UTC Project Information	
Project Title	Monitoring Extreme Loading and Climate Impact on Infrastructure
University	Oklahoma State University
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Start and End Dates	October 1, 2014 – September 30, 2014
Brief Description of Research Project	**PROBLEM**: Infrastructure must endure the aging effects of weather and loads throughout service life. Extreme temperature changes and overloading are known to cause micro-damage in concrete structures, which reduces the concrete material's ability to withstand design loads. As they commence and cumulate, the effect of these forces is difficult to detect and assess within the structure. Typical condition assessment efforts involve mobilizing personnel to conduct lengthy visual inspections and take multiple samples, which offer limited information about the overall condition of the structure. Moreover, by the time visual signs of material degradation appear, the problem is often systemic requiring costly rehabilitation measures to maintain serviceability. **PROPOSED SOLUTION**: The objectives of this project are to evaluate climate and overload impact on transportation infrastructure, determine damage extent and monitor damage progression. First, the study will develop climatological profiles for strategic areas based upon freight transportation. Data will be obtained from *Oklahoma Mesonet* to identify local, relevant weathering conditions that are detrimental to concrete properties so that they can be evaluated. The experimental exposure conditions for testing concrete material will be based upon critical temperature and humidity ranges (freeze/thaw, wet/dry, high temperature variance), and the number of cycles per annum. Second, the study will seek to qualify and quantify damage accumulation in concrete material exposed to various loading conditions that will simulate material

	overload and fatigue deterioration at design loads. The residual structural performance of the concrete will be evaluated using sensing technologies, primarily acoustic emission (AE) and ultrasonic methods. Consequently, signature wave parameters will be developed to provide insight regarding temperature change, moisture change or microstructural changes (e.g. , microcracking). Last, evaluation and monitoring guidelines will be developed, including the use of sensing technologies, to assess deteriorative process due to serviceability loading conditions and climate conditions. The guidelines will be validated through evaluation of a field structure. Implementation will facilitate the development of an effective condition assessment system that will provide the transportation industry a monitoring tool so that infrastructure problems can be detected and corrected sooner, resulting in improved public safety and reduced maintenance costs.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	
Impacts/Benefits of Implementation (actual, not anticipated)	
Web Links • Reports • Project website	