

Title: Innovative Structural Systems, Integrity Assessment and Structural Health Monitoring of High-Speed Railway Bridges (intel-HSR)

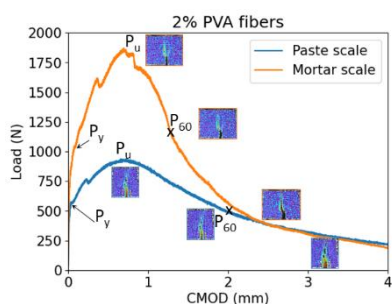
Duration: April 2023 to March 2026

Objectives:

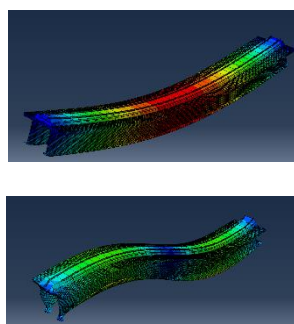
- Innovative materials and structural systems for high speed railway bridges employing multi-scale multi-metric evolutions
- Artificial intelligence (AI) augmented distributed sensing techniques for real time monitoring of bridges

Progress Highlights:

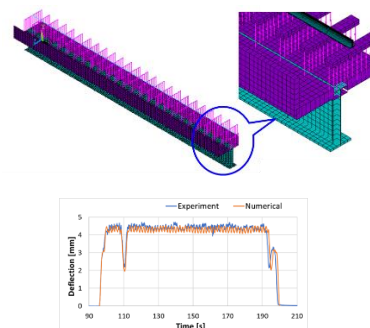
- ❖ Investigations towards development of novel high-performance concrete with strain hardening capabilities using digital image correlation technique
- ❖ Design of steel-concrete composite girder for high speed railway bridges
- ❖ Dynamic response analysis of bridges due to the moving vehicle using vehicle-rail-track-bridge interaction model
- ❖ Establishment of methodology for detection of damage in concrete structural components using linear/non-linear ultrasonic wave propagation techniques
- ❖ Development of technique for damage localization in plate-like steel structural components using guided wave propagation
- ❖ Analytical investigations towards design of vibration mitigation devices for high-speed railway bridges
- ❖ Development of hybrid sensing technique using distributed fiber optic sensor technology for multi-point response measurements
- ❖ AI enabled data fusion techniques, statistical models and novel algorithms for real-time health assessment of bridges using hybrid multi-point responses



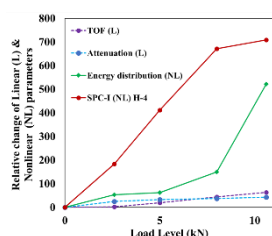
Fracture investigations towards development of nHPC



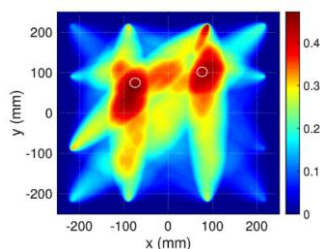
Dynamic analysis for design of steel-concrete composite girders



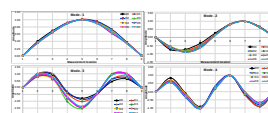
Vehicle-rail-track- bridge interaction model



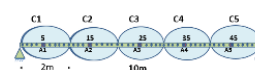
Damage detection using ultrasonic techniques



Damage localization using guided wave propagation



Vibration-based damage detection



Data-fusion technique for damage localization

Future Programme:

- Numerical simulation of high frequency wave propagation for detection of flaw/integrity issue in the steel-concrete composite system
- Experimental investigation on the integrity assessment of composite systems prior to service
- Design of vibration mitigation devices to control the vibration in the high-speed railway bridges
- Analysis of the data measured from multiple sensors embedded in the concrete laboratory specimens under ambient conditions and static/dynamic loading
- Validation of the data-fusion based damage detection using the laboratory experimental data

PI and Co-PI

Dr. B.S. Sindu (PI)

Dr. B. Arun Sundaram (Co-PI)

Team:

Innovative materials and structural systems for high speed railway bridges employing multi-scale multi-metric evaluations	Artificial Intelligence (AI) augmented distributed sensing techniques for real time monitoring of bridges
Mr. M. Kannusamy Dr.-Ing. Saptarshi Sasmal Dr. Srinivasa Babu Ramiseti Mr. K. Saravana Kumar Dr. A. Thirumalaiselvi Dr. A. Subbulakshmi Mr. A.M. Sarath	Dr. K. Lakshmi Dr. Voggu Srinivas Mr. Deepak Kumar Mr. M. Aravindan

Date: September 2024