RUTGERS
Center for Advanced Infrastructure and Transportation

**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
   Adrian Brügger, Ph.D.
   Associate Research Scientist
   Columbia University
   500 West 120th St., MC4709
   New York, NY10027

5. Rutgers/CAIT Project Manager
   Patrick Szary, Ph.D.

6. Customer Principal
   Hamid Ghazemi, Ph.D.
   Rutgers, The State University of New Jersey
   Center for Advanced Infrastructure and Transportation
   100 Brett Road, Piscataway, NJ 08854

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: 8/31/2022
    UTC (CAIT) Dollars: $192,943
    Cost Sharing: $192,945
    Total Dollars: $385,888

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/