**TRANSPORTATION POOLED FUND PROGRAM**

**QUARTERLY PROGRESS REPORT**

Date: \_\_\_\_\_\_\_\_\_\_\_10/28/11\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lead Agency (FHWA or State DOT): \_\_\_\_\_\_\_\_\_\_\_FHWA\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**INSTRUCTIONS:**

*Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.*

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| **Transportation Pooled Fund Program Project #****TPF-5(101)** | **Transportation Pooled Fund Program - Report Period:**□Quarter 1 (January 1 – March 31)□Quarter 2 (April 1 – June 30)xQuarter 3 (July 1 – September 30)□Quarter 4 (October 1 – December 31) |
| **Project Title:****Evaluations and Applications of Mechanistic Performance Prediction Modeling Tools** |
| **Name of Project Manager(s):**Katherine Petros | **Phone Number:** 202-493-3154 | **E-Mail:** katherine.petros@dot.gov |
| **Lead Agency Project ID:** | **Other Project ID (i.e., contract #):**DTFH61-05-D-00017DTFH61-11-D-00009 | **Project Start Date:**5/12/05 |
| **Original Project End Date:**5/12/12 | **Current Project End Date:**8/19/14 | **Number of Extensions:**1 |

Project schedule status:

□ On schedule x On revised schedule □ Ahead of schedule □ Behind schedule

Overall Project Statistics:

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|  **Total Project Budget** |  **Total Cost to Date for Project** |  **Percentage of Work**  **Completed to Date** |
|  1,294,342  | 723627 | 75 |

***Quarterly*** Project Statistics:

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| --- | --- | --- |
|  **Total Project Expenses**  **and Percentage This Quarter** |  **Total Amount of Funds**  **Expended This Quarter** |  **Total Percentage of**  **Time Used to Date** |
| 723627 | $ 30,590.69  | 75 |

**Project Description**:

Delineation between new and exclusive truck routes, distribution hubs, and intermediate truck/auto routes and exclusive light vehicle carriageways are foreseeable as effective means for meeting transportation needs well into the 2000s. Exclusive heavy truck routes may not look at all like we envision a typical highway to be. Such routes may coincide more on the order of airfield pavement designs in order to carry trucks that could be double in size of today's heavy vehicles. Current arteries will need to be strengthened to meet such needs or to enable their existence to continue carrying today's traffic streams well into the future. Heavy vehicles, especially those designated as being overload vehicles must be classified with respect to the level of damage they impose and restrictions for their use must be equitably postulated. Exclusive light vehicular traffic roads will necessitate more care in their design for environmental effects. Allocating user charges will certainly differ given such scenarios. The trend toward ownership of selected highways is inevitable and this certainly will require the use of sophisticated formulations and procedures that provide reliable estimates of the future wear out, performance and repair costs. The most suitable models will be selected for implementation in developing strategies and procedures that address the objective for this PFS. Appropriate training in the use of the models will also be included.

The work of this pooled fund was and is being conducted by task order under two separate larger IDIQ contracts.

The first contract, DTFH61-05-D-00017, contains the following TPF-5(101)-funded tasks:

Task Order #1: Pooled Fund State Travel

This task is to coordinate and support the travel of the State members of TPF-5(101). Annual meetings are held in conjunction with TRB and additional meetings have been held as warranted. This task order period of performance is until May 11, 2012.

Task Order #3: Bridging the Gaps in Research in Load Transfer Across Joints and Cracks of Concrete Pavements

Research findings from this task are published in Transportation Research Record: Journal of the Transportation Research Board, Volume 1947, pages 49-58, “Jointed Plain Concrete Pavement Model Evaluation”, 2006. This task was completed December 31, 2005.

Task Order #8: Development of JSLAB 2007

This task is to create an updated version of JSLAB in order to analyze jointed concrete pavements. The work was performed by the University of Texas at El Paso (UTE) and independently validated by the Ohio Research Institute for Transportation and the Environment (ORITE) at Ohio University. A beta version of the updated software has been developed and named NYSlab. Completed November 2010.

Task Order #10: Enhancement of IntPave

Under Pooled Fund Study SPR - 2(205), IntPave was developed at the University of Texas at El Paso. It provides the capacity to calculate pavement distress under any type of traffic load and to make a comparison of the level of distress caused by a standard and a non-standard truck. The objective of the work requested in this task order is to improve the functionality of IntPave by 1) improving the handling of IntPave inputs and results to make it more user friendly, 2) improving the library of trucks and axle configurations that IntPave can handle, 3) considering the impact of truck suspensions and smoothness of the road on pavement damage, and 4) expanding the damage assessment and fee allocation tools to consider repeated number of applications of different trucks. This task was completed 11/30/10.

Task Order # 13: Development of JPCP Design Catalog for NY State

The objectives of this task order are to 1) evaluate various aspects of the NCHRP 1-37A mechanistic-empirical pavement design guide (MEPDG) in relation to New York State’s current practice and past pavement performance, 2) provide recommended input parameters appropriate to New York, 3)develop the database for JPCP data that will include all parameters used in MEPDG, and 4) develop/automate a pavement design procedure for JPCP based on the MEPDG that fits New York’s environment, materials, construction practices, soils and maintenance needs. This task is being performed by the Ohio Research Institute for Transportation and the Environment (ORITE) and its completion date is 5/14/12.

Task Order # 14: Enhancement of IntPave and NYSlab

Under Task Orders 8 and 10 of this contract, the software packages IntPave and NYSlab (aka

JSLAB-2007) were developed or modified at University of Texas at El-Paso (UTEP). IntPave is software to predict pavement damage with stand-alone finite element programs with the capacity to calculate pavement responses and predict distress under any type of traffic load and to make a comparison of the level of distress caused by a standard and a non-standard truck. A module was also added to the software to aid in the calculation of the permit fee. NYSlab is a fully re-programmed version of JSLAB-2004 with a number of functional foundation layers and a modern graphical user interface (GUI). These software programs (IntPave for flexible pavements and NYSlab for PCC) provide reasonable results, however, there are opportunities for enhancement. This task will make enhancements to these programs to address the following items:

• IntPave

* The variation in material properties are included in a simplistic way
* Conducting parametric and what-if scenarios are cumbersome
* Even though the stresses and strains are calculated as part of IntPave, the user does not have access to this information

• NYSlab

* The slab elements only allow bending and in plane displacement degrees of freedom
* Conducting parametric and what-if scenarios are cumbersome
* The program does not allow for a shoulder that is structurally different from the slabs
* The solid element foundation model is not optimal with excessive execution time and memory requirements.

This task order period of performance is 7/01/2009 to 10/15/2011 and the work is being done at UTEP.

Task Order # 15: Collection of Materials Properties Data for Development of JPCP Design Catalog for New York State

In order to complete the material properties inventory for the NYSDOT implementation of MEPDG in a reasonable way, additional material properties data must be collected. This requires gathering a large number of samples of the materials in question –subgrade, base, and concrete pavement with local aggregate – and testing these samples in the laboratory to determine values to include in the inventory. Task order #13 included some provision for obtaining and testing material samples, the amount of gaps in the available data turned out to be far greater than what was anticipated at the time that task order was awarded. It also turned out that the amount of data that could be collected from existing test roads does not adequately characterize the spectrum of materials used in the New York. The objective of this task order is to enhance the data collection efforts needed for NYSDOT to implement and use the MEPDG.

This task order period of performance is 5/31/2010 to 06/30/2013 and the works is being performed by the Ohio Research Institute for Transportation and the Environment (ORITE).

Work supported by TPF-5(101) is also being carried out under DTFH61-11-D-00009. Those tasks are as follows:

Task Order #3: Implementation of the MEPDG and Associate Software Packages in NYSDOT

In 2010, New York State Department of Transportation (NYSDOT) was downsized and as a result, lost its technical expertise on pavement research, design and analysis. Over the past two decades, NYSDOT invested heavily in the instrumentation of pavement sections, implementation of the MEPDG and the development of two software programs for truck damage and pavement responses. NYSDOT cannot lose all this effort and needs support for the Department to continue the data collection at the instrumented sections, the implementation of the MEPDG, development of IntPave and NYSlab and the day to day technical support for design and analysis in the state. The objective of this task order is to provide technical support services to NYSDOT on:

* Overseeing data collection, data analysis and data reporting from NYS’s experimental sections;
* Reviewing the functionality and applicability of the software packages developed at UTEP;
* Supervising, reviewing and commenting on the work that is being done by OU and UTA in the implementation of the MEPDG in NYS, specifically on its applicability to NYSDOT;
* Providing technical support services to NYSDOT pavement design issues.

The period of performance for this task order is 5/2011 until 8/19/14.

Task Order #XX: Calibration of MEPDG using New York and Ohio Experimental Sections and Enhancement of NYPAS

This planned task has the following objectives:

* Calibration of MEPDG using New York and Ohio Experimental Sections by 1) using DARWin-ME to model selected pavements in New York and Ohio and compare the simulation results to actual measured performance of experimental sections in NY and OH, 2) determine material properties of base materials on various projects in New York State, and 3) determine material properties for concrete materials installed on various projects in New York State and Ohio State. In particular, measure the coefficient of thermal expansion and the elastic modulus.
* Enhancement of NYPAS. Earlier TPF-5(101) efforts resulted in two finite element programs (IntPave and NYSlab) with the capacity to calculate pavement distress. These were combined into a program named NYPAS that provides the capacity to calculate pavement distress under any type of traffic load and to make a comparison of the level of distress caused by a standard and a non-standard truck. The objective under this task will be to improve the functionality of NYPAS by (1) improving the handling of inputs for foundation layers under PCC slabs, (2) improving the visualization of the responses of the pavement layers, and (3) expanding the incorporation of the dowel bars in a more realistic manner.
* Provide logistical support for TPF-5(101) TAC member travel

This task order has not yet been awarded.

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| **Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**Only progress for ongoing task orders is reported below:DTFH61-05-D-00017Task Order #1: PFS Travel*This task order period of performance has been extended to May 11, 2012.**This task order involves paying for PF TAC travel.**Work Accomplished:* None this period.DTFH61-05-D-00017Task Order # 13: Development of JPCP Design Catalog for NY State*This task order period of performance is May 13, 2009 to May 14, 2012.**ESCINC is working with the Ohio Research Institute for Transportation and the Environment (ORITE) under this task order.**Work Accomplished:** Continued analysis of data from New York test road Syracuse I90.
* Continued analysis of forensic data collected from Rochester I490
* Collected concrete samples on I86 to conduct coefficient of thermal expansion (CTE) lab tests.
* Collected additional cores on I86 to examine condition of layers in unbounded overlay

*Problems Encountered/Recommended Solutions:* There has been some delay in getting the new material specimens delivered. DTFH61-05-D-00017Task Order # 14: Enhancement of IntPave and NYSlab*This task order period of performance is 7/01/2009 to 10/15/2011.**ESCINC is working with University of Texas at El-Paso (UTEP) under this task order.**Work Accomplished:*The Doctoral student working on this project has completed the review of previous work on the development of NYSLAB and IntPave. Although this was not identified as a separate task in the statement of work, it was necessary since the student was not involved in the first project tasked with the development of the first version of NYSLAB. The following is a summary of the status of the project: ***Task 1*** is complete at this time. MEPDG damage models for flexible pavements were incorporated into the program.***Task 4*** is complete at this time. The program allows the analysis of multiple projects with different properties. A report will be generated for each project.***Task 5*** is complete at this time. MEPDG damage models for flexible pavements were incorporated into the GUI.***Task 6*** is complete at this time. Determination of equivalent foundation parameters from the elastic properties of foundation is implemented. The GUI was modified to allow the user to input the material properties either using elastic parameters (i.e. *E*, **) or foundation parameters (e.g. modulus of subgrade reaction). If the first option is selected, NYPAS will determine an equivalent foundation parameter after an iterative process based on the method selected by the user (AREA method or a two parameter method for Vlasov foundation). Furthermore, the coding of the interface elements to capture the friction between slab and foundation was completed and integrated into the GUI. ***Task 7*** is complete at this time. ***Task 9*** is concurrently carried at this time. The NYPAS suite is continuously tested for bug related issues. This task will continue until the program is fully delivered.DTFH61-05-D-00017Task Order # 15: Collection of Materials Properties Data for Development of JPCP Design Catalog for New York State*This task order period of performance is 5/31/2010 to 06/30/2013.**ESCINC is working with the Ohio Research Institute for Transportation and the Environment (ORITE) under this task order.**Work Accomplished:*Collected additional FWD data on I86 in Angelica and Cuba and began analysis of data*Problems Encountered/Recommended Solutions:* The FWD data collection on I490 in Rochester had to be postponed due to Hurricane Irene. It is getting to be very late in the season in Rochester, and it may not be possible to collect data before the snow season starts. DTFH61-11-D-00009Task Order # 3 –Implementation of the MEPDG & Associate Software Packages in NYSDOT*This task order period of performance is 05/20/11 to 08/19/14.*1. Conducted a sensitivity analysis of the new version of INTPAVE that was provided in August 2011. A set of comments will be sent to the UTEP researcher.2. Data collection was conducted at I-90, I-86 and I-490. 9/11-15/ 20113. Provided technical support to NYSDOT on pavement damage analysis.4. Continued working with DARWin ME software. |
| **Anticipated work next quarter**:DTFH61-05-D-00017Task Order # 13: Development of JPCP Design Catalog for NY State*Planned Activities:** Continue with laboratory testing of material specimens from New York when further specimens (requested in June) are received.
* Update MEPDG software when new version comes out and funding is made available, then begin sensitivity analysis of program (sensitivity of weather data and level 1, 2, or 3 analysis)
* Run CTE lab experiments on collected specimens
* Travel to I90 in Syracuse to collect specimens

DTFH61-05-D-00017Task Order # 14: Enhancement of IntPave and NYSlab*Planned Activities:*A report with the description of the new slab element formulation, the equivalent foundation methods and damage prediction models will be delivered along with the NYPAS manual.DTFH61-05-D-00017Task Order # 15: Collection of Materials Properties Data for Development of JPCP Design Catalog for New York State*Planned Activities:*Collect FWD data on I490 in Rochester, if conditions permit. Continue to analyze data collected on I86.DTFH61-11-D-00009Task Order # 3: Implementation of the MEPDG & Associate Software Packages in NYSDOT1. Comments will be provided on the functionality of IntPave to UTEP researchers.2. Data collection will be continued at the experimental sections and data analysis.3. Collection of subgrade and subbase samples for testing will be carried out.4. Draft reports for NYSlab and IntPave will be reviewed.5. Technical assistance will be provided to NYSDOT in pavement related issues. Itis anticipated that the work will be coordinated with Dr. Stefan Romanoschi andDr. Shad Sargand in the implementation of the MEPDG.6. DARWin ME analysis will be continued.7. Start working in the training program for NYSLAB and IntPave |
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| **Significant Results:**Development of NYSlab and IntPave |
| **Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that** **might affect the completion of the project within the time, scope and fiscal constraints set forth in the** **agreement, along with recommended solutions to those problems).**Ensuring that invoices are being properly paid from funds associated with the corresponding correct task order. USDOT financial staff currently working to reconcile accounts so that invoices dating back to April 2011 can be paid. |

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| **Potential Implementation:** That is a decision for the participating States. |