

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

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

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## **General Research Problem: Improving Energy Efficiency and Lessening Environmental Impact through Sustainable Construction Practices**

By the very nature of technology, it is in a state of constant change and development as society seeks to maximize efficiency and effectiveness with each subsequent iteration. Over the course of history, technological innovation has gone through several themes dependent on the socio-economic landscape of a particular time period. Recently, there has been a wave of emphasis placed on new technologies and practices that focus on sustainability and lessening our footprint on the environment to make sure that we are leaving behind a cleaner, brighter future for future generations. Investigating the application of these new practices in a real life setting and the reasons behind this shift in cultural mindset will help clarify the benefits of past and current practices and illuminate the motivations of the different groups involved.

## **Technical Research Problem: A Replacement/Rehabilitation of the Ivy Creek Bridge using Accelerated Bridge Construction Methods**

*What is the most cost effective and efficient way to make a bridge functional for the foreseeable future while minimizing the impact of construction on the community and surrounding environment?*

The technical research topic revolves around rehabilitating or possibly even reconstructing the Route 250 bridge over Ivy Creek in Virginia using Accelerated Bridge Construction and other safe efficient methods. Our focus is on completing the assembly of this bridge with minimal impact on the travelling public. This problem is being tackled by a team of civil engineering students following different tracks but primarily focused on infrastructure and structural mechanics. Currently the project is in its initial stages of preliminary research, with team members researching design specifications for the bridge as well as geotechnical reports in order to better understand the foundations around the site. Further information needed are traffic

reports to better gauge traffic flow patterns through the area, which will dictate the scheduling of the project. By continuing to investigate how Accelerated Bridge Construction methods work, we can then as a group split up the design of the bridge into components that can then be individually designed to support the expected load bearings. Our ideal result by the end of the project is to have a working design for our bridge, with a schedule for assembly and construction with minimal impact on the environment, travelers and a focus on long term sustainability for the lowest possible cost.

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

Introduction

For the past decades, there has been a resurgence in environmentalism in society at large. From wealthy private entrepreneurs to government agencies, there has been a noticeable trend towards living green. The construction industry in particular has become heavily focused on decreased construction waste and runoff and designing long lasting sustainable buildings with reduced emissions and environmentally friendly operating practices. The system serving as the template for this sustainability trend is LEED (Leadership in Energy and Environmental Design), founded in the early 1990’s as a means of rating how environmentally conscious buildings were. Resulting from the oil crisis of the 1970’s, LEED was created by the US Green Building Council ([USGBC](#)), a coalition of private and non-profits firms whose original goal was to prevent a similar energy crisis from occurring again that would halt business by creating sustainable building practices. Working together with the Federal Energy Management program, the

USGBC launched LEED which quickly became the standard for federal construction projects (LEED, 2019).

However, LEED's impact on the values of private investors and clients when searching for a construction company to hire is worth investigating to gauge its impact on a societal level. Also pertinent to this investigation is the actual environmental benefits and energy efficiency that come as a result of following LEED guidelines and whether or not a LEED certification makes any actual difference in that regard. A phenomenon that pertains to this is "greenwashing", which first began in the 1980's where companies would proclaim their environmentally friendly policies which more often than not were blatantly misleading (Watson, 2016). While those whose interests align with protecting LEED's public image would be loath to have the system associated with that term, if achieving a LEED rating is possible by adding insignificant design features, then the inherent merit of that rating would be greatly diminished. This would in turn help determine the reasoning behind the push for LEED in its various stakeholder groups, whether it be for its actual positive impact in constructing and operating a building sustainably or more as a means to draw business and employees through the shiny LEED plaque and what people believe that certification represents.

### Background and Theoretical Framework

Whether or not LEED actually represents a shift in thinking amongst the populace can be better understood based on its influence in the private sector as well as on large federal entities who have adopted the system. A few of the principal stakeholder groups to be researched include government entities, construction companies, and the private clients. At the end of the day, all of

these groups act in accordance with the views of employee prospects and civilians who will be using and accessing the projects upon completion. Based on feedback from construction companies, private clients' "agenda" in employing LEED often comes down to wanting to appear themselves as though they care about the environment and community to foster an outer company image. Everyday customers and workers of potential construction clients tend to look kindly upon companies whose public image appears to promote sustainability and lessened environmental impact, and finding studies that support this notion would lend further credibility to my assumption. In an attempt to appeal to customer mindsets, clients hiring construction companies take these values into account, which in turn affects the value system of construction companies themselves.

### Evidence/Data Collection

There is a significant amount of overlap between the agendas of the various groups impacted by LEED and other sustainability rating systems, and researching about various companies and government agency standards and practices will help support my topic question. For example, most major construction companies and general contractors will have detailed websites exhibiting the different facets of the company. From past projects to their geographic reach, these sites typically also have an "About Us" section that contains the company values and will typically address any innovative strides the company is taking towards greener construction and sustainability (Taylor, 2019). Also accessible are legislative articles from different state governments and agencies that discuss the sustainability requirements of each entity as it pertains to new construction projects. For example, since 2012 the District of Columbia passed legislation requiring that all non-residential buildings reach a LEED Silver certification. In order to gauge

nationwide opinions of every day citizens on the LEED system, I will analyze polls conducted by Echelon Insights that were first addressed in an online article published by ACHR News (ACHR News, 2015). Furthermore, I plan to conduct my own poll and survey primarily focusing on college students in order to determine the importance that that demographic places on sustainability and environmental awareness. Additional questions will also revolve around their opinions on LEED and other green rating systems to gain an understanding of whether or not LEED is even known among this critical young demographic. Being that they are the generation about to enter the work force, what college age millennials value will soon become the basis for the next market shift. Seeing how widely LEED is known and what people associate with it is a way to gauge its success in promoting its brand as a symbol of sustainability. Seeing how these different stakeholder groups place value on sustainability will help determine if their motives truly are based in promoting sustainability or are centered on the appearance of sustainability to increase profit and public image.

Apart from researching studies, news articles and government legislature to investigate the values of those who seek to earn and use a LEED certification, looking further into LEED's effectiveness in actually meeting its touted goals of energy efficiency and improved human experience for the workers spending their days in these buildings is also important. There are several existing studies about the benefits of LEED certification, from actual energy saving practices and design features that mitigate a building's impact on the environment, to better health and improved morale amongst clients using the constructed buildings. On the USGBC website for LEED, there exist several reports listing the different alterations made to the rating system and its benefits as there continue to be updates added. Also available on the site are various surveys conducted by the USGBC that gauge overall employee happiness and

productivity in LEED buildings compared to non-LEED certified buildings. Because these studies and surveys will most definitely have a biased positive tilt towards LEED, investigating outside sources will be necessary to have a well-rounded understanding of the current state of the rating system. Various news articles and scholarly posts, each referencing other useful studies to further investigate, have been published lambasting LEED and its ineffectiveness at fulfilling the energy efficient goals it claims to accomplish. Researching scholarly articles on the “greenwashing” phenomena will also help better frame the intent of the system and of those who seek LEED certification. Analyzing the parameters of these studies both for and against the environmental impact of LEED will allow me to determine which claims hold more legitimacy and better represent how successful the LEED system actually is in achieving its environmental goals. Understanding LEED’s usefulness on a technical level will help explain the stances of the different user groups towards this rating system in a more holistic sense and the value the rating holds.

By the end of this research, I hope to be able to show whether LEED is successful in achieving the results and upholding the values that the USGBC claim are at the heart of its rating system. On the flip side, I also would like to show if the system has become nothing more than a means of grabbing the attention of consumers and potential employees who see LEED as representing an organization’s commitment to green and sustainable living. While there do exist methodologies and practices that effectively lessen energy waste and our environmental footprint, it is important to clarify which systems and the users within them are actually successful and honest in achieving their goals or if the system is being used as a gimmick to attract business and pacify environmentalist rhetoric. Understanding the flaws in the LEED rating system that allow businesses to attain certification through easy loopholes can illuminate

what needs to be fixed and educate people about the actual environmental value that buildings with the rating carry.

## **Conclusion**

The work that will result from my technical project will hopefully show the benefits of current accelerated construction practices and which logistical aspects need to be improved upon in order to be more widely used in the industry. As for my STS research, the results of my investigation should be able to determine the danger of placing a numeric value on sustainability. This way we will hopefully be able to see whether rating systems such as LEED actually successfully promote sustainable practices and thinking among their user groups or if they are tools used to promote business that are overall ineffective at fulfilling the environmental and human functions they say they do. Having clarity about the actual impact of sustainability-based practices can promote constant improvement in how the construction industry operates as well as educate others about the effectiveness of different methodologies.

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