

1. **Project Title: BUILD-ABLE BRIDGES**

2. **Project Description**

I am currently working on developing a set of build-able bridge models here in the Civil Engineering department at the University of New Hampshire. These bridge models would represent different structural types and focus on signature bridges throughout New England and bridge type through out history. These models are then intended to be used for outreach in New Hampshire education, primarily for grade K through 8.

Each model would include a set of “construction” drawings that are color coded, a construction sequence and all construction materials, including members and connectors that are also color coded for ease of construction. Using the drawings and construction materials, the students will be able to construct the bridge. This construction sequence will help the student to understand and appreciate engineering at work.

3. **BACKGROUND INFORMATION/STATEMENT OF THE ISSUES/PROBLEM**

Recently, the National Science Foundation and other federal and state agencies have expressed a great interest in “K-12 Engineering”. The American Society of Engineering Educators outlined five ways in which engineering can best benefit K-12 education.

(<http://www.engineeringk12.org/>)

- Engineering is **Academic Glue** – it binds complex math and science concepts to real-world experiences and leads to learning that sticks with students.
- Engineering is **Creativity** – the need for problem-solving and innovation brings out the best ideas from every student.
- Engineering is **Group Work** – students learn to communicate and work together while they learn math and science by applying engineering principles.
- Engineering is **Everywhere** – students learn that engineers have designed, created, or modified nearly everything they touch, wear, eat, see, and hear in their daily lives.
- Engineering is **FUN!**

These build-able bridge models would integrate these five points into one comprehensive activity. Civil Engineering is the application of science and math to practical results such as the design, construction, and operation of efficient and economical structures and systems. The ever-advancing technology demands a skilled, highly-educated technical workforce. From defense to infrastructure, the quality of our engineers affects the quality of our lives. Exposing student to engineering principles at an early age could help encourage a higher percent of the population to explore engineering as both an educational and career choice.

4. **PROJECT DETAILS**

Goals and Objectives:

This project intends to encourage interest in engineering as a possible career choice. The bridge models created through this effort will be housed in the civil engineering department at the University of New Hampshire and will be available for use by local

after school providers including affiliates for Plus Time NH and the 21st Century Community Learning Center.

The students that are part of the after school programs that employ these bridge models will be tracked throughout their academic career to evaluate the effect of the models on the each students' educational choices.

The outcomes of this project will be two to three build-able bridge model kit with educational material. This information will be shared with Plus Time NH and the 21st Century Community Learning Center for use in after school programs.

Target Population/Audience:

After group discussions that were part of the Outreach Scholar Academy, the target audience was transferred from elementary school classroom to several organized after school activities. The school day is filled with necessary curriculum activities leaving very little room for engineering education. However, there are several programmed after school efforts that are looking for fun innovative ways to excite student about learning and engineering.

Methods: Each model will demonstrate a different type of design method, architectural style and construction method. Each model will represent a different phase of world cultural development. The model set will include but is not limited to the following bridge classes

- Roman Arch Bridges (Roman aqueducts)
- Steel Truss Bridges (Firth of Forth in Scotland)
- Steel Beam Bridges (Brooklyn Bridge, Tacoma Narrows)
- Cable Stayed Bridges (Leonard P. Zakim/Bunker Hill Memorial Bridge)
- Suspension Bridge (Golden Gate Bridge)

During the initial assembly, the students will have guidance from their after school provider/teacher, representatives for UNH, including faculty, graduate and undergraduate students. They will also learn how that bridge played an integral role in the cultural development of the users.

Evidence of External Collaboration and Partnership:

Through contacts made in the Outreach Scholars Academy, I have a schedule lunch meeting with both Terri Warren of Plus Time New Hampshire and Suzanne Birdsall of the 21st Century Community Learning Center. The topics that we will discuss at this meeting will include marketing ideas these bridge models to the after school providers and development of instruction packets and activities for each model. Through preliminary telephone conversations, I have learned about an upcoming after school providers conference that will be held this summer at UNH.

Expected Impact:

The two identified external partners, Plus Time NH and the 21st Century Community Learning Center, will gain an innovative set of tools for advancing knowledge through after school programs.

The impact of these bridge models will be measured by surveys and feedback from the after school providers and students. The organization of a New Hampshire Parents' Night at UNH that will introduce parents to the bridge model is also under consideration. The idea of a Parents' Night is also a direct result of my participation in the Outreach Scholars Academy.

Scholarly Connection:

This project is part of the educational component of my NSF: CAREER grant focused on developing a design verification process for bridges and including intelligent transportation system information in the life-long structural condition assessment of the bridge structure. This grant is currently under development and will be submitted in mid-July. I am also interested in developing program that will encourage girls' interest in engineering.

This collection of bridge model will be used to encourage outreach and also to enhance the understanding of civil engineering students at UNH on bridge design and construction.

5. EVALUATION PLAN

I plan on assessment the outreach component of this project by tracking the educational choices of the students that will exposed to the build-able bridge models. I also plan on publishing the procedure involved in the development of these bridge models and educational materials as well as the implementation of these models through after school programs. This publication will most likely by in the Journal of Engineering Education.

The receptiveness of both after school providers and students will help determine if the external partnership is beneficial. I think that after school programs are a possible untapped location for engineering education.