Thesis Project Portfolio

Little Ivy Creek Bridge Replacement using Accelerated Bridge Construction Methods

(Technical Report)

The Emergence of Accelerated Bridge Construction: Analysis of the Components of its Sociotechnical System

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

My technical project for CE 4990/4991 was to complete an Accelerated Bridge Construction (ABC) design for the vehicle bridge over Little Ivy Creek on Route 250 in Charlottesville, Virginia. For my STS project, I chose to analyze the components of the corresponding sociotechnical system of ABC technology, and research how and why this technology is implemented in the construction field. I decided to focus on these aspects of my technical project because I was surprised to see the apparent disconnect between the number of academic and government-funded ABC research endeavors with the number of bridge construction projects that are actually using the ABC technology. As a result, I was particularly intrigued with investigating what factors determine when the accelerated methodology is chosen over the traditional bridge construction, and how these factors are intertwined with the functionality of the impacted society or community.

The technical portion of my thesis produced a comprehensive design for a 2-week Accelerated Bridge Construction replacement of the bridge over Little Ivy Creek on Route 250 in Charlottesville, Virginia. The thorough work that was completed can be thought of as a model for a typical construction analysis that leads to a complete design, nearly ready for construction to begin. This design culminated in a problem statement, scoping of the problem, a list of design constraints, a cost-benefit analysis justifying the technology, detailed structural and geotechnical designs and checks, a constructability assessment, a preliminary project cost estimate, and a set of construction documents.

In my STS research, I analyzed the components of the sociotechnical system for Accelerated Bridge Construction. Specifically, I looked into the discrepancies between research

and implementation, identifying potential causes such as accidents in the past and advantages and disadvantages of the technology from a variety of perspectives. In order to accomplish my goal of better understanding these components, I applied Frank W. Geels' "Multi-level Perspective on Sustainability Transitions: Response to Seven Criticisms" by defining his approach and showing how his framework can be applied to the Accelerated Bridge Construction sociotechnical system. This identification of Geels' sociotechnical niches, regimes, and landscapes, specific to the ABC technology, allowed me to gain a more comprehensive understanding of the specific components of a larger innovative technology, the stability of the existing sociotechnical system, and demographical trends, political ideologies, societal values, and macro-economic patterns that influence the technology's implementation.

By completing the technical and STS projects simultaneously, I gained a greater insight into how the technical components and societal factors are interrelated. The combination of extensive design work and a broader sociotechnical analysis prevented me from getting caught up in the specific details of the technology, and allowed me to see why the ABC technology was created in the first place, and how it will likely shift in the future. While researching the dynamic nature of the relationship between the Accelerated Bridge Construction research and implementation, along with the relevant organizations and their pertinent roles in the sociotechnical system, I had the opportunity to approach learning about ABC from a unique, holistic perspective.

Lastly, I would like to thank my STS and technical advisors at the Engineering School of the University of Virginia: Professor Neeley (STS), Professor Gomez (Technical- Structural), and Professor Burden (Technical- Geotechnical). Without them, my research and analysis would not have been possible.