

PROJECT OVERVIEW REPORT

1. UTC Identifying Number
69A3551847102
2. Center Identifying Number
CAIT-UTC-REG22
3. Project Title
Simulation of Degradation and Failure of Suspension Bridge Main Cables due to Natural and Anthropogenic Hazards
4. Principal Investigator & Contact Information
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7. Project Description
The primary goal of this proposal is to develop a well-defined methodology to estimate the remaining strength of a suspension bridge cable that has been exposed to fire. The methodology will rely on a general purpose Finite Element code (ABAQUS) that is commercially available and widely used in the profession. The cable FEM model will be developed and calibrated using the extensive experimental data already available to the research team: this data will provide the much-needed thermo-mechanical properties for the ASTM 586 steel used in main cables. This will allow us to study the evolution of the reduction of the cable strength over time of exposure, accounting also for the cooling phase when the fire is extinguished. This FEM model is expected to 1) provide high-confidence designs of new structures, 2) retrofit existing structures with novel hardening systems, 3) quantify more accurately the hazards associated with traffic patterns and general access to cables, and 4) perform high-fidelity forensic investigations of structures subjected to fire events.

8. Implementation of Research Outcomes (or why not implemented)

The research aims to provide actionable guidance and engineering tools to support the structural engineering community. The expected deliverables are an academic report that provides a well-documented narrative to the work performed in the generation of the FEM model; a guidebook that will outline the critical results and conclusions of the research, including recommendations for designers to reduce the impact of fire on bridge cables, retrofit/hardening strategies, and optimal emergency response techniques to minimize cable damage and a well-tuned Finite Element Model in a widely used and accepted commercial software package (ABAQUS) that can be modified by structural engineers to simulate fire events for design, retrofit, and forensic applications.

9. Impacts/Benefits of Implementation (actual, not anticipated)

To Be Determined

10. Dates and Budget

Start date: 9/1/2019

End date: 8/31/2020

UTC (CAIT) Dollars: \$97,943

Cost Sharing: \$97,945

Total Dollars: \$195,888

11. Keywords

suspension bridge, cable, fire, safety, hazard, finite element analysis, neutron diffraction, friction, load transfer, safety factor

12. Web Links (Reports and Project Website)

<https://cait.rutgers.edu/research/simulation-of-degradation-and-failure-of-suspension-bridge-main-cables-due-to-natural-and-anthropogenic-hazards/>