Thesis Portfolio

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

Social Justice in a University-Community Interaction: A Case Study on Brandon Avenue
(STS Research Paper)

An Undergraduate Thesis
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As cities expand, they implement new technologies and policies to progress the city forward into the next generation. Cities are developing more sustainable infrastructure in hopes of creating resilient systems that will enable the city to prosper well into the future. Sustainable infrastructure has lower operation and maintenance costs and is more environmentally friendly because of its decreased use of resources and energy. However, there is a third part to sustainability that is often forgotten about, social sustainability. Social sustainability is arguable the most important aspect of sustainability because it serves as a gauge of how well systems serve the needs of the people. A building can be extremely efficient and energy friendly but if it does not serve any need then it is useless. Both my technical thesis and STS thesis are focused on sustainable infrastructure and its social implications. This is an effort to better understand the benefit these systems have to society.

My Capstone project is focused on the rehabilitation or replacement of a bridge north of Charlottesville on US Route 250. After inspection by the Virginia Department of Transportation it was determined that the bridge was in poor condition and would need to be repaired or replaced. The capstone project is focused on the feasibility of using Accelerated Bridge Construction (ABC) to rehabilitate or replace the bridge. ABC is a project planning and procurement approach that improves project delivery time, work-zone safety, and site constructability while also reducing traffic impacts, onsite construction time, and weather-related delays. ABC elevates the priority of minimizing the social cost of the project. The social cost is the impact the project has on the stakeholders affected by the construction activities associated with the project. The social cost of road closures, restricted lanes, and detours is impeded economic activity because of the restriction of flow of people and goods. ABC is aimed at reducing this impact by using “innovative planning, design, materials, and construction methods in a safe and cost-effective manner to reduce the onsite

construction time" (FHWA). While the social costs associated with construction activities are a major issue to consider when deciding to implement ABC, there are other benefits that deal with site constructability and safety of workers. Many times, projects are faced with constructability issues that prolong the construction period. Remote locations, weather delays, worker safety, and cost of temporary structures are all inherent risks faced in construction. ABC uses prefabricated elements and systems to streamline the construction process which limits safety risks for workers and reduces the onsite construction time.

Currently, 11,500 vehicles pass over the bridge per day. Any construction will temporarily restrict vehicular flow over the bridge. Using conventional bridge construction one lane would remain open at all times using a signalized system but construction would take approximately 3 months. Using ABC would restrict all traffic over the bridge but a maximum closure time of two weeks is feasible. From assessing the existing conditions of the bridge and the site along with a cost evaluation and considerations of public opinion we decided to rebuild the bridge using ABC because of the decreased social cost. We performed a geotechnical analysis on the soil and calculated live loads to design a structure that would carry the required weight without disrupting the creek. We decided to construct the bridge using box culverts with wing walls. We preformed a cost benefit analysis and structural analysis in order to make sure our structure was cost effective and safe.

My STS thesis was concerned with the effect of UVA expansion on the Charlottesville community. As UVA continues to grow it will inevitably expand its student body and its grounds. My STS paper focused on the recent Brandon Avenue Redevelopment and explored the power dynamics between the University and the City of Charlottesville. I looked at how the project came to fruition and how it will affect the community once it is completed.

To accomplish this, I first defined all of the stakeholders involved and laid out a timeline of all the important milestones in the project. In my research I identified three conflicts between the university and the city. The first being the issue of the city giving the university land for free to help with the university's projects, but the university has not been reciprocating this help to the city. The second conflict was the issue of the strategic goals of the university not aligning with the comprehensive plan of the city and therefore making it difficult for the city to accomplish its plan. The third was the issue of the increased student body driving up the property values and rent in the city because of the need for off grounds housing.

In both my technical thesis and STS thesis I discovered the social implications of sustainable infrastructure have far reaching effects. I discovered conflicts that I was previously not aware of and the scope of problems to consider was widened. Future work on my research would look more into the economic impact universities have on the cities they reside in.