7th Quarterly Progress Report to the
FEDERAL HIGHWAY ADMINISTRATION
(FHWA)

On the Project:
THE IMPACT OF WIDE-BASE TIRES ON PAVEMENT DAMAGE
DTFH61-11-C-00025

For period
October 1st to December 31th 2012

Submitted by
Illinois Center for Transportation
University of Illinois at Urbana-Champaign

FEDERAL HIGHWAY ADMINISTRATION
QUARTERLY PROGRESS REPORT

FHWA Project   DTFH61-11-C-00025   FY: 2012   Quarter: October - December

Research Agent   Illinois Center for Transportation

Principal Investigator   Imad L. Al-Qadi

Year groupings for month columns: 2011 = A M J J A S O N D; 2012 = J F M A M J J A S O N D; 2013 = J F M A M J J A S O N D.

PHASE	RESEARCH TASK	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	ESTIMATED % COMPLETION
1	1.1. Comprehensive literature review and synthesis on past and current research	20	60	90	100																														100
	1.2. Experimental plan and modeling framework			50	60	80	100																												100
	1.3. Implementation and marketing plan		10	50	70	80	100																												100
	1.4. Phase I report			60	70	80	100																												100
	1.5. Conference call with panel	0	50			100																													100
	1.6. Presentations to relevant conferences and symposiums																																		0
2	2.1. Prepare experimental equipment, test structures, and instrumentation					0	0	0	0	0	10	30	40	45	50	60	70	85	90	95	100														100
	2.2. Conduct experiments, including material characterization and accelerated loading					0	0	0	0	0	5	10	20	25	30	40	50	60	70	40	40	40													40
	2.3. Conduct modeling					0	0	0	0	0	0	1	2	5	6	8	10	20	25	30	30	35	35												35
	2.4. Develope of analysis tool												0	0	0	0	5	5	10	15	15														15
	2.5. Delivery of draft Phase II report and analysis tool																																		0
	2.6. Present to relevant conferences and sumposiums																																		0
	2.7. Prepare article and technical papers																																		0
	Estimated Progress (%)	1	3	7	8	10	11	11	11	11	13	15	19	21	23	27	33	38	43	36	38	38													38
	Planned Progress (%)	1	3	7	10	13	17	21	25	29	33	36	40	44	47	51	55	59	61	63	64	66	68	70	71	73	75	77	81	85	89	93	97	100	66

QUARTERLY PROGRESS REPORT

QUARTER 7

The Impact of Wide-Base Tires on Pavement Damage – A National Study

1. Work Performed

During this quarter, the following tasks have been accomplished:

- Initial truck testing was performed on the perpetual pavement sections in Delaware, Ohio. Two trucks were loaded at maximum capacity: tandem axle with dual-tire assembly (DTA) and single axle with wide-base tire (WBT). Three speeds (5, 30, and 55 mph) and three inflation pressures (80, 110, and 125 psi) were used during testing. At least five runs were conducted for each loading case.

- Samples were collected from the test sections in Ohio and material testing has been initiated.

- A user-friendly interface has been designed for the available databases on pavement responses to wide-base tire loading. Existing data has been gradually organized in a new database. Data from UIUC, Florida DOT, and partly Ohio SPS-8 has been incorporated.

- Details of the testing program at Florida DOT were finalized (sampling rate, number of passes, etc.)

- FE modeling of the relatively thick and thin sections continued during this quarter. The analyzed sections include the following:

  - For the thick pavement sections, all thickness combinations (125 and 412 mm AC and 150 and 600 mm base) were run for WBT and DTA loadings at low load (26 kN) and low tire-inflation pressure (552 kPa).

  - Low load and low tire-inflation pressure were used to analyze thin pavement sections for all thicknesses (75-mm- and 150-mm-thick AC and 150-mm and 600-mm-thick base) utilizing various material combinations (strong and weak AC and base).

Table 1and Table 2 show details of the combinations to be analyzed.

Table 1. Analysis cases for thin pavements

Thin Pavement Structure		
	Different Materials	**Thicknesses**
AC Layer	W, S	75 and 125 mm
Base	140 and 415 MPa	150 and 600 mm
Subgrade	35 and 140 MPa	--
Possible Combination	32	
With Load	320	

Table 2. Analysis cases for thick pavements

Thick Pavement Structure		
	Different Materials	**Thicknesses**
Wearing Surface	W1, S1	25 and 62.5mm
Intermediate Layer	W2, S2	37.5 and 100 mm
Binder Layer	W3, S3	62.5 and 250 mm
Base Granular	140 and 415 MPa	150 and 600mm
Base Treated		
Subbase Treated		
Subbase Granular		
Subgrade	70 MPa	--
Possible Combination	16	
With Load	160	

- Initial results from the FEM for thin pavements with weak materials properties were obtained and tested with close form solutions. The developed models were fine-tuned; especially with respect to some boundary condition issues.

- Specific FEM cases of pavement sections have already started.

  A discussion meeting between the research team at the University of Illinois and the Rubber Manufacturer Association (RMA) was held at the Advanced Transportation Research Engineering Laboratory (ATREL). During the meeting, an update regarding the contact stress measurements and analysis and the project's status were presented. The RMA team commented on the contact-stress measurements that will be used in this project and were satisfied with the approach the experimental plan being considered in the finite element model (non-uniform three-dimensional distribution). This

communications strengthen the collaboration with the tire industry and ensure that all parties agreed in the analysis process.

2. Work to be accomplished next quarter

- Initial set of testing will start at Florida test section. Data will be collected and initial evaluation of the collected data will be performed for repeatability.
- Construction of the test sections at Davis will be completed and loading will start.
- Testing in Delaware, Ohio is expected to resume at the end of first 2013 quarter, once the winter season is over. Data already collected from the Ohio sections will be processed and analyzed. A meeting between the Ohio University and the University of Illinois will be schedule in order to discuss the collected data and the testing during spring.
- Static FEM of DTA and WBT will be developed in order to capture the measured load-deflection curves.
- Testing of field-collected materials will continue.

3. Problems encountered

- Sections at Davis were modified due to changes in the CalTrans testing program. The new sections are composed of 270 mm of aggregate base, 250 mm of pulverized/recycled base, and 120 mm of HMA. The location of the instruments is the same as in the original plan.
- Short delays in FE analysis due to some issues in the boundary conditions. After the results of the initial runs were analyzed, it was found that the dimensions in the plan view and depth of the model were not large enough to guarantee the assumption of infinite half-space. As a consequence, the mentioned dimensions have been revisited (mainly for thin pavements) and modified accordingly. Runs using larger and deeper models have been performed.
- A problem in reporting testing progress was detected. A value representing accelerated testing section building was reported without including material lab testing and APT. This has been corrected in this report. The reported progress value in this report reflects both field and lab construction and testing.

4. Current and cumulative expenditures
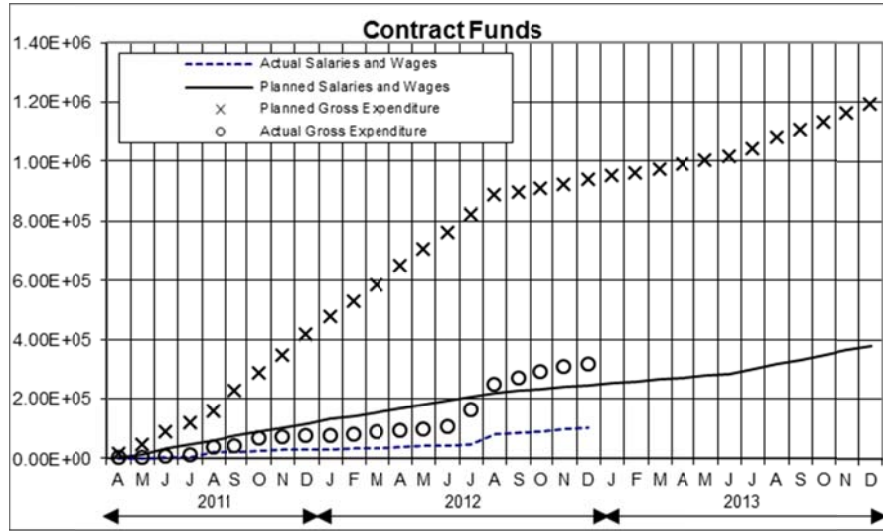
Contract Funds

funds expended	26.6%	time expended, hrs	3193.2	
contract amount	$1,190,456.00	starting date	October 1, 2012	
expended this quarter	$46,507.30	completion date	December 31, 2012	
total expenditures to date	$317,232.75			
balance	$873,223.25			

salaries and wages estimated this quarter	$19,867.61
salaries and wages spent this quarter	$16,094.60
accumulated salaries and wages to date	$101,155.28

5. Planned, actual, and cumulative percent of effort

Contract Period