration of needs of other participating states.

3) A summary of business needs necessary to manage TPF projects.

4) Develop the TPF module.

5) Testing and modification: Partner states will test the beta version and necessary changes will be made to provide a functional module.

6) The development team will work with WSDOT to scope the level of effort and cost to convert WSDOT's existing data into to the new system. Caltrans existing data will be converted to the new system as needed.

Task 3 will focus on meeting the needs of Washington State. Other participating states may wish to have a version of the RPMD that has been modified to meet their unique needs, as described in the scope described in Task 3. The cost estimate for Tasks 3 is approximately $68,000 per participating state based on a general work plan and assumptions about the level of work needed by the states. The option for states who may not need all the services or items listed in Task 3, or have needs for different or additional support can work with the selected vendor to develop an agreed upon scope of work and cost. Funding based on the negotiated scope of work can be contributed to the pooled fund effort to obtain contractor support.

The longer term vision for this project may include additional activities, depending upon the needs of the pooled fund participants. Additional mid-term activities can include:

1. Adding additional functions and capabilities to the RPMD, as jointly requested, with the goal of keeping a common base for all participating states.
2. Using the RPMD as a base application, tailoring the database to meet unique needs of specific participating states.

Longer term activities can include:

3. Migrating the RPMD to a different technology platform such as Oracle/Java or SQL/.Net.

FISCAL YEAR 2009 ACCOMPLISHMENTS

The lead investigator headed the interview and selection process for a contractor to develop the database tools needed by the various participating states. Negotiated the contract ensuring the needs of all of the participating states would be met.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Due to unforeseen circumstances, the FileMakerPro database was not installed on staff computers during FY 2010. The state of California's Department of Transportation's Office of Information Technology (CalDIT) has partnered with Cambria Solutions, Inc. to immediately begin programming the database in an internet language. This internet language is fully supported by the Michigan Department of Information and Technology (MDIT), which, FileMakerPro was not. Once complete, the new database system will be fully compatible with existing servers, firewalls, and software packages. This will allow Office of Research and Best Practices (ORBP) and MDIT to easily integrate the research information currently entered into Excel spreadsheets and an Access database directly into the internet version of the RPMD. This development makes it unnecessary for ORBP staff to first learn FileMakerPro and then the Web version of the software. There will be one learning curve and training period for the MDOT staff that will be using the information housed in the RPMD for administrative and managerial purposes once the internet version of the product is complete.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

CalDIT will work closely with Cambria Solutions, Inc. to create and test an internet version of the RPMD. This system will be available for use by pooled fund members by September 2011. Angela Nelson will be in contact with pooled fund members monitoring and reporting on the progress of the internet version of the RPMD will also sharing MDOT's needs as appropriate. The internet version of the RPMD is expected to be available to pooled fund partners no later than September 2011. At this point, CalDIT will work with MDIT to load, test, and make the software available to ORBP staff. The remaining work during FY 2011 and FY 2012 possibly will be funded with unused MDOT funds in the amount of approximately $16K.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

This change in direction and partnership will allow MDOT to receive the final Web version of the RPMD years prior to the initial estimated time frame. ORBP will not have to load, learn and test the RPMD on a separate database system (FileMakerPro) which is not support by MDIT anyway. ORBP staff can be directly trained on the final beta software, limiting confusion, training time, with quicker final implementation to all MDOT users of the database. This Web based system will be fully support by MDIT who already have connections with CalDIT for quick implementation and trouble shooting should any issues arise.

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

Once the full beta version of the internet RPMD is available, CalDIT will work with MDIT to first make if fully accessible to the appropriate ORBP staff. This should occur no later than September 2011. Cambria Solutions, Inc., CalDIT, Caltrans, pooled fund participants, MDIT and ORBP staff will all work together to ensure MDOT information is properly loaded, the staff are fully trained, and the systems working properly with all necessary security features in place prior to allowing various levels of secured access to other stakeholders whose access to the information stored in this database pertains to their ability to accomplish necessary work assignments. It is projected that project managers will be trained to use the system no later than Spring 2012 and no later than Fall 2012.

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Improving the Foundation Layers for Concrete Pavements

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(183)	MDOT START DATE	10/01/2008
PROJECT NO.	OR09-143	MDOT COMPLETION DATE (Original)	09/30/2013
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Carol Culver, carol.culver@dot.iowa.gov, 515-239-1208		
LEAD AGENCY	Iowa Department of Transportation		
PROJECT MANAGER	Mark Grazioli		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$35,000.00	TOTAL BUDGET	(Original)*	$175,000.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$35,000.00	EXPENDED FUNDS TO DATE***		$70,000.00
			% PERCENT COMPLETE (By Budget)		40%
TOTAL FUNDS REMAINING		$105,000.00	% PERCENT COMPLETE (By Work)		40%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

CA, IA, MI, PA, WI

PURPOSE AND SCOPE

To Improve the foundation layers and construction practices and verification for base support of Portland Cement Concrete pavements. This work will also be applicable for foundation layers for Hot Mix Asphalt pavements.

FISCAL YEAR 2009 ACCOMPLISHMENTS

The project began. The research team surveyed each state regarding specifications, construction testing and practices, past relative state DOT research projects and material source information. Two Technical Advisory Group conference call meetings were held. In May 2009 the research team mobilized and spent one week testing, sampling and assessing materials and practices on MDOT's I-94 pavement reconstruction project in St. Clair County. They arranged and performed unique to Michigan testing including Intelligent compaction equipment, Light Weight Deflectometer stiffness and in place field permeability using a gas permeameter. They also visited projects in Iowa and Pennsylvania later in the summer. In October, Dr. White from Iowa State University presented initial results from the I-94 testing at the National Concrete Consortium Fall Technology Transfer Conference.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

In May 2010, the research team visited a second MDOT project, the I-96 reconstruction work west of Lansing in Delta Township. They performed many of the same testing as the previous year on I-94 in St. Clair County. Of interest, on I-96, was the constructed base was bound cement treated crushed concrete. Comparison with the unbound aggregate base on I-94 will help MDOT assess base selection in the future. No project report has been produced to date.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Following will be the main emphasis for 2011:

- Complete data analysis for the field projects and develop project reports for TAC review and comments.
- Finish a report summarizing M-EPDG sensitivity analysis results.
- Finish phase I report.
- Conduct periodic performance monitoring testing in Iowa.
- Finish fabrication of the large scale permeameter and the frost-heave susceptibility test equipment.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

Expand the preliminary (research) use of Intelligent compaction equipment and Light Weight Deflectometers to additional MDOT projects through this pooled funds project.

*The original authorized total budget amount of the study
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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Concrete Pavement Road Map Operations Support

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(185)	MDOT START DATE	10/01/2008
PROJECT NO.	OR09-144	MDOT COMPLETION DATE (Original)	09/30/2011
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Ahmad Ardani, Ahmad.Ardani@dot.gov, 202-493-3422		
LEAD AGENCY	Federal Highway Administration		
PROJECT MANAGER	John Staton		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$25,000.00	TOTAL BUDGET	(Original)*	$75,000.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$25,000.00	EXPENDED FUNDS TO DATE***		$50,000.00
			% PERCENT COMPLETE (By Budget)		67%
TOTAL FUNDS REMAINING		$25,000.00	% PERCENT COMPLETE (By Work)		67%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

IA, MI, MS, NY, PA, VA

PURPOSE AND SCOPE

The purpose of this pooled fund project is to provide the necessary resources for operational management of the CP Roadmap.
The scope of work includes:

- Coordinating and facilitating Executive Committee's leadership and oversight activities and decisions
- Overseeing track- and project-level budgets
- Providing detailed financial and progress reports as described under Reporting, below
- Inspiring and facilitating stakeholders' support for and active participation in the CP Road Map
- Championing the CP Road Map to stakeholders and the public

FISCAL YEAR 2009 ACCOMPLISHMENTS

The TPF-5(185) Web page quarterly report (9/30/09) for the current Iowa State University/FHWA: Contract No. DTFH61-06-D-00023 executed under the TPF project is as follows:
Project Dates: September 11, 2008 – July 12, 2010 (Task Order No. 3)
Project Title: CP Road Map Administrative Support Contract
(Task Order No. 3 – Continue Activities to Initiate CP Road Map)
Contract Amount: $409,588.
Contract Balance: $270,016.
Contract Funds Expended: 34%

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MDOT's Project Manager's Report of accomplishments:

- Initiated contact with 5 DOT and PCC industry representatives to set up webinars to develop research needs and potentials for collaboration.
- Held bi-monthly conference calls for all of the participating pooled fund states.
- Published one MAP (Moving Advancements into Practice) Brief on use of Geotextiles as a stress relief layer. Draft of MAP Brief for diamond grinding is completed and out for review. Six others will be developed.
- Contacts made with Priority Track Leadership Team members to update the research activities for each track.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

- A presentation was developed for the International Conference on Sustainable Concrete Pavements which was held in Sacramento, California on September 15-17, 2010.
- Two MAP Briefs were developed and are listed as follows:
  - Two-Lift Concrete Paving
  - Roller Compacted Concrete (RCC)

- Developed three monthly e-news.
- Communicated with FHWA on MAP Brief topics and general project questions on the phone and in person in California at the NC2 meeting. The Sustainability Track Leadership conference call was held on July 13, 2010.

Brief summary of research and activities pertaining to the project:

- Each month a new edition of the e-News is developed and distributed which includes a tech brief. Subjects include:
  - ACPA launches Web site database for concrete overlays
  - Virginia Transportation Council investigates high friction surfaces
  - University of Illinois investigates two-stage mixing for recycled concrete aggregates
  - Texas research project evaluates alternatives to asphalt for sub-base layers
  - Free ACPA software helps users develop job-specific dowel bar designs
  - Special Issue - Updates from International Technology Scanning Tour on Long-life Concrete Pavements
  - MAP Brief 13-1: Two-lift Concrete Paving
  - Two-lift concrete paving
  - Concrete pavement design catalogs
  - High-quality concrete pavement foundations
  - Improved concrete mixture designs
  - Geotextile interlayers between cement-bound layers
  - Exposed aggregate concrete pavement surfaces
  - Highlighted research in Minnesota
  - RCC MAP Brief
  - September links include:
  - Dowel Bar Retrofit Performance in Wisconsin
  - Evaluation of In-Situ Stiffness of Subgrade by Resilient and FWD Modulus
  - Improving Concrete Overlay Construction
  - Quantifying Pavement Sustainability for Ontario Highways
  - Effect of Pavement Type on Fuel Consumption and Emissions in City Driving
- Preparation for and participated in the Sustainability Track Leadership conference call held on July 13, 2010.
- Presented at the NC^2 meeting for the CP Road Map in Sacramento, California on September 14, 2010 to update the states on the current status of the Road Map.
- Prepare for and attended the International Conference on Sustainable Concrete Pavements which was held in Sacramento, California on September 15-17, 2010.
- Preparations have begun to schedule a face-to-face Executive and Pool Fund Committee meeting sometime in December 2010 or early 2011.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

- Continue to work to set up discussions for industry and DOT interaction.
- Develop e-news and MAP Briefs for continued distribution.
- Implement changes to the Design Track Leadership's key areas of concentration and subcommittee membership as necessitated by the conference call of January 6, 2010.
- Set up a conference call with state DOTs.
- Set up conference call with all track leadership groups including Business Track.
- It is planned to hold regular Web meetings on the sustainability track and invite researchers around the country to participate.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

STUDY TITLE: Implementation of Concrete Pavement Mixture Design and Analysis (MDA) Track of Concrete Pavement Road Map

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(205)	MDOT START DATE	10/01/2008
PROJECT NO.	OR08-025	MDOT COMPLETION DATE (Original)	09/30/2011
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Carol Culver, carol.culver@dot.iowa.gov, 515-239-1208		
LEAD AGENCY	Iowa Department of Transportation		
PROJECT MANAGER	John Staton		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$15,000.00	TOTAL BUDGET	(Original)*	$45,000.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$15,000.00	EXPENDED FUNDS TO DATE***		$30,000.00
			% PERCENT COMPLETE (By Budget)		67%
TOTAL FUNDS REMAINING		$15,000.00	% PERCENT COMPLETE (By Work)		67%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

IA, KS, MI, MO, NY, OK, TX, WISDOT

PURPOSE AND SCOPE

The purpose of this pooled fund initiative is to draw synthesis of pertinent information from various past and currently active research projects, and also to initiate necessary studies in efforts to facilitate linkage between what is currently known and what is needed. The scope work to be covered by this pooled fund addresses focused activities under the Concrete Pavement Road Map (CP Road Map) Track 1, Mix Design and Analysis.

FISCAL YEAR 2009 ACCOMPLISHMENTS

The TPF-5(205) webpage 9/30/09 quarterly report notes the project is on schedule and within budget.
The project expenditures as reported by the Iowa State University (ISU) (lead agency) are approximately 17% of the budget amount.
The service contract period is from May 15, 2009 - May 14, 2011.
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The MDOT's project manager report of accomplishments are as follows:

Tests
Mix Proportions in fresh concrete - Contact has been made with staff at ISU who has a Portable XRF. We are looking at how the programming has to be modified to analyze silica based systems rather than metals.
Set time - Contact has been made with organizations that have devices that can assess setting time using acoustic methods.

Models
What air do we really need - waiting on FHWA contract to allow subcontractor to start work Mix proportioning - A literature review is being conducted to investigate approaches that have been used before.

Specifications
Guide specification - waiting on FHWA contract to allow subcontractor to start work.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Work on the following tasks was either started or was ongoing:

- Investigate on-site proportions analysis tool
- Investigate acoustic methods to determine setting time
- Assess requirements for the air void system
- Develop alternative method of calculating mix proportions including work on a spreadsheet to handle calculations, and comparison of alternative approaches
- Prepare Guide Specification
- Prepare "Check Sheets" to accompany specification
- Contract for funding through the cooperative agreement was signed in September

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Work will continue on preparing mixtures and testing them using the tools developed, to date, as part of this pooled fund project.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Research Program to Support the Research, Development, and Deployment of System Operations Applications of Vehicle Infrastructure Integration (VII)

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(206)		MDOT START DATE	10/01/2008
PROJECT NO.	OR09-146		MDOT COMPLETION DATE (Original)	09/30/2010
			COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Catherine McGhee, cathy.mcghee@virginiadot.org, 434-293-1973			
LEAD AGENCY	Virginia Department of Transportation			
PROJECT MANAGER	Steve Cook			
CONTRACTOR				

BUDGET STATUS

FY 2010 MDOT Budget				MDOT Total Budget		
FY FUNDS	(Original)****	$50,000.00		TOTAL BUDGET	(Original)*	$100,000.00
	(Revised)*****				(Revised)**	
TOTAL FY EXPENDITURES		$50,000.00		EXPENDED FUNDS TO DATE***		$100,000.00
				% PERCENT COMPLETE (By Budget)		100%
TOTAL FUNDS REMAINING		$0.00		% PERCENT COMPLETE (By Work)		100%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

CA, FHWA, FL, MI, NY, TX, VA

PURPOSE AND SCOPE

Through a set of pooled fund studies, the Virginia Department of Transportation (VDOT) proposes to work with federal, state, and local departments of transportation, to establish a multi-phase program to facilitate the development, field demonstration, and deployment of IntelliDrive^{SM} infrastructure applications. In phase 1, the participants in this program will create an IntelliDrive^{SM} infrastructure deployment plan, participate in developing an IntelliDrive^{SM} business plan, and complete applied research to create deployable IntelliDrive^{SM} infrastructure applications. Future phases of the program will focus on large-scale field demonstrations of IntelliDrive^{SM} infrastructure application and evaluation.

The purpose of this program is to provide a means to conduct the work necessary for infrastructure providers to play a leading role in IntelliDrive^{SM}, as described in the AASHTO IntelliDrive^{SM} strategic plan. All efforts will be coordinated with the partners currently engaged in the IntelliDrive^{SM} program namely USDOT and automobile manufacturers.

FISCAL YEAR 2009 ACCOMPLISHMENTS

Program Overall

- Project kick-off meeting:

A project kick-off conference call was held on July 8, 2009. At this meeting, the overall scope of the pooled fund study was reviewed and finalized and the direction for the first year research was presented.

Year 1 Program

- Selection of the applications for the Year 1 Research Program:

A list of potential applications with brief descriptions, goals and objectives was identified and distributed to the Pooled Fund Study members. Feedback was received through a conference call on August 26, 2009 and emails/phone calls. Finally, based on the feedback, three applications for prototyping and evaluation in the Year 1 research program were selected as following:

  - o IntelliDrive Traffic Signal Control Algorithms,
  - o Pavement Maintenance Support, and
  - o Improving Arterial Travel Using Signal Phase and Timing (SPAT) Data.

- Detailed scopes of work have been developed to guide the development and evaluation of the three selected applications for the Year 1 Research Program. Also, the strategy for assembling the research teams capable of completing the applications was prepared. These were finalized by the pooled fund study members.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Year 1 Program

- The University of Virginia Center for Transportation Studies has released two RFPs for two applications for a competitive bidding process on December 4, 2009. These applications are:
  - o Investigating the Potential Benefits of Broadcasted Signal Phase and Timing (SPAT) Data under IntelliDrive, and

- Investigation of Pavement Maintenance Support Applications of IntelliDrive.

- Research Teams for Two Year 1 Applications Selected
  - In response to the RFPs for two Year 1 applications, i.e. Pavement Maintenance Support Application (PMSA) and Signal Phase and Timing (SPAT) Data Application, 13 proposals – six for PMSA and seven for SPAT – were received by January 15, 2010.
  - Received proposals were evaluated by the review panel consisting of one representative from each of the pooled fund study members, AASHTO and the pooled fund study management team by January 26, 2010.
  - Finally, based on the evaluation scores and the negotiation results, the University of California PATH Program was selected for the Signal Phase and Timing (SPAT) Data Application project and Auburn University for the Pavement Maintenance Support Application (PMSA) project.
- Kick-off Conference Calls Held
  - Kick-off conference calls with the selected research teams for the Year 1 applications were held as following:
  - Pavement Maintenance Support Application (PMSA) with Auburn University on Monday, March 8 3:00-4:00PM
  - Signal Phase and Timing (SPAT) Data Application with the University of California PATH on Monday, March 15 1:00-2:00PM

IntelliDrive[SM] Traffic Signal Algorithms

- Task2 and Task3 reports delivered
  - UVA CTS has submitted a report for Task2: Development of New Traffic Signal Algorithms and Task3: Development of Tools for Arterial Performance Measures. These reports along with the deliverables from other two projects (see below) were reviewed and distributed to the pooled fund study members for comments.

Signal Phase and Timing Data Application

- Task1 and Task2 report delivered
  - California PATH has submitted a report for Task1: Review of SPAT Data and Task2: Identification of Use Cases. This report identifies and provides concise descriptions of ten potential SPAT applications.

Pavement Maintenance Support Application

- First and Second quarter reports submitted
  - The first and second quarter reports describing the recommended methodologies for IRI estimation and preliminary results was submitted by Auburn University.

Year 2 Program

1. Face-to-face meeting held at the ITS America annual meeting
   - A face-to-face meeting of the pooled fund study members, associate members, liaisons, and the selected contractor was held in Houston, Texas on Wednesday, May 5th 1:00-5:00PM CDT.
   - Major items discussed/presented at the meeting were:
     - The pooled fund study restructuring, and
     - Updates of the three year 1 projects.
2. A face-to-face meeting held on June 22nd
   - In conjunction with the AASHTO meeting, a face-to-face meeting took place at 8:30-12:00EDT on June 22nd in Dulles, Virginia.
   - At this meeting, the designated chairs of four technical committees shared their initial thoughts on the proposed activities for the year 2 research program.
3. Pooled fund study meeting on September 23rd in California
   - Specific items discussed at this meeting were:
     - General updates on the pooled fund study
       - Updates on the current financial status of the PFS
       - New and potential members
4. Year 2 projects selected
   - Two projects were selected to comprise the year 2 program:
     - Development of a Multi-Configurable 5.9 GHz OBE and Retrofit / After-Market IntelliDrive Equipment for Light-Duty Vehicles
     - Standards Compliance and Interoperability Certification for IntelliDrive Hardware and Software
     - Draft scopes of the selected projects were prepared and being discussed

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Year 1 Program

- Three Year 1 projects will be completed early 2011

Year 2 Program

- Scopes for the two selected projects will be finalized
- RFPs for two selected projects will be released to solicit research teams
- Submitted proposals in respond to the RFPs will be evaluated by the pooled fund study members.
- Finally, two projects will be initiated early 2011
- Several other states are in the process of joining with additional funds, another project will be selected and initiated with those funds
- Likely, another project will be initiated that will support the USDOT Dynamic Mobility Application Program. Currently, the PFS is finalizing the MOU process to secure funding for this project

Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Support of the Transportation Curriculum Coordination Council (TCCC)

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(209)	MDOT START DATE	10/1/2009
PROJECT NO.		MDOT COMPLETION DATE (Original)	9/30/2014
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Christopher Newman, Christopher.Newman@fhwa.dot.gov, 202-366-2023		
LEAD AGENCY	Federal Highway Administration		
PROJECT MANAGER	Brenda O'Brien		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$20,000.00	TOTAL BUDGET	(Original)*	$100,000.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$20,000.00	EXPENDED FUNDS TO DATE***		$20,000.00
			% PERCENT COMPLETE (By Budget)		20%
TOTAL FUNDS REMAINING		$80,000.00	% PERCENT COMPLETE (By Work)		20%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

CA, IA, ID, MI, MN, MO, NY, OK, SC, TX

PURPOSE AND SCOPE

Rebuilding and maintaining the nation's highways requires agencies and industry to have a trained and qualified workforce from agencies and industry. With the loss of experience in the workforce, training is an industry priority. Agencies and the highway industry across the country face this serious shortage of trained and experienced personnel because of attrition and an aging workforce. We must meet the challenge to preserve the system investments and carry out capital improvements for future growth.

Since 2000, the TCCC, a partnership between the FHWA, State and local DOTs, and private industry, has diligently worked to support the training of transportation industry's technical personnel. The TCCC's mission is to:

- Provide leadership at the national level.
- Develop and maintain national curricula for the various transportation disciplines.
- Identify training and certification requirements.
- Coordinate/facilitate training efforts.

To achieve its mission, the TCCC embraces the following objectives:

- Optimize resources through concentrated efforts in the development of core training and qualification mediums.
- Improve the skills and abilities of the transportation technical personnel.
- Promote the sharing of technical training resources among government and private transportation industry organizations.
- Promote uniformity in training content and qualification requirements to facilitate reciprocity between States, local organizations, and regions.
- Optimize the usage of AASHTO standards in training development.

This project will be for the creation of a new pooled fund with similar goals to support the TCCC. It will be used for the further development of core curriculum, development of training materials, and tools for sharing training materials.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The TCCC has released a series of free online training sessions related to concrete materials and construction, made possible through pooled funds participation. We expect widespread department and contractor participation in the training modules, as a part of the Department/Industry Construction Quality Partnership initiative. Participation in these training modules is expected to improve quality through a shared knowledge.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

We anticipate the continued development and release of more online training modules related to transportation construction materials, inspection, and administration, all free to those who chose to take the training. By continued support of the TCCC Pooled Funds Study, we will continue to have a voice for the subject matter identified for development into formal curriculum.

Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Transportation Engineering and Road Research Alliance (TERRA)

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(215)		MDOT START DATE	10/01/2009
PROJECT NO.			MDOT COMPLETION DATE (Original)	09/30/2014
			COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Maureen Jensen, maureen.jensen@dot.state.mn.us, 651-366-5507			
LEAD AGENCY	Minnesota Department of Transportation			
PROJECT MANAGER	Andre Clover			
CONTRACTOR				

BUDGET STATUS

FY 2010 MDOT Budget				MDOT Total Budget		
FY FUNDS	(Original)****	$5,000.00		TOTAL BUDGET	(Original)*	$25,000.00
	(Revised)*****				(Revised)**	
TOTAL FY EXPENDITURES		$5,000.00		EXPENDED FUNDS TO DATE***		$5,000.00
				% PERCENT COMPLETE (By Budget)		20%
TOTAL FUNDS REMAINING		$20,000.00		% PERCENT COMPLETE (By Work)		20%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

MI, MN, ND, NY, WI

PURPOSE AND SCOPE

TERRA exists to:

- Guide future pavement research investments and activities
- Exchange information, share ideas, and learn research results
- Develop relationships, and provide a network for expanded collaboration and development of proposals
- Attract key public, industry, academic and other program partners to contribute resources
- Expand entrepreneurial use of the capacity and capabilities of the MnROAD facility by pursuing opportunities to serve a broader research community

TERRA was formed in 2004 by a task force of government, industry, and academic representatives. TERRA's mission is to develop, sustain, and communicate a comprehensive program of research on pavement, materials, and related transportation engineering challenges, including issues related to cold climates. TERRA does not fund research, but its members have helped secure funding for a $10M program of TERRA-initiated research.

All project funds are utilized to implement the strategic directions and action plans of TERRA, as defined and approved by the full TERRA board. Currently, a majority of TERRA's operating funds are being utilized to disseminate research results and help put these results into practice. Project funds will not be used for research projects. Tasks to be supported by these project funds include, but are not limited to:

- Plan and conduct three board meetings and multiple committee meetings per year to establish research priorities, share research findings, exchange information, and define direction of the organization. Up to two representatives from each member organization can participate on the board.
- Discuss and screen potential research projects and seek partners from the public, academic, and private sectors to collaborate on these projects. Utilize available resources to ensure research is not duplicative.
- Communicate and disseminate TERRA research results and innovations through the use of communication products such as the Web site (www.TerraRoadAlliance.org), quarterly electronic newsletter, and fact sheets.
- Put research results into practice through technology transfer events such as the TERRA Innovation Series.
- Communicate impacts of the organization's activities to national leaders in transportation. Organizational support to staff and manage these activities is outsourced.

Comments: $5,000 per year requested from each organization for five years. In addition, organizations can cover travel to board meetings by adding $2,500 per person per year for up to two people.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

TERRA board meetings were held on November 12, 2009, March 11, and August 19, 2010. Multiple meetings were held by the various TERRA committees throughout FY 2010.

A TERRA Innovation Series Event was held on August 20, 2010, in Madison, WI. This TERRA Innovation Series event highlighted sustainability in transportation. The event was held in conjunction with the 2010 Mid-Continent Transportation Research Forum. Topics included; Sustainability and Environmental Quality Improvements: Environmental review process, best management practices, and construction practices used in Wisconsin; Sustainability and Beneficial Reuse: Of Construction Materials used by Wisconsin DOT; A Hot-Mix-Asphalt Plant Tour: Incorporation of post-consumer shingles and recycled asphalt pavement (RAP) into hot-mix asphalt (HMA) pavement.

Following the General TERRA Project Selection Process, a solicitation for research project ideas from partners and friends was conducted in April and May 2010. Twenty-two (22) projects were submitted in response to this solicitation. Nine project submissions are moving forward in the TERRA project selection process.

TERRA accomplishments in marketing new members resulted in the addition of three (3) new DOT members; Wisconsin, N. Dakota, and NY DOT; and 1 new association; American Traffic Safety Services Association (ATSSA).

TERRA was represented (by MI: A. Clover) at the July 2010 Research Advisory Committee meeting in Kansas City. The meeting brought together 120 representatives of state DOT's, federal agencies, universities, and private consultants to see research results and discuss key issues facing the national transportation research community. TERRA presentation was given at the session on *Breaking Out of the Silos: Coordinating and Collaborating Research Activities to Achieve Greater Strategic Benefits.*

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Host a TERRA Open House at the MnROAD facility in July 2011. TERRA plans to sponsor the Minnesota Pavement Conference in February 2011. The Research and Implementation committee will provide topic ideas to the Marketing and Communications Committee for Fact Sheet topics and E-News articles. Develop three (3) research fact sheets by May 2011. Develop a one-pager highlight FY 2011 accomplishments.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

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Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Clear Roads Winter Highway Operations Pooled Fund [Continued from TPF-5(092)]

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(218)		MDOT START DATE	10/01/2009
PROJECT NO.			MDOT COMPLETION DATE (Original)	09/30/2011
			COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Debra Fick, deb.fick@dot.state.mn.us, 651-366-3759			
LEAD AGENCY	Minnesota Department of Transportation			
PROJECT MANAGER	Tim Croze			
CONTRACTOR				

BUDGET STATUS

FY 2010 MDOT Budget				MDOT Total Budget		
FY FUNDS	(Original)****	$25,000.00		TOTAL BUDGET	(Original)*	$50,000.00
	(Revised)*****				(Revised)**	
TOTAL FY EXPENDITURES		$25,000.00		EXPENDED FUNDS TO DATE***		$25,000.00
				% PERCENT COMPLETE (By Budget)		50%
TOTAL FUNDS REMAINING		$25,000.00		% PERCENT COMPLETE (By Work)		50%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

IA, IN, MI, MN, WI

PURPOSE AND SCOPE

This pooled fund project will maintain its focus on advancing winter highway operations nationally but will include a more pronounced emphasis on state agency needs, technology transfer and implementation. State departments of transportation are aggressively pursuing new technologies, practices, tools and programs to improve winter highway operations and safety while maintaining fiscal responsibility. This pooled fund is needed to evaluate these new tools and practices in both lab and field settings, to develop industry standards and performance measures, to provide technology transfer and cost benefit analysis and to support winter highway safety. This project responds to research and technology transfer needs not currently met by other pooled fund projects. Existing partners make every effort to coordinate with other agencies to avoid duplication of efforts and to encourage implementation of results.

Objectives of this ongoing pooled fund project will include:

- Conduct structured field testing and evaluation across a range of winter conditions and different highway maintenance organizational structures to assess the practical effectiveness, ease of use, optimum application rates, and barriers to use, durability, safety, environmental impact and cost-effectiveness of innovative materials, equipment and methods for improved winter highway maintenance.
- Establish industry standards and develop performance measures for evaluating and utilizing new materials and technologies.
- Support technology transfer by developing practical field guides and training curriculum to promote the results of research projects.
- Conduct cost-benefit analysis to ensure that new technologies, materials or methods contribute to operational efficiency.
- Support the exchange of information and ideas via peer exchanges and collaborative research efforts that provide opportunities for winter maintenance specialists to share experiences related to winter maintenance.
- Promote public education and outreach related to winter maintenance and winter driving safety.
- Conduct state of the practice surveys to share best practices on current operational issues (for example salt shortages, level of service requirements or other hot button issues).

Scope of work - Research reports, technical briefs, synthesis reports, field guides, specifications, PowerPoint presentations, video documentation, training materials, public safety messages and software programs.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

Clear Roads closed out the following projects in FY2010:

- Developing and Evaluating Safe Winter Driving Messages
- Development of Standardized Test Procedures for Evaluating Deicing Chemicals
- Development of Interface Specifications for Mobile Data Platforms on DOT Vehicles
- Development of Standardized Test Procedures for Carbide Insert Snowplow Blade Wear
- Correlating Lab Testing and Field Performance for Deicing and Anti-icing Chemicals (Phase I)

- Development of a Toolkit for Cost-benefit Analysis of Specific Winter
- Maintenance Practices, Equipment and Operations
- Identifying the Parameters for Effective Implementation of Liquid-only Plow Routes
- Final reports for all projects can be found at www.clearroads.org Web site.

MDOT staff will be incorporating results from some of these research projects into presentations given to our maintenance personnel at the TSC's and contract agencies during the Winter Operations Workshops this fall. The MDOT Division of Operations will utilize the results of two of these projects (*Development of Standardized Test Procedures for Evaluating Deicing Chemicals* and *Development of Standardized Test Procedures for Carbide Insert Snowplow Blade Wear*) into specifications for winter material purchases for next season.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

The following projects will be completed during FY 2011.

1) Developing a Training Video for Field Testing of Deicing Materials
2) Development of a Toolkit for Cost-benefit Analysis of Specific Winter Maintenance Practices, Equipment and Operations
3) Identifying the Parameters for Effective Implementation of Liquid-only Plow Routes

Projects to be awarded in FY 2011

1) Understanding the True Costs of Snow and Ice Control Operations

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

*The original authorized total budget amount of the study
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Core Program Services for a Highway RD&T Program – FY 2010 (TRB FY 2011)

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(223)	MDOT START DATE	10/01/2009
PROJECT NO.		MDOT COMPLETION DATE (Original)	09/30/2010
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT			
LEAD AGENCY			
PROJECT MANAGER	Calvin Roberts		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$206,710.00	TOTAL BUDGET	(Original)*	$206,710.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$206,710.00	EXPENDED FUNDS TO DATE***		$206,710.00
			% PERCENT COMPLETE (By Budget)		100%
TOTAL FUNDS REMAINING		$0.00	% PERCENT COMPLETE (By Work)		100%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

(_____ %), (_____ %), (_____ %), (_____ %), (_____ %), (_____ %), (_____ %),

PURPOSE AND SCOPE

To provide a mechanism for state transportation departments to support the TRB's core program and services.

Activities supported by this subscription include the collection of available information concerning past, current, and proposed research related to transportation from all sources including federal, state, and other governmental agencies, colleges and universities, research and planning organizations, transport operators and industry. Also included are activities associated with the TRB Annual Meeting and Conference Programs.

In 2008, the TRB Executive Committee decided to delay the triennium budget until further notice. Therefore, states will be asked to provide their support to TRB on a year-by-year basis until notified otherwise.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

MDOT provide support to TRB through this subscription on an annual basis.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

*The original authorized total budget amount of the study
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Investigation of Jointed Plain Concrete Pavement Deterioration at Joints and the Potential Contribution of Deicing Chemicals

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(224)		MDOT START DATE	10/01/2009
PROJECT NO.			MDOT COMPLETION DATE (Original)	09/30/2013
			COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Todd Hanson, todd.hanson@dot.iowa.gov, 515-239-1226			
LEAD AGENCY	Iowa Department of Transportation			
PROJECT MANAGER	John Staton			
CONTRACTOR				

BUDGET STATUS

FY 2010 MDOT Budget				MDOT Total Budget		
FY FUNDS	(Original)****	$15,000.00		TOTAL BUDGET	(Original)*	$60,000.00
	(Revised)*****				(Revised)**	
TOTAL FY EXPENDITURES		$15,000.00		EXPENDED FUNDS TO DATE***		$15,000.00
				% PERCENT COMPLETE (By Budget)		25%
TOTAL FUNDS REMAINING		$45,000.00		% PERCENT COMPLETE (By Work)		25%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

IA, IN, MI, MN, MY, SD, WI

PURPOSE AND SCOPE

Research Tasks:

1. Perform a literature search on the incidence of PCC joint deterioration nationwide and any proximate causes.

2. Conduct a survey of states and Canadian provinces to determine the incidence of joint deterioration, collect available information on possible causes, including construction practices, maintenance and repair activities, current deicing/anti-icing practices and other concrete performance issues. Distribute the survey, after a panel review of the draft, to obtain suitable information for use in conducting the research.

3. Select appropriate locations for coring and extensive concrete analysis based on survey results and panel input. Each participating state will provide a list of at least two potential sites, including a control, for consideration at the meeting outlined in Task 4. Documentation provided for each site will include age and service history, concrete mix design, aggregate characterization (coarse and fine), method of curing, deicer types and application history, sealant, climatic conditions and the presence and type of any concrete surface treatments.

4. Meet with the technical panel four months after initiation of the project to discuss the project scope and finalize the list of coring locations and develop a sampling plan for each.

5. Examine concrete field samples that will be obtained by the state DOT's, with the cooperation of the researchers, using appropriate test methods to determine concrete quality, hardened air content, permeability, possible mechanisms of deterioration and any effects due to various deicers including a chemical analyses of the cement paste for chloride, sodium and magnesium ions in the top and bottom portion of each specimen (estimated xx cores).

6. Develop a laboratory testing plan, based on any evidence obtained from field cores, designed to duplicate, in an accelerated fashion, the joint deterioration process, or processes, emphasizing any chemical or mechanical agencies which may be involved. Provide an interim report summarizing the results obtained from completing the above tasks and outlining necessary further laboratory testing of both field and laboratory specimens, both to demonstrate any mechanisms thought to cause joint deterioration and to validate proposed methods to repair damage in existing concrete and mitigate any future damage in new concrete.

8. Meet with the technical panel at the researcher's facility to review the interim report and scope of work prior to approval for further testing.

9. Conduct the second phase of laboratory testing to demonstrate joint deterioration by under controlled conditions.

10. Develop joint repair guidelines based on the field and laboratory results and any input from state DOT's as to successful repair strategies.

11. Develop general guidelines for current practices, which will insure minimal damage to concrete pavements and structures while

allowing the ongoing application of appropriate liquid deicers if they are implicated in the deterioration.

12. Estimate effects on concrete life and performance characteristics based on the utilization of different deicers and proposed mechanisms of deterioration with various concrete types using available deicer application strategies and develop life cycle cost analyses derived from the research results.

13. Prepare a final report and executive summary of the literature review, research methodology, findings, conclusions, guidelines and recommendations.

14. Make an executive presentation to the research panel and provide each panel member with an MS PowerPoint version of the presentation after submission of the final report.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

- A face to face TAC / technical expert meeting was held in June to develop a future work plan.
- Initial laboratory tests were completed and data are being analyzed.
- Work has been started in investigating effects of salts on freeze thaw cycle frequency and intensity based on weather data and heat of solution calculations.
- Questions for the surveys have been reviewed.
- Work is being done on the third T2 document.
- Perform literature search as described in Task 1. Research panel plans to discusS research results next fiscal year.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

- Continue collection of field samples.
- Continue laboratory evaluation of field samples.
- Continue evaluation of survey responses.
- Develop plan for further activities based on field, laboratory, and survey findings.
- Prepare technical briefs, as necessary.
- Results from the literature review will be discussed.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

*The original authorized total budget amount of the study
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Validation and Implementation of Hot-Poured Crack Sealant

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(225)	MDOT START DATE	10/01/2009
PROJECT NO.		MDOT COMPLETION DATE (Original)	09/30/2012
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Kevin McGhee, Kevin.McGhee@VirginiaDOT.org, Phone 434-293-1956, Fax 434-293-1990		
LEAD AGENCY	Virginia Department of Transportation		
PROJECT MANAGER	Andy Bennett		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$25,000.00	TOTAL BUDGET	(Original)*	$100,000.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$25,000.00	EXPENDED FUNDS TO DATE***		$25,000.00
			% PERCENT COMPLETE (By Budget)		25%
TOTAL FUNDS REMAINING		$75,000.00	% PERCENT COMPLETE (By Work)		25%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

CO, MI, MN, NH, NY, ON MOT, RI, VA, WI

PURPOSE AND SCOPE

Round robin tests at five to seven various laboratories will be conducted. As an outcome of the TPF-5(045) study preliminary threshold(s) for each test were established based on extensive laboratory testing and limited field data. Therefore, a comprehensive field study is urgently needed to validate and to fine-tune the threshold values. Eight test sections in various climatic regions (dry-freeze, dry-non-freeze, wet-freeze and wet-non-freeze) will be included in the study. Representative crack sealants will be installed in these field sections and monitored for three years. At least five field surveys will be conducted. The field surveys will include sealant inspection and data and sample collection. Collected samples will be used to validate the laboratory tests and the proposed parameter threshold values. The following tasks are proposed in this study:

Task I : Laboratory Validation

Conduct round robin testing to establish test precision and bias for the recently developed six tests.

Develop training program that includes detailed testing procedures.

Task II: Field Validation

Construct eight test sections in the four environmental regions (Wet-Freeze, Wet-Non-freeze, Dry-Freeze, Dry-Non-freeze). Install two sealant types at each test section.

Task III: Monitoring Test Section for Four Years

Conduct field inspection of crack sealant five times during the project duration. Collect sealant samples annually from the test sections to measure their theological properties and identify any changes. Monitor crack movement and temperature variation to provide insight into the selection of the current temperature shift used in the proposed guidelines.

Task IV: Threshold Value Fine-Tuning

Use field performance to fine-tune the testing parameter thresholds in the proposed guidelines.

Task V: Quantify the Cost Effectiveness of Utilizing Crack Sealants
Measure pavement condition annually, in accordance with SHRP Distress Manual, to examine the cost effectiveness of crack sealant.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

No work on Phase II done prior to 10/01/2010. Kickoff meeting scheduled for 11/09/2010 in Urbana Illinois.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: Continued Advancements in Load and Resistance Factor Design (LRFD) for Foundations, Substructures and Other Geotechnical Features

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(227)		MDOT START DATE	10/01/2009
PROJECT NO.			MDOT COMPLETION DATE (Original)	09/30/2011
			COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Silas Nichols, silas.nichols@fhwa.dot.gov, 202-366-1554			
LEAD AGENCY	Federal Highway Administration			
PROJECT MANAGER	Ryan Snook			
CONTRACTOR				

BUDGET STATUS

FY 2010 MDOT Budget				MDOT Total Budget		
FY FUNDS	(Original)****	$25,000.00		TOTAL BUDGET	(Original)*	$50,000.00
	(Revised)*****				(Revised)**	
TOTAL FY EXPENDITURES		$25,000.00		EXPENDED FUNDS TO DATE***		$25,000.00
				% PERCENT COMPLETE (By Budget)		50%
TOTAL FUNDS REMAINING		$25,000.00		% PERCENT COMPLETE (By Work)		50%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

GA, IL, MI, MS, MT, NC, NH, NM, OH, OR, PA, WI

PURPOSE AND SCOPE

The project objectives are to:

1) Revise and update comprehensive bridge design examples to reflect the most recent changes to Sections 3, 10 and 11 of the AASHTO LRFD Bridge Design Standards.
2) Redevelop instructor led and Web-based training for transportation engineers responsible for substructure and foundation design of bridges.
3) Identify research needs for continued advancement, and improved reliability and cost effectiveness of LRFD design methodologies for substructures and foundations.

The scope of this pooled fund is to:
1) Redevelop the instructor led training for state DOT's to focus on adaptation of state geotechnical and foundation design practice to the AASHTO LRFD specifications.
2) Develop and maintain Web-based training modules to focus on specific technical aspects of the LRFD transition. This would include methods for calibration of design methods and development of local/regional resistance factors, information and guidance on bi-annual changes to the AASHTO LRFD specifications.
3) Update and distribute comprehensive design examples for state DOT use.
4) Identify research needs and develop work statements for future funding.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

A kickoff conference call was done on July 28, 2010. An introduction to the purpose of the project was discussed. Also discussed were some of the implementation problems and issues with the new LRFD Bridge Design methods as well as some of the implementation needs of the states. No other meetings or conference calls have been done for fiscal year 2010.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

Proposed activities for fiscal year 2011 are as follows:

1) Revise and update comprehensive bridge design examples to reflect the most recent changes to Sections 3, 10 and 11 of the AASHTO LRFD Bridge Design Standards.
2) Redevelop instructor led and Web-based training for transportation engineers responsible for substructure and foundation design of bridges.
3) Identify research needs for continued advancement, and improved reliability and cost effectiveness of LRFD design methodologies for substructures and foundations.

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: ITS Pooled Fund Program (ENTERPRISE)

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(231)	MDOT START DATE	10/01/2009
PROJECT NO.	111159	MDOT COMPLETION DATE (Original)	09/30/2014
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT	Lee Nederveld, nederveldl@michigan.gov, 517-636-0036		
LEAD AGENCY	Michigan Department of Transportation		
PROJECT MANAGER	Lee Nederveld		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$35,000.00	TOTAL BUDGET	(Original)*	$175,000.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$35,000.00	EXPENDED FUNDS TO DATE***		$35,000.00
			% PERCENT COMPLETE (By Budget)		20%
TOTAL FUNDS REMAINING		$140,000.00	% PERCENT COMPLETE (By Work)		20%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

AZ (7.5 %), ID (7.5 %), IL (7.5 %), IA (7.5 %), KS (12.5 %), MI (8.75 %), MN (7.5 %),
TX (7.5 %), VA (7.5 %), WA (7.5 %), Ontario (12.5 %), Netherlands (6.25 %),

PURPOSE AND SCOPE

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

The objectives of the project include the following:

- Investigate and promote ITS approaches and technologies that are compatible with other national and international ITS initiatives.
- Support the individual ITS program plans of ENTERPRISE participants.
- Provide a mechanism to support multi-state and international project cooperation and technical information interchange.
- Facilitate the formation of public-private partnerships for appropriate program activities.
- Pursue emerging ITS project opportunities in areas of interest to the group.
- Provide test beds in a variety of environments and locations for emerging ITS technologies.
- Identify common needs within the group and proceed with appropriate technical activities.

The scope of work for the project includes the following tasks:
The tasks to be completed as part of the program vary from year to year, and are decided through an annual project selection process, as established by the ENTERPRISE member agencies. As a direct result of this selection process, a work plan is developed annually for the ENTERPRISE program, detailing the projects that will be pursued in the upcoming year.

Program Management and Administration

Michigan DOT received official approval from FHWA and a TPF number to accept SP&R funds for the ENTERPRISE Pooled Fund to complete the transition of the administration of the program from the Iowa DOT to the Michigan DOT. Michigan DOT began to receive funds from member states for FY2010.
A Request for Proposal (RFP) was distributed from Michigan to solicit a program management consultant for the ENTERPRISE Program. Athey Creek Consultants was selected to provide administrative and technical project support and authorized to start work on September 10, 2010.

New Members

Four new members joined the ENTEPRISE Program (Oklahoma, Idaho, Illinois, and Texas).

Meetings

The ENTERPRISE Executive Board held three meetings during FY 2010.

- **May 21, 2010 in Detroit, Michigan.** The group approved based on research and recommendations to move the hosting of the ENTERPRISE program Web site to Media Temple Grid Service. Project updates were provided on the three FY 2009 projects and the group reviewed and approved the project proposals for FY 2010.

- **June 23, 2010 Conference Call.** The primary focus of the conference call was to review project ideas for FY 2011.
- **August 1, 2010 in Huntington, West Virginia.** The group voted on the FY 2011 project ideas and based on the available budget agreed to develop full project proposals for the top seven projects.

On-going Projects

The ENTERPRISE Executive Board continued work on the following projects that were approved in previous fiscal years.

- Intersection Collision Avoidance Phase II.
- Development and Field Evaluation of Renewable Electric Power Station for RUal ITS Applications.
- Nationwide Advanced Traveler Information System (ATIS).
- Autonomous Monitoring Station Phase 2.
- IP Cameras.

FY 2009 Project Updates

- **ITS Warrants Phase 2.** Developed warrants for five additional technology devices to guide the initial decision of whether or not to deploy a device at a specific location or to validate existing device deployments as a continuation of the four devices focused on during Phase I.
    - Project completed. Final Report submitted in May 2010.
- **Mobile Advanced Traveler Information Systems.** Pilot deployment of a Mobile ATMS/ATIS application and develop interface control documents.
    - Project completed. Final Draft Report submitted.

FY 2010 Project Updates (Approved December 2009)

The following projects will start as soon as Michigan DOT receives member states contributions for FY2010.

- **Low-Cost ITS Safety Solution Systems.** To develop a consensus between agencies for an accelerated uniform deployment of low cost ITS safety solution projects (intersection warning and collision avoidance systems).
- **Impacts of Travel Information on the Overall Network.** To understand the impacts of traveler information dissemination on the overall operations of an urban transportation network.
- **Next Generation Traffic Data and Incident Detection Video.** To explore potential advantages of 3-D vector-based object recognition in capture of traffic data and incident detection and to validate Roadway Animal Detection System (RADS).
- **Crashworthiness and Protection of ITS Field Devices.** To determine if there are appropriate crashworthy supports for ITS field devices.

Program Management and Administration

Michigan DOT to continue to receive funds from the ENTERPRISE member states for FY 2010 and FY 2011.

New Members

Continue to encourage other states to join ENTERPRISE. Recently Georgia DOT as well as the Mississippi DOT has expressed interest in joining the program.

Meetings

The ENTERPRISE Executive Board is scheduled to hold the following meetings during FY 2011.

- November 8 and 9, 2010 in Phoenix, Arizona
- January 6, 2011 Conference Call
- February 3, 2011 Conference Call
- March 3 and 4, 2011 in Austin, Texas
- April 7, 2011 Conference Call
- May 5, 2011 Conference Call
- June 2, 2011 Conference Call
- July 7, 2011 Conference Call
- August 4, 2011 Conference Call
- August 28, 2011 in Coeur d' Alene, Idaho
- September 15, 2011 Conference Call
- October 6, 2011 Conference Call
- November 3, 2011 Conference Call
- December 1, 2011 Conference Call

Project Updates

- Start FY 2010 projects as well as begin work on the proposed FY 2011 projects.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

*The original authorized total budget amount of the study
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount

Michigan Department
Of Transportation
5307-10 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT TRANSPORTATION POOLED FUND STUDY
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

STUDY TITLE: NCHRP for FY 2010

FUNDING SOURCE: ☒ FHWA ☐ OTHER (*PLEASE EXPLAIN*)

TPF NO.	TPF-5(410)	MDOT START DATE	10/01/2009
PROJECT NO.		MDOT COMPLETION DATE (Original)	09/30/2010
		COMPLETION DATE (Revised)	
TECHNICAL CONTACT			
LEAD AGENCY	Federal Highway Administration		
PROJECT MANAGER	Calvin Roberts		
CONTRACTOR			

BUDGET STATUS

FY 2010 MDOT Budget			MDOT Total Budget		
FY FUNDS	(Original)****	$1,050,000.00	TOTAL BUDGET	(Original)*	$1,050,000.00
	(Revised)*****			(Revised)**	
TOTAL FY EXPENDITURES		$1,050,000.00	EXPENDED FUNDS TO DATE***		$1,050,000.00
			% PERCENT COMPLETE (By Budget)		100%
TOTAL FUNDS REMAINING		$0.00	% PERCENT COMPLETE (By Work)		100%

PARTICIPATING STATES

ABBREVIATE THE PARTICIPATING STATES. IF MDOT IS THE LEAD AGENCY, ALSO LIST THE CONTRIBUTION PERCENTAGE PER STATE.

(_____ %), (_____ %), (_____ %), (_____ %), (_____ %), (_____ %), (_____ %),

PURPOSE AND SCOPE

A fund source to conduct research in acute problem areas that affect highway planning, design, construction, operation, and maintenance nationwide.

FISCAL YEAR 2010 ACCOMPLISHMENTS TO DATE

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of participation)

Research findings are published in the NCHRP Reports series and the NCHRP Synthesis of Highway Practices series.

*The original authorized total budget amount of the study
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Contract Research Studies (Proposed)

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Review and Revision of Overload Permit Classification

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Rebecca Curtis

CONTRACT/AUTHORIZATION NO.	2010-0317 / Z1	PROJECT START DATE	10/01/2010
PROJECT NO.	109095	COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR10-010	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Michael Baker Jr., Inc.		
PRINCIPAL INVESTIGATOR	Bryan J. Spangler		

BUDGET STATUS

FY 2010 Budget				**Total Budget**		
FY FUNDS	(Original)****	$0.00		TOTAL COST	(Original)*	$209,405.64
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$0.00
SALARIES				% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$209,405.64
TOTAL FY EXPENDITURES		$0.00				

PURPOSE AND SCOPE

The objectives of this project include the following:

1) Review current Overload Permitting procedure from the structure and vehicle perspective. Compare this procedure to current National Best Practices, MDOT and local agency business needs, and reliability of the system.
2) Create an interim report summarizing the current method identifying deficiencies of the current procedure and proposing a method to be approved by MDOT.
3) Create a software program to replace the current BridgeOv program that addresses all vehicle and structural variables outlined in the problem statement.
4) Educate MDOT staff and local agency bridge owners.

The scope of work includes the following tasks:
1a).Review current Overload Permitting procedure from the structure and vehicle perspective. Interview key MDOT staff.
1b).Verify the deficiencies noted by in Task 1a and the impact of the deficiencies by comparing the current process to a sample of the MDOT bridge inventory taking into account factors including but not limited to: year of construction, functional classification, material type and design loading. A research database with standard MDOT structures is available for use with the AASHTOWare Virtis program.
2). Submit draft interim report identifying areas of current process that require improvement. As part of this report, develop an action plan to create a proposed process for MDOT Overload Permitting. The action plan should outline how the proposed process will impact current practice and the implementation of the proposed process.
3a).Incorporate MDOT comments from the above Task 2. Develop the software tool for implementation of the proposed process.
3b).Test and verify the software.
3c).Verify the proposed process against the review performed in above Task 2.
3d).Provide software documentation of coding for possible future edits and third party developers.
4). Prepare material and give a minimum of two training sessions for MDOT staff and local agencies bridge owners on use of the software tool and the proposed process.
5). Prepare final report including proposed revisions to the BAG for the process as modified in Task 3a.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Feasibility of Digital Imaging to Characterize Earth Materials

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Richard Endres

CONTRACT/AUTHORIZATION NO.	2010-0296 / Z2	PROJECT START DATE	10/01/2010
PROJECT NO.	109198	COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-158	COMPLETION DATE (Revised)	
RESEARCH AGENCY	University of Michigan		
PRINCIPAL INVESTIGATOR	Dr. Roman Hryciw		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$0.00	TOTAL COST	(Original)*	$129,707.10
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$0.00
SALARIES			% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$129,707.10
TOTAL FY EXPENDITURES		$0.00			

PURPOSE AND SCOPE

The objectives of this project include the following:
1) Identify or develop innovative methods for soil characterization.
2) Test and evaluate the new method for potential application in Michigan.
3) Investigate implementation opportunities or challenges for the new method.

The scope of work for this project includes the following tasks:
1) Perform a literature search on developed alternatives and approaches for image-based soil grain size assessment.
2) Develop an optimal method based on the available alternatives.
3) Perform testing to validate this method, including a range of soil types to fill gaps in previous research.
4) Refine the procedure and produce instructional materials to make the new method readily usable by technicians.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Evaluating the Performance and Effectiveness of Roundabouts

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Dean Kanitz

CONTRACT/AUTHORIZATION NO.	2010-0278 / Z2		PROJECT START DATE	10/01/2010
PROJECT NO.	109207		COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-083		COMPLETION DATE (Revised)	
RESEARCH AGENCY	Opus International Consultants, Inc.			
PRINCIPAL INVESTIGATOR	Jeffrey Bagdade			

BUDGET STATUS

FY 2010 Budget				Total Budget		
FY FUNDS	(Original)****	$0.00		TOTAL COST	(Original)*	$149,944.15
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$0.00
SALARIES				% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$149,944.15
TOTAL FY EXPENDITURES		$0.00				

PURPOSE AND SCOPE

The objectives of this project include the following:
1) Determine the impact on crash severity at locations where roundabouts have been installed.
2) Observe roundabout operations including truck maneuvers.
3) Identify the key geometric configurations and site characteristics that influence safety, performance and return on investment.

The scope of work for this project includes the following tasks:
1) Literature Review -- Conduct a review of national and international research on the cost, effectiveness and performance of roundabouts, identifying effective research approaches that could potentially apply to this study.
2) Field Data Collection -- Document driver maneuvers in roundabouts, including trucks, as well as design features and variations.
3) Data Collection -- Compile three years of before and after traffic and crash data on the roundabouts installed on Michigan state trunklines. In addition, compile data on roundabout construction costs, including time to return traffic to the roadway.
4) Final Analysis -- Analyze the costs, geometric configurations and characteristics of roundabouts as they influence safety, operations and performance.
5) Final Report -- Synthesize the results of above tasks (literature review, field data collection, data collection, and final analysis) and provide guidance on site and design characteristics that most influence safety and performance in Michigan roundabouts.
6) Presentation -- Develop a PowerPoint presentation of the research approach and findings to support dissemination of findings within MDOT.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Evaluating the Performance and Making Best Use of Passing Relief Lanes

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Dean Kanitz

CONTRACT/AUTHORIZATION NO.	2010-0278 / Z1		PROJECT START DATE	10/01/2010
PROJECT NO.	109234		COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-117		COMPLETION DATE (Revised)	
RESEARCH AGENCY	Opus International Consultants, Inc.			
PRINCIPAL INVESTIGATOR	Jeffrey Bagdade			

BUDGET STATUS

FY 2010 Budget				Total Budget		
FY FUNDS	(Original)****	$0.00		TOTAL COST	(Original)*	$159,887.20
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$0.00
SALARIES				% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$159,887.20
TOTAL FY EXPENDITURES		$0.00				

PURPOSE AND SCOPE

The objectives of this project include the following:
1) Evaluate the safety performance of design and operations of passing relief lanes in Michigan.
2) Assess the effectiveness of current designs to reduce delay.
3) Use modeling to determine before-and-after impacts of passing relief lanes on traffic characteristics.

The scope of work for this project includes the following tasks:
1) Literature review -- Review literature on passing relief lane best practices (design, deployment, modeling and analysis) nationwide. Summarize current practices in Michigan, including both practices required by specification and common practices not included in specifications.
2) Field test design and site selection -- Design the field analysis based on existing and available data sets and data that can be collected. Consider and select appropriate field sites, which may include collecting data on highway sections that already have passing relief lanes (for before-and-after analysis) as well as those that may benefit from them.
3) Testing -- Conduct testing and collect data according to the test design, modifying as necessary.
4) Analysis and recommendations -- Analyze the data for conclusive impacts — actual or modeled — of passing relief lanes on safety, capacity, cost, and other performance factors. Recommend candidate sites for future deployments and possible design modifications as appropriate based on the data.
5) Deliverables -- Prepare the final deliverables. These will include a final report, a technical presentation, and materials suitable for executive decision-making at MDOT.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Implementation of Sustainable and Green Design and Construction Practices for Bridges

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Beckie Curtis

CONTRACT/AUTHORIZATION NO.	2010-0294 / Z1		PROJECT START DATE	10/01/2010
PROJECT NO.	109235		COMPLETION DATE (Original)	09/30/2012
ORBP NO.	OR09-157		COMPLETION DATE (Revised)	
RESEARCH AGENCY	Michigan State University			
PRINCIPAL INVESTIGATOR	Dr. Kasim Armagan Korkmaz			

BUDGET STATUS

FY 2010 Budget				Total Budget		
FY FUNDS	(Original)****	$0.00		TOTAL COST	(Original)*	$99,818.00
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$0.00
SALARIES				% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$99,818.00
TOTAL FY EXPENDITURES		$0.00				

PURPOSE AND SCOPE

The objectives of this project include the following:
1) Understand the key factors that define and measure sustainability.
2) Determine how existing sustainability methodologies can be adapted and incorporated into bridge design and construction.
3) Incorporate sustainability into bridge design and construction practices at MDOT.

The scope of work for this project includes the following tasks:
1) Framework development -- Develop a framework to define and measure sustainability. Review literature and best practices to determine the most important and sensitive factors.
2) Assessment of current practice -- Based on the framework developed above, assess the sustainability of current MDOT bridge design procedures.
3) Recommendations -- Recommend modifications to MDOT's bridge design and construction procedures to improve sustainability.
4) Education -- Develop and deliver appropriate tools to educate MDOT engineers about sustainability practices.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Safety Analysis of 4-Lane to 3-Lane Conversions (Road Diets) in Michigan

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Tracie Leix

CONTRACT/AUTHORIZATION NO.	2010-0294 / Z2		PROJECT START DATE	10/01/2010
PROJECT NO.	109236		COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-118		COMPLETION DATE (Revised)	
RESEARCH AGENCY	Michigan State University			
PRINCIPAL INVESTIGATOR	Dr. Richard Lyles			

BUDGET STATUS

FY 2010 Budget				Total Budget		
FY FUNDS	(Original)****	$0.00		TOTAL COST	(Original)*	$149,281.00
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$0.00
SALARIES				% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$149,281.00
TOTAL FY EXPENDITURES		$0.00				

PURPOSE AND SCOPE

The objectives of this project include the following:
1) Determine the safety impact 4-lane to 3-lane conversions have had on the corridors in Michigan where this countermeasure has been implemented.
2) Determine the impact on motorist delay of those conversions.
3) Develop a statistically sound crash reduction factor for 4-lane to 3-lane conversions.
4) Provide guidance within the draft and final reports on when MDOT and/or local agencies should be considering the use of a 4-lane to 3-lane conversion for a corridor.
The scope of work for this project includes the following tasks:
1) Literature Review -- Review relevant research and provide a summary to the oversight team.
2) Data Collection -- Collect data on the segments that have been converted, including location of installations, installation dates, crash data, volume information, photos of locations, before and after installation, etc.
3) Data Analysis and CRF Development -- Analyze the data collected to capture crash and traffic delay impacts of the conversions. In addition, develop a crash reduction factor(s) based on this analysis for guiding effective future application of the treatment.
4) Develop Preliminary Draft Report.
5) Develop Final Report consisting of all data collected, pictures taken, study format and findings, and recommendations.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
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****The current fiscal year's original budget amount
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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Low-Cost, High-Impact Measures to Meet the Transportation Needs of Michigan's Aging Population

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Kimberly Lariviere

CONTRACT/AUTHORIZATION NO.	2010-0296 / Z1	PROJECT START DATE	10/01/2010
PROJECT NO.	109239	COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-102	COMPLETION DATE (Revised)	
RESEARCH AGENCY	University of Michigan		
PRINCIPAL INVESTIGATOR	Dr. David Eby		

BUDGET STATUS

FY 2010 Budget				**Total Budget**		
FY FUNDS	(Original)****	$0.00		TOTAL COST	(Original)*	$203,104.79
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$0.00
SALARIES				% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$203,104.79
TOTAL FY EXPENDITURES		$0.00				

PURPOSE AND SCOPE

The objectives of this project include the following:
1) Determine population concentrations and travel needs and habits of Michigan's older population.
2) Provide a list of low-cost, high impact changes MDOT can make that would positively affect older transportation users.

The scope of work for this project includes the following tasks:
1) Literature review -- Perform a review of the current literature regarding seniors' travel needs and the strategies for meeting these needs as suggested by research and practices of other states.
2) Demographic analysis -- Perform a demographic analysis of the older population in Michigan, including projected demographics.
3) Survey of seniors -- Administer a survey of seniors, caregivers and family members to determine travel and residency patterns, gaps in transportation services and transportation needs/wants of Michigan's senior population.
4) Recommendations -- Based on the findings of tasks 1-3, create a list of low-cost, high-impact measures that could be taken to increase senior safety and mobility, including but not limited to specific multi-modal investments.
5) Final report -- Prepare a report of the study format and findings and a PowerPoint presentation for use in distributing the results within MDOT.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Evaluating Pedestrian Safety Improvements

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Deirdre Thompson

CONTRACT/AUTHORIZATION NO.	2010-0297 / Z1	PROJECT START DATE	10/01/2010
PROJECT NO.	109241	COMPLETION DATE (Original)	09/30/2012
ORBP NO.	OR09-096	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Western Michigan University		
PRINCIPAL INVESTIGATOR	Ron VanHouten		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$0.00	TOTAL COST	(Original)*	$199,999.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$0.00
SALARIES			% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$199,999.00
TOTAL FY EXPENDITURES		$0.00			

PURPOSE AND SCOPE

The objectives of this project include the following:
1) Identify national practices with regard to pedestrian safety countermeasures that can influence practices in Michigan.
2) Understand the effectiveness of current Michigan countermeasures at reducing pedestrian crashes.
3) Gauge public response to the pedestrian safety improvements.
4) Develop recommendations for application of future pedestrian safety improvements in Michigan.

The scope of work for this project includes the following tasks:
1) Literature review -- Scan and evaluate national guidance, research findings and state-of-the-practice related to pedestrian safety improvements similar to the signage and traffic control countermeasures used in the recent Detroit installations.
2) Data collection and analysis -- Conduct before-and-after studies of pedestrian crashes at Detroit installation sites to determine the effects of the countermeasures on pedestrian safety. Identify the location characteristics relevant to any safety gains made.
3) Driver survey -- Conduct a survey of drivers and pedestrians using selected installation sites to determine public perception of the pedestrian safety improvements.
4) Final report -- Submit a final report that synthesizes the results of the literature review, driver survey and before-and-after studies. Include recommendations for implementing the countermeasures in similar locations statewide.
5) Best practices guide -- Produce a guide for implementing safety countermeasures in Michigan that outlines effective available measures, provides guidance on the location characteristics desirable for installation, and discusses how and why the countermeasures are effective at reducing pedestrian crashes.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Sharing the Road: Optimizing Pedestrian and Bicycle Safety and Vehicle Mobility

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Deirdre Thompson

CONTRACT/AUTHORIZATION NO.	2010-0352 / Z1		PROJECT START DATE	10/01/2010
PROJECT NO.	109274		COMPLETION DATE (Original)	03/31/2012
ORBP NO.	OR09-101		COMPLETION DATE (Revised)	
RESEARCH AGENCY	T.Y. Lin International Great Lakes, Inc.			
PRINCIPAL INVESTIGATOR	John LaPlante			

BUDGET STATUS

FY 2010 Budget				**Total Budget**		
FY FUNDS	(Original)****	$0.00		TOTAL COST	(Original)*	$199,751.95
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$0.00
SALARIES				% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$199,751.95
TOTAL FY EXPENDITURES		$0.00				

PURPOSE AND SCOPE

The objectives of this project include the following:
1) Document reasoning for pedestrian safety improvements.
2) Investigate pedestrian and bicycle safety countermeasures and effects on vehicle mobility.
3) Investigate best practices for pedestrian and bicycle safety.
4) Investigate effects of vehicle safety and pedestrian safety improvements.

The scope of work for this project includes the following tasks:
1) Literature review -- Conduct a review of pedestrian and bicycle research related to signalization and rights of way for roadways that have volumes of both pedestrians and vehicles. Identify innovative pedestrians and bicycle safety countermeasures that may be applicable in Michigan.
2) Data collection -- Identify challenging roadways in Michigan with high volumes of pedestrian and vehicle traffic. For those roadways, gather crash history; vehicle, pedestrian and bicycle mobility data; and roadway design information. Analysis of innovative pedestrian and bicycle safety countermeasures.
3) Data analysis -- Analyze the data collected to identify opportunities for improving pedestrian and bicycle safety and when pedestrian and bicycle safety should take priority over vehicle mobility. Make recommendations for applying the innovative treatments identified based on the outcomes of the analysis.
4) Final report -- Produce a final report of the study format and findings as well as recommendations for implementing the results.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Improving Bridges With Prefabricated Precast Concrete Systems

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Steve Beck

CONTRACT/AUTHORIZATION NO.	2010-0297 / Z2	PROJECT START DATE	10/01/2010
PROJECT NO.	109275	COMPLETION DATE (Original)	09/30/2012
ORBP NO.	OR09-153	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Western Michigan University		
PRINCIPAL INVESTIGATOR	Dr. Haluk Aktan		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$0.00	TOTAL COST	(Original)*	$264.935.62
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$0.00
SALARIES			% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$264,935.62
TOTAL FY EXPENDITURES		$0.00			

PURPOSE AND SCOPE

The objectives of this project include the following:
1) Determine the state of practice related to prefabricated precast concrete bridge systems.
2) Determine appropriate steps for evaluating and implementing possible systems in Michigan.
3) Identify systems with the greatest potential for use in Michigan.
4) Evaluate identified systems for Michigan conditions and provide implementation recommendations.

The objectives of this project include the following:
1) Literature search -- Review literature on existing practices and proposed techniques for using prefabricated, precast concrete bridge systems.
2) Specify evaluation criteria -- Determine the design, construction, and performance-related factors against which possible prefabricated precast concrete bridge systems will be measured. Define evaluation methodologies (modeling, lab testing, field testing or otherwise).
3) Propose feasible system -- Based on current practice and anticipated needs in Michigan, propose one or more specific prefabricated precast concrete bridge systems for evaluation.
4) Investigate proposed system(s) -- Use the methodologies, revised as needed, to evaluate the proposed system.
5) Findings and Recommendations -- Report on the findings, including their implications for possible implementation. Provide specific recommendations on possible further research or testing, pilot studies, small-scale implementation or large-scale implementation.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

*The original authorized total budget amount of the project
**The authorized total budget amount as revised, if applicable
*** The project life to date expenditure
****The current fiscal year's original budget amount
*****The revised fiscal year budget amount, if applicable

Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Developing a Congestion Mitigation Toolbox

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Jason Firman

CONTRACT/AUTHORIZATION NO.	2009-0661 / Z2		PROJECT START DATE	10/01/2010
PROJECT NO.	109276		COMPLETION DATE (Original)	09/30/2011
ORBP NO.	OR09-093		COMPLETION DATE (Revised)	
RESEARCH AGENCY	Texas A&M Research Foundation			
PRINCIPAL INVESTIGATOR	Jason A. Crawford			

BUDGET STATUS

FY 2010 Budget				**Total Budget**		
FY FUNDS	(Original)****	$0.00		TOTAL COST	(Original)*	$154,580.09
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$0.00
SALARIES				% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$154,580.09
TOTAL FY EXPENDITURES		$0.00				

PURPOSE AND SCOPE

The objectives of the project include the following:
1) Understand all the different strategies used to alleviate congestion.
2) Identify what strategies have been implemented (by polling other states and metropolitan areas) and document what have made them a success.
3) Develop a toolbox that can be used to identify projects to reduce congestion.
4) Assign a cost benefit ratio to each strategy to aid in choosing the most cost effective projects.

The scope of work for the project includes the following tasks:
1) Literature review -- Conduct a review of current research and practices to identify promising congestion mitigation strategies and any evaluation studies carried out on those strategies.
2) Develop list of potential strategies -- Based on the literature review, create a list of potential congestion mitigation strategies that MDOT should consider.
3) Survey states -- Conduct a survey of other states to capture experiences, both good and bad, with the mitigation strategies identified.
4) Review Michigan Transportation Management Areas & Congestion Management Processes.
5) Implementation recommendations -- Propose processes for implementing the mitigation strategies, discussing the barriers to implementation, how to overcome these barriers, recommendations regarding and the expected benefits of each strategy.
6) Develop a cost-benefit analysis for each strategy.
7) Create a statewide toolbox to reduce congestion.
8) Produce a final report of study format and findings for all tasks.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: Cost Effectiveness of MDOT Preventive Maintenance Program

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Kevin Kennedy

CONTRACT/AUTHORIZATION NO.	2009-0663 / Z3	PROJECT START DATE	10/01/2010
PROJECT NO.	109277	COMPLETION DATE (Original)	09/30/2012
ORBP NO.	OR09-160	COMPLETION DATE (Revised)	
RESEARCH AGENCY	Applied Pavement Technology		
PRINCIPAL INVESTIGATOR	David Peshkin		

BUDGET STATUS

FY 2010 Budget			Total Budget		
FY FUNDS	(Original)****	$0.00	TOTAL COST	(Original)*	$179,989.00
	(Revised)*****			(Revised)**	
			FUNDS EXPENDED TO DATE***		$0.00
SALARIES			% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)		% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)				
TRAVEL					
OTHER			**Total Contract Amount Available**		$179,989.00
TOTAL FY EXPENDITURES		$0.00			

PURPOSE AND SCOPE

The objectives of the project include the following:
1) Determine the costs and benefits (in terms of pavement life extension) of each pavement preventive preservation option used by MDOT.
2) Document the cost and benefits of the MDOT pavement preservation program.
3) Determine the variability in the costs and benefits of each pavement preservation option relative to the types of pavement distress and the timing of the treatment application.
4) Establish a relational matrix for the selection of time, location, and pavement preservation option for given pavement project and pavement surface distresses.

The scope of work for the project includes the following tasks:
1). Data collection -- Obtain from MDOT and Asset Council (PASER) a list of pavement projects where pavement preservation actions were taken, the cost of the action, and the historical pavement distress before and after preservation.
2) For each project, determine the benefits (pavement life extension) that are directly related to the undertaken pavement preservation action.
3) Prioritize the pavement preservation actions relative to their cost and benefits.
4) Produce final report containing all the data, recommendations, and conclusions

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

RBP
OFFICE OF RESEARCH & BEST PRACTICES

PROJECT TITLE: A Framework for Statewide Roadway Asset Management

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Frank Kelley

CONTRACT/AUTHORIZATION NO.		PROJECT START DATE	
PROJECT NO.	109722	COMPLETION DATE (Original)	
ORBP NO.	OR10-011	COMPLETION DATE (Revised)	
RESEARCH AGENCY	To be determined		
PRINCIPAL INVESTIGATOR	To be determined		

BUDGET STATUS

FY 2010 Budget				**Total Budget**		
FY FUNDS	(Original)****	$0.00		TOTAL COST	(Original)*	$150,000.00
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$0.00
SALARIES				% PERCENT COMPLETE (By Budget)		
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$0.00
TOTAL FY EXPENDITURES		$0.00				

PURPOSE AND SCOPE

The objectives of this project include the following:
1) Develop and document the typical cost per mile to maintain and operate roads in Michigan by functional classification, agency type, and geographic location currentlly being spent.
2) Develop and document the typical cost per mile to maintain and operate roads in Michigan by functional classification, agency type, and geographic region that would be required to sustain the roads in a fair to good condition.
3) Determine the available revenues per mile to maintain and operate roads in Michigan by functional classification, agency type, and geographic location currently being provided.
4) Provide and compile the above data in a format that can be readily analyzed and updated now and annually thereafter.
5) Develop a data matrix of the activities and costs associated with the maintenance and operation of roads in Michigan by functional classification, agency type, and geographic location.

The scope of work for this project includes the following tasks:
1) Develop a sampling procedure, survey and interview protocols, and collect the needed cost data from the various agencies. Agencies include: state, county (road commissions) and local (cities), etc.
2) Determine the required actual costs (investment) needed to maintain, and operate the roads of Michigan by functional classification, agency type, and in different geographic locations needed to sustain the roadway system in fair to good condition.
3) Acquire and compile the data into a matrix type spreadsheet file that can be readily updated with new data, expanded with the miles of roads per category to determine overall system expenditures, needs and projected revenues and a comparison between the figures.
4) Prepare a final research document that includes a summary of research results, deliverables, any pertinent guidelines, and recommendations or actions required (i.e., action plan). Develop a narrated PowerPoint presentation showing the results of the study. Prepare training materials and PowerPoint that can be presented to decision makers. Develop a marketing strategy for contacting, educating, and informing our stakeholders, politicians and decision makers.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

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Michigan Department
Of Transportation
5312 (2010)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 2010

PROJECT TITLE: Evaluation of Durable Pavement Markings

FUNDING SOURCE: ☒ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*

PROJECT MANAGER: Jill Morena

CONTRACT/AUTHORIZATION NO.		PROJECT START DATE	11/30/2010
PROJECT NO.	109723	COMPLETION DATE (Original)	11/30/2011
ORBP NO.	OR09-100	COMPLETION DATE (Revised)	
RESEARCH AGENCY			
PRINCIPAL INVESTIGATOR			

BUDGET STATUS

FY 2010 Budget				**Total Budget**		
FY FUNDS	(Original)****	$0.00		TOTAL COST	(Original)*	$230,000.00
	(Revised)*****				(Revised)**	
				FUNDS EXPENDED TO DATE***		$0.00
SALARIES				% PERCENT COMPLETE (By Budget)		0%
EQUIPMENT	(Expendable)			% PERCENT COMPLETE (By Work)		0%
EQUIPMENT	(Non-expendable)					
TRAVEL						
OTHER				**Total Contract Amount Available**		$0.00
TOTAL FY EXPENDITURES		$0.00				

PURPOSE AND SCOPE

The objectives of the project include the following:
1) Determine if durable markings are placed at higher retro reflectivity reading than typical one-year products.
2) Determine how well durable markings retain their retro reflectivity compared to typical one-year products.
3) Determine what is considered "good visibility" by the general population.
4) Determine if there are fewer crashes due to the use of durable markings.

The scope of work for the project includes the following tasks:
1) Literature Review
2) Office data -- Collect data on the use and impact of durable markings (field locations, crash history on segments using the markings, etc.) In addition, conduct a survey of the public to document public perceptions of durable markings.
3) Field data -- Gather retro reflectivity readings and any other relevant data on durable markings and one-year products both newly placed and already on the roadway.
4) Analyze Data -- Analyze the data to capture the performance and safety impacts of durable pavement markings versus one-year markings.
5) Final report -- Prepare a final report synthesizing the results and providing recommendations for optimizing safety through the use of pavement markings.

FISCAL YEAR 2011 PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

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