

Thesis Portfolio

A Replacement/Rehabilitation of the Old Ivy Creek Bridge using Accelerated Construction Methods

(Technical Report)

How have “green building” rating systems such as LEED impacted the motivations and practices of stakeholder groups within the construction industry?

(STS Research Paper)

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A REPLACEMENT/REHABILITATION OF THE OLD IVY CREEK BRIDGE USING ACCELERATED CONSTRUCTION METHODS

with Benjamin Redfern, Beau Gutridge, Avery Davis, Collin Shepard, Edler Saint-Jean, Jacob Hegemier, Marc Michaud, Miguel Ricardo de Obaldia, Sam Cave, Tommy Blankenship

Technical advisor: Jose Gomez and Lindsey Burden, Department of Engineering Systems and Environment

HOW HAVE “GREEN BUILDING” RATING SYSTEMS SUCH AS LEED IMPACTED THE MOTIVATIONS AND PRACTICES OF STAKEHOLDER GROUPS WITHIN THE CONSTRUCTION INDUSTRY?

STS advisor: Kent Wayland, Department of Engineering and Society

PROSPECTUS

Technical advisor: Jose Gomez and Lindsey Burden, Department of Engineering Systems and Environment

STS advisor: Kent Wayland, Department of Engineering and Society

For years the construction industry was associated with a resistance to change, an adherence to long established methodologies and practice that left little room for significant development. These days however, the different stakeholder groups within the industry are making rapid strides towards cultivating practices that embody values more in line with society's current sensibilities. Before heading out to begin my career, I wanted to learn more about these new trends that have been revolutionizing both the public and private sectors. The goal of my technical project was to go through the steps that would be followed in a real world setting in order to design and organize the construction of a bridge using accelerated bridge construction methods that highlight efficiency and sustainability as their core pillars. In a similar vein, my STS research paper centered on investigating the impact green building rating systems, specifically LEED, have had on the stakeholder groups that make up the construction industry.

For the technical project, my team and I were responsible for making the Route 250 bridge spanning Old Ivy Creek usable for the foreseeable future. This included determining first whether it would be best to either rehabilitate or completely replace the existing bridge, which we compared by conducting a cost benefit analysis of both options. Ultimately, we found that it was more viable to completely replace the existing structure by employing accelerated bridge construction methods, such as prefabricated concrete, which would drastically shorten construction time. By lessening construction time, we would be able to cut costs and lessen traffic and environmental impacts. Using daily traffic data and geotechnical logs, our team calculated the strength characteristics of the soil and the loads that the bridge would have to withstand upon completion. From there we were able to successfully design the foundational supports as well as the superstructure of the bridge itself. The final phase of our research

culminated in a preliminary conceptual estimate that helped visualize what the costs of our current design would entail from the materials to construction.

The research problem I investigated as the topic of my STS paper was ‘How have “green building” rating systems such as LEED impacted the motivations and practices of stakeholder groups within the construction industry?’ My central claims revolve around the fact that the concept of these third-party verification rating systems for sustainability have not only changed how preexisting groups behave in the marketplace, but also created entirely new stakeholder groups due to the rising dominance of “green” construction. Some of the principal groups studied include the public, federal and state government bodies, general contractors, and finally the people actually occupying these LEED certified buildings. Apart from researching the impact that this rating system has had on the stakeholder network of the construction industry, I also looked into the actual efficacy of LEED in helping buildings reach their sustainability and health goals to better determine the reasons behind the system’s popularity.

From the work accomplished this year, I can say that I achieved the majority of what I set out to do. By going through the process of designing and building a bridge from scratch for my technical project, I gained insight into the key aspects of bringing a proposed project to completion, as well as how new construction methods are increasing the overall efficiency of the industry. Using these developing practices can lead to further advancing them, with the goal of using even less resources to accomplish projects in a way that’s faster and better for the environment. Separately, from my investigation into the LEED rating system I was surprised to discover that LEED may not be as successful in its goals as the organization behind LEED may want people to think. While most LEED buildings for which data has been made publicly available do shown increase in occupant satisfaction and some level of energy reduction, they

unfortunately do not serve as an accurate representation of the efficacy of the system as a whole due to the selective bias inherent in the energy data acquisition. Future studies should focus on developing methods to more clearly sift through the data to determine how effective LEED standards really are, and prevent groups from using the system simply for brand recognition and PR. But regardless, it is unequivocal that LEED has been paramount in redefining the construction industry's values and facilitating the standardization of green construction in our society.