Thesis Proposal - Revised

Final Proposal for Spring Thesis Project

Ingleside at King Farm

Rockville, MD

Joseph Podwats
2008-2009 construction management option
AE Faculty Consultant: Dr. David Riley
Date of Submission: 3/2/2009

Table of Contents

Executive Summary

Introduction:

A brief review of the project basics is provided in the introduction. It summarizes the building type, CM, owner, architect, contract type, delivery method, etc.

Analysis Descriptions:

Analysis Description 1-Building Envelope Performance:

Identified as a constructability issue in a previous submission, the exterior wall will be studied for opportunities to improve constructability, thermal performance, value. It addresses the critical issues associated with the energy crisis, high first costs, and changing roles. This analysis primarily covers a breadth in sustainability and structural.

Analysis Description 2-Alternative Mechanical Systems:

The mechanical system design is being questioned for its feasibility. A comparison of alternative systems will be done to see which is most appropriate. It's believed that the opportunity exists to incorporate alternative energy saving equipment into the design as well. This analysis will primarily compare the cost and schedule impacts of the current system against the proposed system. An analysis of the achievable LEED credits will be performed. This Analysis has been revised from the original.

Analysis Description 3-Construction Waste Management:

Analysis Description 3 is aimed at greening the project and project team while improving productivity through maintaining a clean site. This is believed to be assisted by developing an achievable and affordable construction waste management plan. An evaluation will be performed to compare the cost and schedule impacts of implementing the plan. It will also contribute to the LEED certification of the project.

Analysis Description 4-Water Efficiency:

In a last minute race to earn LEED certification, this analysis will attempt to replace the current plant species with more conservative ones, harvest rain water, and utilize water efficient fixtures. It's believed that this type of activity could be implemented late in the construction process on many projects if they are on the verge of earning enough LEED points for certification. This Analysis has also been revised from the original.

Weight Matrix:

The weight matrix shows an estimate of how much time will be allotted toward the research, value engineering, constructability, or schedule reduction for each analysis description. In this case, it is respectively 25%, 38%, 26%, 11%.

Appendix 1-Breadth Studies:

Breadth studies demonstrate a student's competency and interest outside construction management. This is done through additional research or evaluation in at least two outside areas. As mentioned in the Analysis Descriptions, this thesis will demonstrate some form of breadth in several areas, but will focus primarily on Sustainability and Structural. These breadths have been revised from the original.

Introduction

Construction on Ingleside at King Farm started on 3/14/2007 and is expected to be substantially complete on 2/20/2009. Ingleside is a Continuing Care Retirement Community project located in Rockville, Maryland with a $97 million GMP contract. The project is delivered as a CM joint venture, Turner-Konover, and Turner is acting as the GC. Arthur Shuster and CSD People Architecture designed the seven story building, which is approximately 700,000 square feet. There are independent living units, assisted living units, skilled nursing units, and dementia units. This project is seeking LEED Certification and is owned by Ingleside Presbyterian Retirement Community, a non profit organization.

The organization is dedicated to providing a quality living atmosphere for senior citizens at an affordable price. The facility is located on an 11.5 acre site and it will consist of many amenities such as a site pond, gardens, pool, tennis courts, theater, bank, marketplace, etc. Another key feature is the heated garage beneath the building, which provides convenient parking for the senior residents.

The structural system consists primarily of a post-tensioned flat plate concrete floor system with a steel roof structure. Mechanically, it is split between a constant volume air system serving the common areas and primarily individual water source heatpump units that serve the residences. There are two separate electric services entering the building; backed by a 750KW emergency generator set. Main living and corridors are lit using compact fluorescent down lighting. Dining and roof gardens contain primarily incandescent decorative lighting and the other outdoor lighting and pool lighting are high intensity discharge (HID). Plumbing is relatively simple; each of the living units is served by PEX tubing and the food service area contains a grease recovery unit.

Throughout the first half of the architectural engineering senior thesis, a thorough understanding was gained of the above mentioned building elements. A study of the architectural, structural, mechanical, electrical, lighting, and plumbing systems taught the basics of how the project ticks. Detailed cost estimates and project schedules were developed in order to understand the cost impacts of system changes and magnitude of construction coordination required to build Ingleside at King Farm. Interviews with project team members and the owner tuned professional communication skills and educated on the positive and negative experiences gained throughout construction and the expectations for a successful project. Attending a PACE seminar related to current industry issues allowed for real application to the project, which clarified why certain project elements or activities were the way they were.

Once the project was understood, personal observations and ideas were documented. Theses observations and ideas were developed into observed problems or areas of opportunity to improve. The proposed analyses in the following sections are a product of time spent up front planning how to better a project through research, value engineering, constructability reviews, and schedule reductions. Ingleside at King Farm, like the architectural engineering senior thesis, is a great candidate to prove that proper planning can yield improved results in the long haul.

Analysis Descriptions

The following analysis descriptions have been introduced in the *Technical Analysis Method* section of *Technical Assignment 3-Alternative Methods Analysis*. They were presented as observed problems, or potential areas of opportunity. Each was provided with a description of the construction management activities stating how a technical analysis will be completed on the building systems and what research will be required to perform the analysis. Although some preliminary information was provided on these areas of opportunity in the previous assignment, this section will clearly reiterate the problem or opportunity and offer supporting research, potential solutions, analysis steps, anticipated time to complete each step, and an anticipated outcome.

Analysis Description I-Building Envelope Performance:

Breadths Covered:

Sustainability, Structural, Mechanical, Architectural, and Construction

Critical Issues Addressed:

Energy Crisis, High First Cost, and Changing Roles

Background:

Ingleside at King Farm's building envelope is an area that is believed to have significant room for performance improvement in the areas of energy efficiency and constructability. It is evident through an interview with one of the project managers that a viable design did not exist at the time the exterior wall was ready to be constructed, which resulted in the CM on the project, Turner-Konover, taking charge of the design completion. In turn, the building has been constructed using a somewhat "traditional" design and a building envelope that seems to lack much consideration of innovations in energy efficiency and schedule reduction.

Given the current energy crisis, owners are demonstrating a larger push for reductions in utility costs. Some owners are also concerned with carbon footprint. Reducing carbon footprints is another challenge facing the industry, which is intertwined with acquiring LEED certifications and developing sustainable projects. These challenges can be overcome for the industry through many opportunities in developing technologies.

Problem/Opportunity Statement:

Owners are concerned with rising energy costs and requesting to build projects that will provide immediate energy savings, but are faced with financing high first costs for innovative sustainable systems. Integrating photovoltaic panels, for example, into a building's design can replace direct energy costs for owners, but they won't reduce overall energy consumption and they have a high first cost. Localized cogeneration systems are approximately 80% to 85% efficient making them more efficient than buying power from the grid, which is typically less than 15% efficient; these systems also have a high first cost (Greenbuild Educational Session: Net Zero-Pearl River).

This area of the construction industry is being driven by rapidly increasing energy demands. Although there are power generation technologies that can alleviate some of the financial burden associated with rising energy demands, the technologies are

expensive and may not be highly efficient. Continuous developments are being made as designers, builders, and owners educate themselves on these technologies. This inspires the opportunity to creatively think and use innovations in increasing efficiencies amongst the existing building systems and investigate areas where reductions can be made, but this is one of the major challenges facing the industry. How can energy costs be reduced while keeping payback periods short? It's best to first begin by designing more efficient systems into the project.

Proposed Solution:

A potential solution to the problem is to use an alternative construction method such as the prefabricated kama-EEBS wall system mentioned in Technical Assignment 3 and addresses the critical industry issue of Changing Roles since the CM took charge of design completion.. It creates a strong thermal break and can add up to 21 LEED credits to the project; a better solution than just adding additional insulation to the system. In order to investigate this solution, outside information sources include product literature and representatives from companies in attendance at Greenbuild 2008 and interviews with the CM on the Ingleside at King Farm project, Turner-Konover.

Research Steps:

1. Educate self on thermal resistance and performance of current building envelope design; including windows and walls. (2 days to complete)
2. Research innovative materials and prefabricated building envelope systems and educate self on thermal resistance and performance of the alternative systems and windows to ensure that performance exceeds current design. (2 days to complete)
3. Evaluate cost and schedule associated with current building envelope design. (1 day to complete)
4. Compare energy efficiency of current design to alternative systems using standard R-Value comparison, hand calculations, and/or COMcheck program (http://www.energycodes.gov/comcheck/). (2 days to complete)
5. Compare material cost of current design to alternative systems. (3 days to complete)
6. Compare labor costs, duration of construction, and constructability of current design to alternative systems including an evaluation of structural impacts. (3 days to complete)
7. Evaluate additional impacts on schedule for alternative systems in terms of design time and procurement. (1 day to complete)
8. Evaluate current design for LEED credits achieved and compare to anticipated credits achievable with alternative systems. (1 days to complete)
9. Review proposed alternative with CM for industry acceptance and viability. (5 days to complete)
10. Develop a score card to compare the current design to alternative systems and propose an alternative system. (1 day to complete)

Research Goals:

- To prove that upgrading the building envelope to a more thermally efficient design is a feasible alternative to reducing operational costs by solely integrating localized power generation features into Ingleside at King Farm.
- To educate designers, engineers, CM's, and owners about the opportunity to incorporate affordable and sustainable technologies into their projects.
- To uncover opportunities to save costs in other areas of Ingleside at King Farm, such as a reduction mechanical equipment sizes.
- To show the benefit of immediate cost savings to owners and long term economical and environmental benefits to society through a reduction in energy consumption.

Expected Outcome/Conclusions:

An innovative prefabricated building envelope system will cost more per square foot and require more attention to detail during procurement than the currently designed building envelope, but this cost will be offset by labor savings and schedule reduction. The thermal performance of the proposed system will meet code requirements and exceed the performance of the currently designed system, while allowing the exterior face of the envelope to maintain its currently designed appearance.

As mentioned, improving the building envelope performance will address the challenges associated with the energy crisis critical industry issue. Designing with higher efficiency in mind is a way to significantly and truly reduce operational costs to owners; building system performance must first be improved before attempting to rely on localized power generation and an improved building envelope performance will still help reduce Ingleside at King Farm's carbon footprint. This research will be advantageous to the CM on the project in the event that they are tasked with leading the design completion on future projects with a similar design because it potentially offers a quick and direct replacement of existing system with minimal structural impacts. One concern with using a prefabricated system is that it will increase lead time and require more attention to detail during the procurement of the system. On the positive side, it is anticipated to improve constructability, require much less installation time, and prove to be an achievable value engineering idea by potentially adding LEED points.

Analysis Description II-Alternative Mechanical System:

Breadths Covered:

Sustainability, **Mechanical**, Structural, Construction, and Acoustics

Background:

Mechanical systems present a multitude of design, construction, and financial challenges to a project such as aesthetics, self weight added to the structure, noise, adequate space to place units, lead time, first cost, and maintenance cost. Previous experiences taught that startup and commissioning of mechanical equipment can be timely and costly, especially if controls programs are not properly functioning. Another area of Ingleside that relies heavily on equipment is the residences. Each one contains its

own water source heatpump for localized individual control. Eliminating reliance on mechanical equipment can prevent major headaches on a project. If the cooling towers, for example, could be removed from the design, it would reduce first cost for equipment by $100,000, or more, based on a preliminary cost estimate (Advantage-Making Water Work www.advantageengineering.com).

Problem/Opportunity Statement:

A major challenge to owners is acquiring sufficient funds to build their project. Mechanical equipment adds significant cost to a project in terms of designing, purchasing, installation, and commissioning. Additionally, relying on delivery of equipment also presents risks of delaying progress on a project. There is a large quantity of individual pieces of mechanical equipment for Ingleside that creates staging challenges and each piece requires protection until it is installed. All owners are faced with efficiency of the system, maintenance costs, and operation costs.

Proposed Solution:

One solution is to research alternative systems and compare them to the current systems in terms of feasibility, efficiency, equipment reductions, first costs, maintenance costs, and operation costs. Integrating energy optimization systems is also an option. Another solution is to investigate opportunities for switching to a centralized distribution system to save labor and equipment cost of individual heatpumps.

Research Steps:

1. Research typical mechanical systems used in this building type to determine benefits, advantages, and disadvantages of current mechanical system design. (1 day to complete)
2. Research and/or interview mechanical engineer to find 2 to 3 alternative systems to replace the existing system or to be integrated into the existing system such as Solar Hot Water, Geothermal, or Pond Loop. (5 days to complete)
3. Estimate cost of alternative system or additional cost of integrated system. (2 days to complete)
4. Compare labor costs, duration of construction, and constructability of alternative design or integrated design to current design. (3 days to complete)
5. Evaluate schedule impacts of alternative system or integrated system in terms of equipment procurement and/or construction durations. (2 days to complete)
6. Evaluate current design for LEED credits achieved and compare to anticipated credits achievable with switching to alternative system or integrated system; such as calculating energy savings. (2 day to complete)
7. Develop a score card to compare the current system to alternative system present the best option. (1 day to complete)

Expected Outcome/Conclusions:

An enlarged site pond is expected to provide added benefits in terms of aesthetics of the property and also help lower ambient temperatures surrounding the building due to the effects of natural evaporative cooling. A pond loop system is likely to increase design and sitework costs, but will add value by cutting equipment costs of the cooling towers

and also result in an overall energy savings to the owner. Immediate payback, or savings, is anticipated. LEED credits will be earned for innovation if a site pond can be integrated into the mechanical system. Design time may be increase along with schedule delays if the project team is not experienced with a pond loop system, but this will be overcome by reduced startup and commissioning. Additional anticipated effects on the project include improved constructability and reduced costs for the roof structure due to a reduced roof load and eliminating the use of the crane to erect or place the cooling towers. More indirect benefits include a reduction in sound isolation and lower maintenance and lifecycle costs due to a closed loop system.

After evaluating the use of the individual heatpump units, it is believed that they may prove to be a more energy efficient system switching to the centralized system. It's also suspected that there will be a higher first cost associated with the heatpump units. Replacing equipment more equipment with ductwork associated with a more centralized system may not be the best option and will not likely result in much energy savings to the owner.

Analysis Description III-Construction Waste Management:

Breadths Covered:

Sustainability and Construction

Background:

A site visit to Ingleside at King Farm revealed an issue with construction waste management on this project from a volume and logistical standpoint. It was stated that there was no construction waste management plan in place and that everything was being tossed into one type of dumpster. On a project that's pursuing LEED certification, this seems to be counterproductive when building a sustainable project is the goal. One of the superintendents expressed that the amount of construction waste inherently created is a recurring issue on many projects throughout his career.

Problem/Opportunity Statement:

The issue noticeably impacted site safety in some areas and efficient use of space to complete work. Construction waste, as presented in a previously submitted photo, can cause tripping hazards, can block trash chutes, and can crowd potential material staging or storage areas. Piles of trash were found in a couple different locations throughout the site, so it did not just appear to be a coincidence.

A large footprint like the Ingleside at King Farm project may result in trash being set low on the priority list and set aside to worry about later, which allows a project team to maintain focus on the critical path. Managing waste, though, is not just an item that can be left for a punchlist at the end of a project, or left for a laborer to clean up at the end of the day. Although managing waste may not be on the critical path and may be the least of a contractor's concerns, maintaining a clean and safe site through the proper planning and reduction in waste generation should be a task that everyone is motivated to do. Long term side effects of neglecting waste management will add significant expense to construction projects as the world adopts more environmentally responsible practices in other industries. Designers, CM's, and builders can take the lead in long term waste

reductions by following responsible practices that can even be taught to owners, but not all take this lead.

CM's and builders may view a construction waste management plan as a hindrance, but don't always realize the potentially positive results while wrapped up in the middle of deadlines, change orders, inspections, etc. Goals and procedures for managing waste are not always laid out up front and construction companies are not obligated to provide additional services that are not in the drawings, specifications, or other front end documents.

Proposed Solution:

Carefully planning construction waste management into the project seems to be the obvious solution to the problem. Adding a few lines of text to the drawings, specifications, and/or front end documents could help set the tone for a whole project. This would be accompanied by a construction waste management plan including clearly defined leaders for implementing the plan. Part of the plan would be request minimal packaging for items shipped to the site. The plan would also include suggestions for greening the project team.

Research Steps:

1. Interview CM to determine safety concerns, schedule impacts, and staging area impacts of excess trash on site and also determine how the trash is left to build up. (1 day to complete)
2. Research current trends, average waste percentages, and execution methods in construction waste management. (2 days to complete)
3. Estimate amount of trash generated for project without waste management plan. (2 days to complete)
4. Investigate options for reducing waste such as requesting minimal packaging from vendors and suppliers and investigate opportunities to purchase items with recycled content and/or reclaimed materials from other projects. (5 days to complete)
5. Evaluate site impacts of implementing a construction waste management plan by developing a new site plan showing locations of additional dumpsters and logistics of implementing a construction waste management plan on the floor plan. (1 day to complete)
6. Estimate cost of implementing construction waste management plan in terms of additional dumpsters, labor, and tipping fees. (1 day to complete)
7. Evaluate anticipated schedule reductions of implementing a construction waste management plan through interviewing the CM. (2 days to complete)
8. Calculate tonnage of trash saved from landfill and present cost savings on tipping fees. (1 day to complete)
9. Evaluate anticipated LEED credits that would be earned in terms of construction waste management and recycled content to determine value added to the project. (1 day to complete)
10. Develop prototype construction waste management plan including informational brochure to communicate a construction waste management plan to designers and builders. (2 days to complete)

Expected Outcome/Conclusions:

Implementing a construction waste management plan is expected to earn acceptance by the project team and spark creative thinking. The change in thinking will result in a successful reduction in construction delays, safety concerns, and tipping fees. If implemented in the beginning, perceived hindrances by builders can be overcome by maintaining a positive flow of trash removal, which will help create a positive construction atmosphere, increase team morale, improve productivity, and promote efficiency by maintaining the appearance of a well organized project. Although hard to quantify the full value of the program, the benefits to the CM and builders include creating a positive image in the owner's eye during inspections, invitations to bid on future projects, long term reductions in operations costs, an environmental marketing advantage, and overall environmental stewardship. This proposed plan is also anticipated to earn the project additional LEED credits.

Moreover, it is anticipated that a clear and affordable construction waste management plan will improve site safety. The reduction or elimination in site clutter will improve productivity by reducing loss time due to unworkable areas of the site. If the plan is well developed and achievable, it may uncover significant cost and time savings that could potentially be passed on to the owner. Additional environmental benefits due to reduced landfill waste are also anticipated; existing U.S. landfills have less than 20 years of capacity remaining.

Analysis Description IV-Water Efficiency:

Breadths Covered:

Sustainability, Mechanical, Construction, and Architecture

Background:

Ingleside at King Farm is pursuing LEED certification, which is being tracked in part by the owner's son. Recent correspondence, with him uncovered a concern with the current design not being able to achieve the LEED certification. Since the idea to pursue LEED certification for Ingleside at King Farm was thought of after design had already begun, it will be more difficult to achieve the foreseen credits. In order to achieve many of the available LEED credits, considerations must be made during the design phase. In this case, water efficient landscaping is something that might be possible to implement late in the game.

Problem/Opportunity Statement:

The plants called for in the drawings are believed to be large consumers of water and costly to maintain. In an effort to offset the lack of early LEED planning, water efficient landscaping can be investigated since a change in the landscape design will not likely have adverse affects on the currently designed building systems.

Conservation is ever growing in terms of water usage. Wasted water also consumes unnecessary energy, takes away from the local water tables, and costs owners in utilities. Introducing foreign species of plants to the landscape design can bring a "taste of the

tropics" to a project, for example, but introducing a tropical species to a project in the D.C. Metropolitan area calls for consideration of the required care for that species.

Often, plants can be watered and cared for using recycled water from the building. This Analysis topic has been revised from its original version and research to this point has proven that gray water reuse is difficult to accomplish due to code restrictions, but another opportunity to reduce overall water consumption in this project is present in low flush toilets, waterless urinals, and low flow shower heads. Additionally, Ingleside at King Farm has a large footprint and a large site that could make use of rainwater harvesting to meet irrigation demands.

Proposed Solution:

The proposed solution is simple for this analysis. It involves suggesting alternative, native flora fauna in place of some of the exotic species. It also involves research on rainwater harvesting systems and more efficient fixtures in order to meet water demands. The focus of this analysis will be to evaluate site and schedule impacts of meeting water demand while contributing to the achievable LEED points required for certification.

Research Steps:

1. Research native flora and fauna for opportunities to reduce or replace some of the currently specified large water consuming species. (2 days to complete)
2. Compare material cost of currently specified design to alternative species. (3 day to complete)
3. Research weather for location to determine average rainfall during normal season and average rainfall during droughts. (1 day to complete)
4. Evaluate design for potential areas to collect rain water and calculate anticipated collection. (3 days to complete)
5. Evaluate schedule impacts of using alternative species in terms of procurement. (1 day to complete)
6. Estimate cost of alternative water efficient fixtures. (3 days)
7. Calculate utility savings to owner for use of rainwater harvesting and water efficient fixtures.
8. Evaluate rain water harvesting system for anticipated LEED credits achieved in terms of water efficient landscaping. (1 day to complete)
9. Develop a score card to show results of calculations and cost savings. (1 day to complete)
10. Review rainwater harvesting and more efficient fixtures with owner for acceptance. (1 day to complete)

Expected Outcome/Conclusions:

Residents of an area often enjoy state parks for the native flora and fauna, which offer a natural curb appeal. A building that is designed to blend into a neighborhood in a native sense can offer a "taste of home" that also has a natural curb appeal. Water efficient landscaping is expected to sustain a healthy site and living condition for the residents, which also aligns with the goals of the owner. The use of more native flora and fauna will

require little to no fertilizers or chemical pest control to maintain root structure and physical appearance, which will attract native bird species, butterflies, and other desirable insects acting as natural pest control. A reduction in water usage will save operations and maintenance costs to the owner. The alternative species will require less procurement time and result in a lower first cost for the owner. As the expected outcomes of the other analysis topics, this proposed design is anticipated to earn the project additional LEED credits.

Incorporating a rain water harvesting system and the use of water efficient fixtures will be a simple solution to meeting water demands. Overall, the system will add additional cost to the project, but will add significant value to the community in terms of health and safety. Potential water savings and harvesting may translate into savings in other areas such as the elimination of a storm drain connection. The owner may end up with more money to spend in other areas while earning LEED credits to the project and adding substantial value.

Weight Matrix

The weight matrix below is designed to provide an anticipated percentage of workload in each analysis area to maintain focus with the senior thesis project.

Description	Research	Value Engineering	Constructability Review	Schedule Reduction	Total
Building Envelope Performance	5%	10%	5%	5%	**25%**
Mechanical System Design	5%	10%	18%	2%	**35%**
Construction Waste Management	10%	10%	-	2%	**22%**
Water Efficient Landscaping	5%	8%	3%	2%	**18%**
Total	**25%**	**38%**	**26%**	**11%**	**100%**

Appendix 1 - Breadth Studies

Breadth is covered in all of the analyses in some form, but some of the analyses require additional investigation to fully demonstrate breadth. In particular, two breadths will be further addressed in order to maintain focus; Sustainability and Mechanical System Design. The focus on sustainability will be addressed in each of the analyses and the mechanical system design will be addressed primarily in *Analysis Description II*.

Sustainability:

The first area of breadth will be the overall sustainability of the project; a sustainable architecture breadth. It will focus on schedule and budget impacts of implementing additional or alternative features, materials, and construction methods into Ingleside at King Farm in order to acquire some of the LEED credits that are not currently attainable. Some additional or alternative features include, but are not limited to, an improvement in material selection, a reduction in energy consumption, and a consideration of life cycles.

This breadth will suggest the appropriate phase of the project that such features should be considered in order to be successfully implemented. When necessary, calculations will be performed in order to prove the credibility of the suggested elements. In addition, the breadth will offer suggestions on greening the project team to allow a smooth and sustainable design and construction process. Each of the *Analysis Descriptions* are already leaning toward developing a more sustainable Ingleside, which not only aligns with the goals of the owner, but allows for integration of the various Analysis Descriptions.

Problem/Opportunity Statement:

Sustainability is sometimes viewed as a gimmick or a fad that ends up leaving owners wondering what happened with their project and leaving them with less money in their wallets. It's closed minded thinking that sparks these ideas, which are not always generated explicitly from an owner's point of view. Designers and contractors often don't take the time to learn about sustainable practices and can easily fall into a closed minded mentality. Seeing the other side of the fence, like the more than 30,000 attendees and 1,400 exhibitors at Greenbuild, one can quickly be enlightened and understanding why sustainability is not a fad. Nature has practiced the concept since its existence and is capable of healing itself under natural circumstances. Many areas of the earth have evolved into unnatural habitats and daily human population has grown exponentially along with human consumption. Some believe that this unnaturalness and exponential growth has caused an environmental condition in which earth is not capable of healing before its resources are spent, so human nature has forced us to seek other resources. Seeking other resources is only a short term solution, but each resource that's harvested from the earth has an impact in some way. No one is really certain where the line must be drawn before earth can't sustain human existence as it is known in today's day in age.

We are certain that there are many types of crisis in the world and many of them relate to the economic status of the countries we live in. The fundamentals of economics are all about supply and demand, which has to do with the quantity of resources available to manufacture products that consumers desire. Desires will soon be unanswered if there is not a concerted effort to take advantage of every opportunity possible to reduce or

eliminate wasted resources and increase efficiency. The United States Green Building Council has been tossing around the idea of restorative projects, or buildings that replenishes as many resources as they harvest, which may also be known as carbon neutral. A breadth study of some of Ingleside at King Farms's systems will be step toward neutrality.

Structural:

Evaluating the exterior wall system design will also require a significant amount of additional work to demonstrate breadth. Part of the goal in this area is to be able to improve thermal performance, improve constructability, reduce the schedule, and add value by utilizing an alternative wall system. With a low effective R-Value of the current design, there are many options to improve.

Problem/Opportunity Statement:

This breadth addresses structural impacts of the new exterior wall system. Ingleside at King Farm's current superstructure consists of a PT floor system with metal stud infill construction. The project consists of three basic wall assemblies, which all support either face brick, cast stone, or EIFS. They are insulated primarily using an R-19 fiberglass batt, which is heavier than the insulation in the proposed wall system.

It is believed that the proposed wall system will perform the same as the current system. Additionally, no improvements to the superstructure (floor and column system) will be required. This breadth will show calculations proving that the proposed system will not add additional weight to the system and will support the currently designed interior and exterior finish systems. It is also integrated into a single existing analysis element, which makes it simpler to evaluate overall impacts of the change.