Thesis Portfolio

Little Ivy Creek Bridge Replacement Using Accelerated Bridge Construction Methods
(Technical Report)

Crumbling Infrastructure: Fixing our Nation's Failing Public Works
(STS Research Paper)

An Undergraduate Thesis

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

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Sociotechnical Synthesis

My technical and STS topics both dealt with the failing infrastructure of the United States. While my technical topic looked at just one example of an old, decaying bridge my STS topic attempted to take a step back and determine the extent of the problem and what could be done to fix it.

My technical topic dealt with the replacement of an old bridge over a stream on Route 250 in Albemarle County. We were to determine the best method of construction and then come up with a design. The design we chose used Accelerated Bridge Construction (ABC) methods to minimize impact on the traveling public. Accelerated Bridge Construction involves using precast concrete bridge sections and shipping them onsite for installation. This is more expensive than conventional bridge construction methods, but construction time is significantly shortened. Using this method, the project took two weeks whereas it would have taken three months using conventional bridge construction methods. The increased cost was deemed worth it given the reduced impact to the traveling public. Our design consisted of two twin-celled box culverts with a roadway on top. Box culverts are a common design, so price was reduced as a result. The culverts also allowed the stream to continue with its flow. Bridge design guidelines from various state's Departments of Transportation were consulted for relevant design criteria such as wall thickness and culvert width. Our final design was very similar to the design that the Virginia Department of Transportation actually implemented.

My STS topic was inspired by our technical topic's original design question: what is the best way to replace this existing bridge that is in poor condition? The crux of the question lies in the word "best." We had to determine what criteria we were willing to describe as the most desirable. We ended up determining estimated costs of construction for both conventional and

Accelerated Bridge Construction methods. When price is the only cost taken into account, conventional methods will win out every time. The strength of ABC, however, is the dramatically reduced construction timelines. The traveling public bears the brunt of road construction's effects. This had to have a quantifiable cost, so I set out to determine what that was. Additionally, I wanted to take a look at how bad the infrastructure problem in the United States actually is, how we should address it, and how we can avoid similar problems in the future.

My technical topic got me thinking about how the types of solutions we implement as engineers can affect a lot of people in very profound ways. We have all been stuck in traffic due to construction, and this results in lost time, productivity, burnt gas, and a myriad of other problems. There are, however, ways to try to mitigate these costs and annoyances. There is also a great motivation to do so, but it requires looking at the whole picture and taking into account societal costs as well as construction price tags.