Strategies for Reducing the

Environmental Impacts of Construction

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Abstract

In order to carry out a successful and sustainable construction project, quality project planning is essential. In this paper, I will discuss how design and preconstruction are the most important parts of a sustainable construction project. The three main points will be about the importance of selling sustainability to the owner, choosing the proper project delivery method to integrate team members, and planning for the future when designing the project. Finally, I will touch on how my own education through the Construction Science and Management program at Clemson University has prepared me for this new era of construction.
Sustainable development has been defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs,” (Brundtland, 1987). In the grand scheme of things, the idea of sustainable construction hasn’t been around all that long. Just a few decades ago, concepts like energy-efficient materials, reduced site waste, and many environmental measures had not been emphasized nearly as much as they are today. Mankind is on the leading edge of this sustainability movement, and it’s evidenced by the existence of about 60 green building councils worldwide and over 32,000 construction projects that are registered with the US Green Building Council (Kibert 2013).

With this growing emphasis on addressing environmental concerns, utilizing resources more efficiently, and leaving a smaller footprint on our world, it has become increasingly important for current and future project managers to take control of the elements of the construction process which can affect the environment in both the short and long run. However, doing so is difficult without proper planning before the project begins. The effort and attention invested into planning a project sets the tone for its entire duration and has a huge impact on its overall success. As the complexity of a project increases, so does the importance of planning. Due to the wide array of standards and requirements that must be meet, sustainable construction projects are generally more complicated than projects which are not intended to achieve sustainability goals. Therefore, design and preconstruction have the greatest impact on the success and sustainability of a construction project. The level of attention and effort invested in these stages determines the project’s level of success in achieving its environmental efficiency goals.
Design, Preconstruction, and Sustainability

It’s important for construction teams to understand and handle the environmental issues that are present during the construction phase. There are plenty of ways to mitigate air quality issues, noise pollution, site waste, and other risks during this phase. However, the design and preconstruction stages of a construction project are by far the most critical to its success. During this time, the purpose and objectives of the project are determined. The owner, design team, and often the contractor together should establish a thorough plan of action, make sure that each party is on the same page, supports program objectives, and is aware of the project’s goals. Once a project is beyond these stages, any changes in its course start to cost the owner and contractor time and money. To maintain productivity and efficiency, it’s important to plan the work and work the plan. For an exaggerated example, if an owner wanted to build a 4-story motel, but decides at the beginning of the construction phase that it should be a ten-story mixed-use development, everything about the project would have to be changed. Thorough planning is just as important, if not more, when setting goals for sustainable development. There are so many things that set sustainable projects apart from non-sustainable projects. Green design standards cover every aspect of the project including site location and size, material requirements like availability and renewability, and energy conservation goals. Because these standards deal with so many different aspects of a project, an owner can’t just decide to pursue sustainability goals once a course has been set, design is complete (depending on the delivery method), and construction has begun.
To get the most out of these early stages of a sustainability-centered project, the most important goals should be convincing the owner of the long-term benefits of sustainable construction and getting them onboard, choosing the most appropriate delivery method, and designing the actual project to mitigate environmental impacts in the field.

Selling Sustainability to the Owner

Project owners are consumers just like us. When they buy products, they consider whether the cost is worth the benefit. However, the owner’s perception of cost may not always be supported by facts. Marketers know that customer perception is everything, and when it comes to green construction, the common perception is that initial costs are much higher than traditional construction. Nora Knox of the US Green Building Council points to a public opinion survey conducted in 2007 by the World Business Council for Sustainable Development which shows that many people believe that green building adds a premium of 17% over normal building costs. This same study collected the costs of 146 green buildings and concluded that the extra cost for sustainable construction is actually under 2% of normal building costs on average (Knox 2015). With this being said, it is important for owners to be educated about the true initial costs of a sustainable project. Sustainable buildings also offer a multitude of savings opportunities over their lifetime. LEED certification is meant to set standards for buildings that are not only environmentally sensitive, but also cost-effective in the long run by means of energy conservation methods and other design decisions. In 2013, the World Green Building Council reported that green buildings use between 25% and 35% less energy than comparable non-green buildings (WGBC 2013). A 2003 study by Greg Kats of Capital E
collected financial data from 33 LEED certified buildings built between 1997 and 2004 and concluded that after 20 years, the financial benefits of these projects were over ten times the amount of the sustainability premium (Kats 2003). The design team and contractor, if present during the design phase, should make it a priority to emphasize the long-term benefits of a sustainable project and give the owner all of the information necessary to make a decision as to whether they want to invest in a sustainable project.

However, this isn’t just about money. The potential of saving a few bucks in the long run or obtaining grants cannot be the only reason that the owner commits to a sustainable project. It’s about motivating the owner and getting them onboard with the sustainability effort. If the owner is excited about the project and is in it for more than just the money, but is still assured that the team is interested in helping them save money down the road, they will be much more cooperative and confident in the undertaking, which will lead to project success.

Choosing a Delivery Method

There is no such thing as a one-size-fits-all delivery method. There are multiple approaches to construction projects. Most are better suited for different purposes, and are
usually chosen based on the owner’s experience, budget, time constraints, and design criteria. This section will focus primarily on Design-Build, Construction Management At Risk, and Integrated Project Delivery, and how they can improve the effectiveness of sustainable projects. These three provide the highest level of integration, which is the most important aspect of a project delivery method when concerning sustainable construction.

**Design-Build** and **Construction Management at Risk** are both integrated delivery methods in that they overlap the design and construction phases and allow the design team and contractor to collaborate on the project’s design. Again, sustainable construction projects are very complex and require a high level of integration of all team members. Design-Build allows for this, since most DB firms either have their own design team or get to choose which design firm they work with. CMAR firms offer the same advantage by providing consulting services during design and perform work if they have the expertise. Owners choose DB and CMAR firms based primarily on qualifications, so the selection of a quality delivery team needed for sustainable construction is covered. Initial costs should not be as great of a concern to the owner if the DB or CMAR firm has thoroughly communicated the long-term gains of sustainable construction. One other advantage that these integrated delivery methods offer for sustainable projects is fast-tracking. The faster a project is finished, the sooner the owner will start to see returns on their
investment. In order for a firm to yield a successful sustainable project, it must be up front with the owner and keep them involved and informed in the project.

**Integrated Project Delivery** is a relatively new integrated delivery method. Basically, the risk is distributed among each member of the team, so the success of one person or group is dependent on the success of the IPD team. This is great for sustainable projects because everyone is equally as motivated to provide top quality in their field of expertise. However, this method is resource-heavy and is typically utilized by larger projects.

Sustainable projects incorporate lots of environmentally sound and energy saving materials and equipment, and this applies to most every trade on the job. Having subcontractors working closely with the team during design will bring their specialized expertise to the design process, improve coordination, and eventually lead to a faster schedule during construction. In the field, this will help to reduce waste and reduce tensions between subs. One way of utilizing this sort of integration could be for subs to coordinate deliveries. If multiple subs need materials at the same time, instead of their suppliers using separate trucks, they could combine their shipments into one load and cut down on the number of trucks coming to and from the site. This would help to reduce material delays and having to keep materials from sitting on the site, potentially being damaged, and creating waste.

**Mitigate Environmental Impacts in Project Design**

At this point, the owner has fully committed to a sustainable construction project and the owner, design team, contractor, and potentially the subs, are all integrated into
one team. Now, the goal is to focus on material and system choices that would reduce the environmental impacts of the project.

Site choice makes a huge difference in the success of a project, as there are certain LEED standards which require the contractor to protect the natural state of the site as much as possible. Essentially, the idea is to work with what you have, disturb the site and its natural resources as little as possible, and contour the project around the natural landscape as much as possible. The most ideal approach, however, would be to choose a lot that has already been developed but is now blighted property. The land has already been leveled out, which minimizes the amount of excavation necessary, and untouched land would be spared. One idea would be to try and reuse any of the site’s old structure, either as being broken down and turned into new products or integrated into the new project where it stands.

As far as physical design features in the building itself, there are plenty of materials available that help to cut consumption of natural resources and reduce environmental impacts. However, knowing what’s out there right now isn’t going to be what makes the difference in your sustainable project. Sustainability is about looking forward, so it’s critical for project managers, architects, engineers, and subcontractors to always be on the lookout for what’s next. It’s important to hone your senses of prediction and noticing patterns in innovation. If a project’s integrated team has this sort of insight, this can increase its level of sustainability significantly. Instead of using proprietary technology that is difficult to upgrade or replace, shape the building around the idea of interchangeability. Prepare it for the technology that has yet to be created by preparing the building to accept change. Don’t make things like MEP equipment, high
efficiency windows, high R-value insulation, recycled roofing, or any other materials hard to replace. Along with having a plan to install materials, be sure to plan how they will be replaced. Plan for today’s high-efficiency, low-emissions, eco-friendly materials to be outdated and superseded by something better and more efficient. Make sure the transition will be as smooth as possible, because it’s inevitable.

**Conclusion and Relation to Curriculum**

The sustainability movement has completely changed the way we look at construction. As we’ve come to realize how temporary our environment is, we’ve become more aware of the importance to slow down and think about how it’s being used. Thankfully, Clemson University’s Construction Science and Management program has given me the tools necessary to react to this change as a member of the construction industry.

Sustainable construction is centered around the idea of reducing the effects that our traditionally dirty and costly industry can have on our environment. As members of the construction industry, we need to embrace this idea and convey its importance to the owners who give us work; not only for its monetary benefits, but also for the benefits it provides everyone. The CSM curriculum branches out beyond the technical aspects of construction and hones in on the business and marketing aspects of construction, which has helped me to better understand owners’ roles as customers. This portion of my curriculum has reinforced the values of working with owners instead of simply seeing them as the source of your next paycheck, and also understanding that making their problems and success your own will benefit both parties.
A sustainable project can’t be successful without a plan, and having every member of your team united under a cause, cooperating with one another, utilizing everyone’s expertise, and contributing at every point of the project is key to that plan’s success. Without a dynamic team, no amount of clever biodegradable materials or low-emissions equipment can save a project. In both my business-related classes and core construction classes, I have been taught that the quality of your planning determines the quality and success of its execution. In the many team environments I’ve been involved with here at Clemson, it’s become more and more evident that integrating a team, cooperating, and recognizing the strengths of each member is essential to the success of a project as well.

When your team is assembled and working together well, it’s important to continue forward thinking through the design phase. Project location is key when dealing with sustainability, as it impacts how the project will interact with the surrounding natural environment. Developing on blighted property eliminates the need for breaking ground on undisturbed land and provides a site that’s previously been prepared for construction. When designing the actual building, green materials are great. However, it’s even more important to plan for the next wave of technology and how to integrate it into today’s construction. Predicting these trends will set a project apart from everything else and keep it in a constant state of improvement for years. At Clemson, tomorrow’s technology is heavily emphasized, and we are constantly taught to plan for the future. The CSM department is constantly inviting innovators in the industry to speak with us and show us what’s really happening in the industry so that when we graduate, we’ll be up to speed with everyone and ready to take the next steps forward.
Works Cited


