

**19th 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 the Period  
October 1st to December 31st, 2015**

**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: 2015 Quarter: 19 October-December  
 Research Agent Illinois Center for Transportation  
 Principal Investigator Imad L. Al-Qadi

PHASE	RESEARCH TASK	2011				2012				2013				2014				2015				2016				ESTIMATED % COMPLETION																																					
		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	J	F	M	A																								
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			30	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																																									100																					
2	2.1. Prepare experimental equipment, test structures, and instrumentation					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	5	10	20	25	30	40	50	60	70	80	85	90	95	97	98	99	100													100																				
	2.3. Conduct modeling									0	0	0	0	1	2	5	6	8	10	20	25	30	30	35	35	40	45	50	50	53	55	56	57	59	60	61	62	65	68	70	72	73	75	77	80	82	84	85	87	88	90	92	95	95	97	98	99	100					100
	2.4. Development of analysis tool													0	0	0	0	5	5	10	15	15	20	25	35	40	42	45	46	48	49	51	52	55	58	60	62	65	70	75	77	80	85	90	90	92	93	95	97	98	100					100							
	2.5. Delivery of draft Phase II report and analysis tool																																																	98													
	2.6. Present to relevant conferences and symposiums																																																	98													
	2.7. Prepare article, technical papers, user manuals, training, TAC meeting, and TRB webminar																																																	80													
Estimated Progress (%)																																																	100														
Planned Progress (%)																																																	100														

## QUARTERLY PROGRESS REPORT

### QUARTER 19

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

##### 1. Work Performed

The following tasks were accomplished during this quarter:

- The combined NG-WBT to DTA ratio, CWD, has been calculated. It utilizes logarithmic weighting factors to appropriately combine the damage caused by bottom-up and top-down fatigue cracking and AC and subgrade rutting using MEPDG transfer functions. Previous results produced an unreasonable number of repetitions to failure for AC rutting (under the assumption of 0.5 in rutting threshold). The scripts have been updated and corrected.
- LCA and cost analysis were performed using updated responses from the ICT wide tool. The new results showed that NG-WBT created greater compressive strain on top of the subgrade compared with DTA for the thick section (671HC); other results were similar.
- The ICT-Wide tool was updated to include pavement damage calculations. Five damage criteria, including bottom-up fatigue cracking, top-down longitudinal cracking, near-surface shear cracking, AC rutting, and subgrade rutting based on the MEPDG method, were added. For bottom-up fatigue cracking, the Asphalt Institute (AI) method was also implemented. Appendix A shows the snapshots of ICT-Wide tool after implementing the damage.
- More details were added to the final report regarding the vision from the research team at UIUC to modify MEPDG to include NG-WBT. Implementation of adjustment factor 2 (MEPDG to FEA) is straightforward since it does not require any additional input parameters. The strain value calculated by MEPDG will be multiplied by  $AF - 2$  to account for advance simulation effects on the response. The new modified strain will be used in transfer functions to predict pavement performance. By contrast, implementation of  $AF - 1$  (DTA to NG-WBT) requires additional information such as NG-WBT market penetration and number of axles using NG-WBT in traffic. The approach suggested for AF1

implementation is based on distress prediction. Details regarding the proposed approach are provided in the review version of the final report.

- The final meeting with project panel was productive. Panel members were satisfied with the progress and the outcome and provided constructive suggestions. These suggestions are being fully implemented

## **2. Work to Be Accomplished in the Next Quarter**

- The report will be finalized by next quarter

## **3. Problems Encountered**

- No issues were found in this quarter

#### 4. Current and Cumulative Expenditures

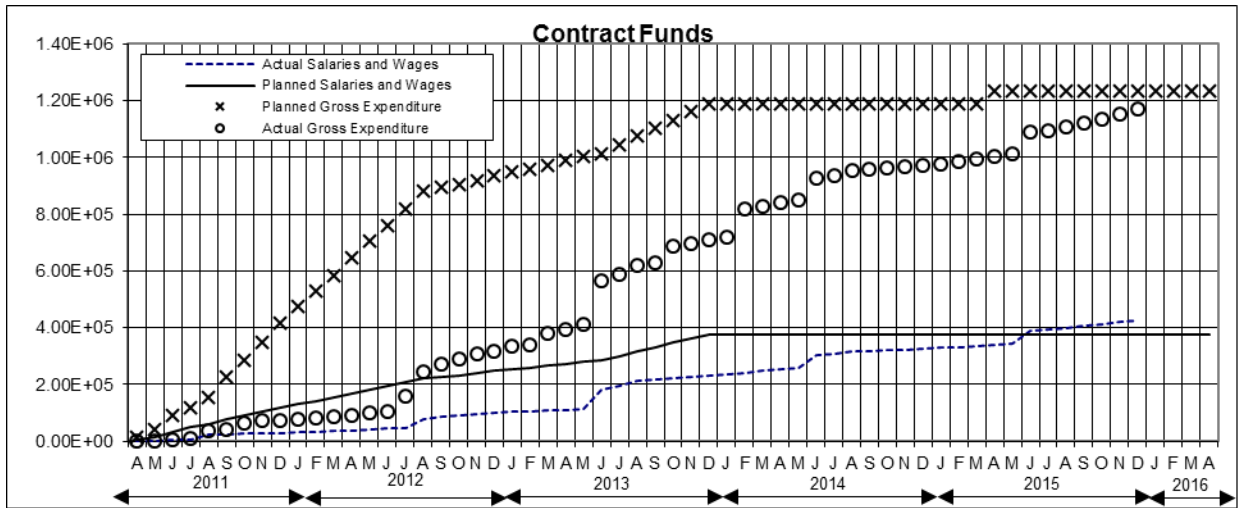


Figure 1. Project's expenditure (based on current plan including amendments).

#### 5. Planned, Actual, and Cumulative Percentage of Effort

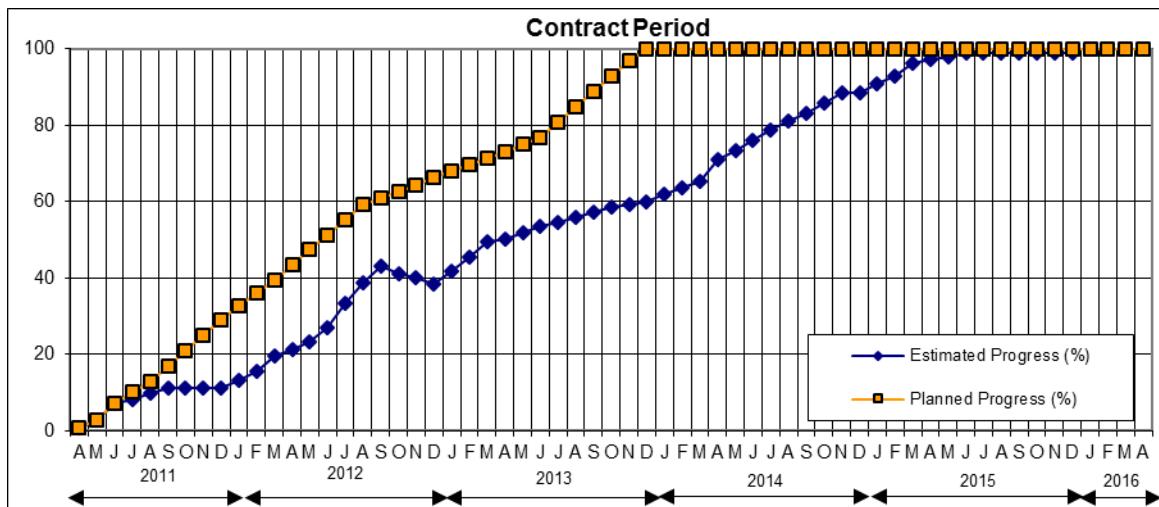


Figure 2. Project's progress (based on current plan including amendments).

# APPENDIX A

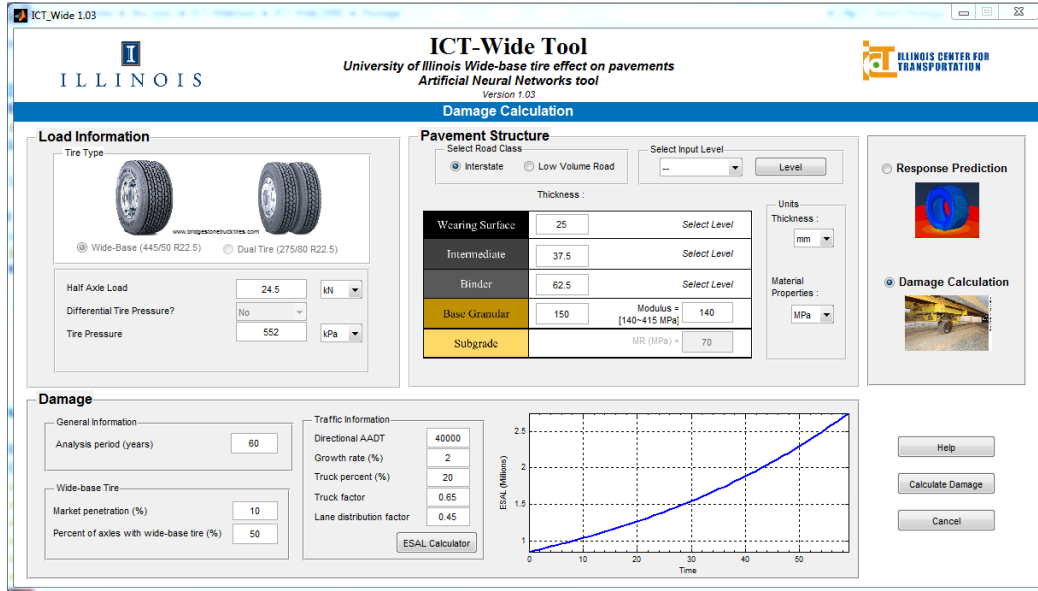


Figure A-1. ICT-Wide tool main menu with damage module selected.

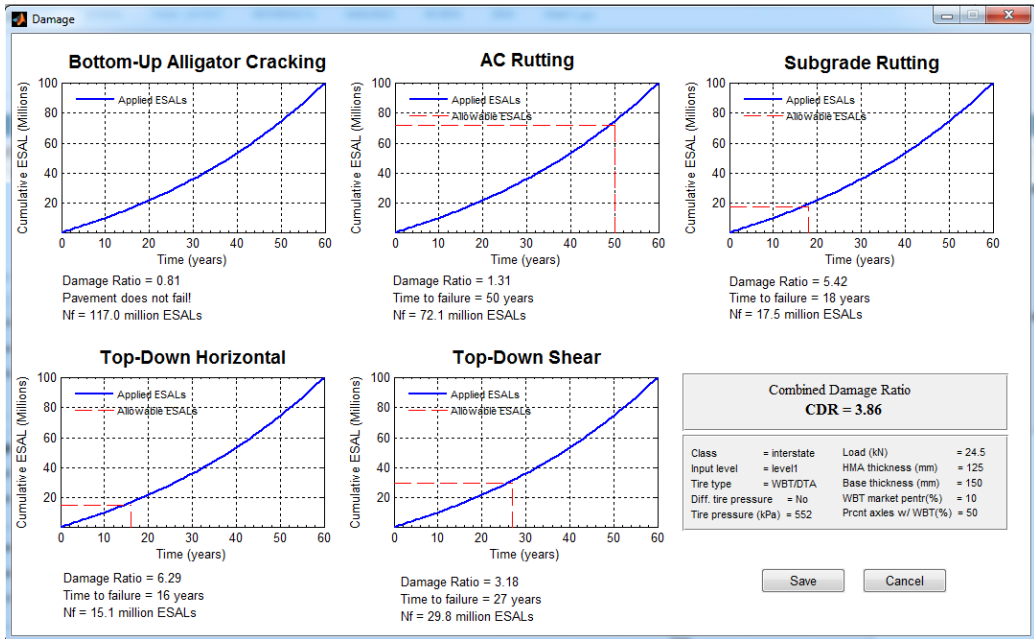


Figure A-2. Results window for pavement damage calculation from ICT-Wide tool.