UTC Project Information

Project Title	Estimation of the Rolling Resistance performance of a pavement in view of the roughness profile
University	Michigan State University
Principal Investigator	Roozbeh Dargazany, Ph.D. Karim Chatti, Ph.D.
PI Contact Information	Department of Civil and Environmental Engineering 3546 Engineering Building, East Lansing, MI 48824 Tel: (517) 432-0180, roozbeh@egr.msu.edu
Funding Source(s) and Amounts Provided (by each agency or organization)	$58,342 USDOT $15,861 MSU
Total Project Cost	$74,203
Agency ID or Contract Number	DTRT13-G-UTC44
Start and End Dates	January 31, 2017 to January 30, 2018
Brief Description of Research Project	The reduction of rolling resistance is essential for a more environmentally friendly transportation system, a process is highly influenced by both tire and pavement design. Here, we propose to develop a systematic model to provide the correlation between surface roughness of the pavement and the rolling resistance experienced by the vehicles. To this end, a multi-scale simulation model will be assembled to consider the pavement profile, the energy dissipation of tire and the complicated contact mechanism involved. In this work, our recently developed tire/pavement interaction model will be advanced to account for micro-and meso-scale pavement roughness and the energy losses due to the corresponding small-scale tread deformation. The correlation between energy loss and rolling resistance will be described using a ranking and rating system. Currently, direct formulation of such correlation is a complicated procedure that involves the mechanics of the vehicle and dynamics of the tire to be understood at multiple scales. In this work, tire-pavement contact will be simulated using finite element (FE) solvers with respect to the a multi-scale visco-elastic model for rubber. By profiling surfaces up to few microns, the contact mechanism and the resulting energy

	dissipation will be concurrently modeled in micro-, meso and macro-scales for the first time.
Describe Implementation of Research Outcomes (or why not implemented)	N/A
Place Any Photos Here	
Impacts/Benefits of Implementation (actual, not anticipated)	The work has immediate implications in both pavement and tire industries. The results of this study provide: 1. A bottom-up tire/road interaction modeling scheme; 2. A generic multi-scale pavement surface profiling method 3. A tire/pavement contact mechanism to estimate correction factors for localization of standard RR and grip tests; and 4. A micro-friction prediction technology transfer to both tire and pavement industries. Moreover, since rolling resistance appears to be dominated by meso- and macro-scale parts of a pavement profile, and friction is affected more by micro-scale features, the results of the project can be potentially used to introduce a surface spectrum that minimizes rolling resistance with respect to friction. Not only does maximizing the friction improve braking performance of a vehicle, more friction will also keep the tire surface from slipping during rolling, a condition that happens during normal rolling of a tire. Slippage against the road could actually decrease rolling resistance because it would dissipate more energy.
Web Links • Reports • Project website	<www.chpp.egr.msu.edu>