Thesis Project Portfolio

Little Ivy Creek Bridge Replacement using Accelerated Bridge Construction Methods

(Technical Report)

Organizational and Technical Strategies to Mitigate Indirect Costs in Construction

(STS Research Paper)

An Undergraduate Thesis

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

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring, 2020

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Table of Contents

Sociotechnical Synthesis

Construction of all types facilitates or provides some sort of social or economic good to the public or a certain group. In general, the intention of construction is to provide a benefit; whether it is opening a new hospital, building new homes, or a new highway for commuters, the intention is to provide a benefit to the end users. While this is the case, there are indirect costs that associate itself with construction that can have a significant negative impact on the surrounding community. Indirect costs such as travel time delay or local business impact are two examples that construction can have. My STS and technical projects both focused on how to execute a construction project in a way that will mitigate the indirect costs of construction. My technical project's end goal is to design and construct a bridge while implementing accelerated construction techniques and methods. My STS research was focused on how technological or organizational change and innovation can facilitate the transition into an improved construction industry where indirect costs are a big part of decision making processes and can be limited through technological or organizational means.

In the technical portion of my thesis, the end goal was a constructible bridge design for the Route 250 bridge that spans Old Ivy Creek while implementing accelerated bridge construction techniques when necessary. Challenges arose when traditional construction delivery methods came at high cost to the public who use Route 250 to commute and local businesses along this highway. With these high indirect costs, it forced our hand into specifically looking at accelerated construction which shortened construction to two weeks compared to three months but also limited the indirect costs. With this delivery method chosen, a design that could be constructed within a two week time frame was needed. The final design consisted of a two-cell box culvert system that is prefabricated off site and put into place once it is transported. This

allowed for a short construction time we were designing around. The indirect costs played a major role in what delivery method and design was ultimately chosen.

Though there are clear benefits to accelerated construction, it is still only used in certain cases where the indirect costs are very high and the high cost of accelerated construction is justified. My STS research explored why indirect costs were not highly prioritized in the decision making process on construction projects and how this could be changed. Through my research, technological or organizational advancements, like accelerated construction or organizational values, can provide a means of prioritization of indirect costs. These technological innovations, if adopted more quickly by the industry, can provide social and environmental benefits for the whole community beyond just making a profit. Organizations can also instill values beyond making money that will create an environment that is empathetic in considering the indirect costs of their design. This can also go the other way by which technological change could force companies to consider the social and environmental impacts more prominently then just organizations taking the initiative to prioritize the indirect costs. Regardless, prioritization of indirect costs can occur through technological innovation or organizational changes with one often influencing the other.

My STS and technical research projects combined proved that technical and non-technical aspects can shape the priorities and costs of an engineering project. The research done in both projects showed that the mitigation of indirect costs were not just an added benefit that we stumbled upon but can actually be dictated through technological and organizational changes that are deliberately done with a purpose. If engineers can act empathically and ethically through considering the impact of a new technology or the implementation of their design, the indirect or negative impacts can be limited significantly.