This research initiative is funded under the auspices of the CFIRE Tier 1 University Transportation Center.

Title: Non-Destructive Technologies for Monitoring and Condition Assessment to Support Safety, Maintenance Programming, and Cost Allocation

Description:
Local, state, and federal legislators have expressed concerns about heavy commercial vehicles potentially causing accelerated damage to pavements and highway bridges. The health of large-scale structures such as bridges, embankments, railways, locks, and tunnels is essential for maintaining the continuity of the nation's freight systems. However, by increasing the legal truck weight limits, the nation could benefit from more efficient freight transportation by creating energy savings, fewer greenhouse gas (GHG) emissions, and much higher driver productivity. CFIRE partners are interested in the application of various non-destructive technologies for monitoring and condition assessment of freight transportation infrastructure. This initiative will pursue the creation of field-validated modular systems of fiber optic sensors (FOS) for monitoring transportation infrastructure leading to better information for maintenance and prevention of catastrophic failures. This research will evaluate the viability and efficacy of other new technologies, such as LIDAR, for damage assessment of pavements and bridge decks. Partners at UW-Madison have worked with MicronOptics, a leading fiber optics measurement company, and applied the technology for evaluating rail track deformations as part of the ballast fouling process.

Outcomes:
This research will evaluate the potential uses of new technologies for infrastructure monitoring and damage assessment. The research will produce practical methods to install sensors, collect data, and summarize results for both short- and long-term monitoring of critical freight infrastructure components and elements. This research will provide local, state, and federal agencies with information sources on non-destructive tools for structural health monitoring, developing risk management systems, upgrading design standards, and assessing and allocating cost associated with structural damage.

Deliverables:
The research effort will be compiled in a final report that will include all tasks presented in the work plan. Moreover, the results from this project will be summarized in a web-based interactive module. The success of our research project will be the implementation of the web-based interactive decision-making module by DOT engineers, contractors, and transportation-related companies in assessing the use of non-destructive testing technologies in transportation projects.

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Industry Impact:
This research proposal will

1. Evaluate the proper use of NDT techniques as applicable for transportation infrastructure components/systems inspection;
2. Address the potential impact of heavy commercial vehicles on the deterioration of transportation infrastructure components/systems;
3. Help develop timely maintenance schedules using performance-based data;
4. Improve economic competitiveness by proper assignment of resources;
5. Add to the environmental sustainability of transportation systems by creating climate-related monitoring of infrastructure deterioration, developing tools to protect transportation infrastructure and systems against natural hazards, and reducing safety impacts of climate change on the transportation system).

Research Team:

- Alan Horowitz, University of Wisconsin-Milwaukee (Management Committee Representative)
- Hani Titi, University of Wisconsin-Milwaukee (Project Coordinator)
- Dante Fratta, University of Wisconsin-Madison
- Jose Pincheira, University of Wisconsin-Madison
- Rani El-Hajjar, University of Wisconsin-Milwaukee
- Habib Tabatabai, University of Wisconsin-Milwaukee

Funding:

- Total: $382,547
- UTC Funds: $190,000

Duration:

- 18 months

Student Involvement

- University of Wisconsin-Madison: One graduate student for three semesters
- University of Wisconsin-Milwaukee: One graduate student for one semester and one student hourly

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