FINAL PROPOSAL

HFS WAREHOUSE AND BAKERY EXPANSION

University Park, PA

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EXECUTIVE SUMMARY

In construction almost every project encounters different problematic areas that could be addressed and analyzed to help the project succeed. The Housing and Food Services Warehouse and Bakery expansion is like most projects and has several areas that could be analyzed more thoroughly. This proposal will look into several problematic features of the Housing and Food Services Warehouse and Bakery expansion. In addition, four areas of improvement on the project will be further analyzed. Several breadth topics will also be researched for the different areas of analysis.

Analysis 1 – SIPS Utilization

This analysis focuses on reducing the time to renovate the office space in the Housing and Food Services building. The area of investigation would be to see if implementing a SIP schedule to the renovation of the office space would accelerate the schedule and reduce office downtime.

Analysis 2 – BIM Process

This analysis focuses on the use of BIM to improve the project. BIM was not used at all on this project but could have been used to improve the project in several ways. BIM could have been used from the start to turn the original building drawings into electronic files. Having an electronic model of the HFS building could be used to show the problems with the as-built. The electronic model will also allow for the use of clash detection software. Both reasons explained above should help to greatly reduce the total amount of RFI's and ASI's.

Analysis 3 – Building Envelope

This analysis focuses on the building facilities and systems to make sure the manufacturing environment is sanitary and well-maintained. Design changes could be made to the building in order to make it more maintainable, cleanable, and durable by use of coated concrete flooring, insulated metal panels, and grid ceiling. The goal is to increase the efficiency of the processes within the bakery and warehouse.

Analysis 4 – LEED Certified

LEED Certification is the evaluation and qualification of a sustainable project. By taking measures to increase LEED credits, the Housing and Food Services Warehouse and Bakery expansion will benefit in terms of energy efficiency life cycle costs as well as building and user performance.

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PROJECT BACKGROUND

The project for my senior thesis is the Housing and Food Services Warehouse and Bakery Expansion for The Pennsylvania State University in University Park, Pennsylvania. Scheduled for completion in March 2016, the project includes increasing freezer, cooler, and dry storage capacity, expanding the bakery, and improving building systems. The current plan will be funded through many sources such as, operational reserves, state funding, self-supporting units, capital investments, and borrowing and debt services. At University Park, its buildings are in need of major renovation and significant changes with 65% of the buildings older than 25 years.

Penn State has hired Architect LSC Design Inc. to design the addition and renovation of the Housing Food and Services Warehouse and Bakery Expansion. LSC Design Inc. was founded in 1980 as Land Survey Consultants, and has since grown to include architecture, interior design, civil engineering, survey management and landscape architecture. They are now known for their ability to listen and advocate for their clients, like Penn State, and to effectively marry design with constructability within a budget and schedule.

The 94,000 square foot existing HFS building will undergo approximately 44,500 square feet of renovations during the three phases of construction. The warehouse will be expanded on the north side by about 25,000 square feet. Starting with phase 1A, the addition to the warehouse will be erected. The renovation of the south side will make the start of phase 1B. Phase 2 marks the start of the existing cooler and freezer renovation, and construction of new racking within the cooler and freezer. Phase 3 starts with the existing freezer. This will be renovated into more dry storage. The first part of phase 3 will start with the southern part of the dry storage area and the offices. As the offices continue to be renovated, the northern part of the dry storage area will start renovations. This expansion will allow Penn State Housing and Food Services to increase the variety and scope of product offerings to meet the culinary needs of students, faculty, staff and visitors. This project also will provide opportunities to capitalize on additional direct manufacturer relationships that will reduce overall food costs.

The goal of this renovation is to increase the capacity of freezer, cooler and dry goods storage, improve workflow and provide more effective use of space. The project will reorganize and expand the warehouse and bakery and replace aging and inefficient building systems.

ANALYSIS 1: SIPS UTILIZATION

PROBLEM

The Housing Food and Services building is undergoing an addition and renovations to the warehouse, bakery and office space. The office renovations start from April and end in August 2015. This makes the office space unusable during these months. The downtime causes congestion and inefficiency within the employees of the HFS Building. The office renovations have an opportunity to compare and contrast the possible benefits of implementing SIPS. Penn State will want to know if SIPS is beneficial for this project and future construction.

RESEARCH

Short interval production scheduling (SIPS) is a tool used by many contractors to maximize worker efficiency, minimize project delays, and increase project team communication. SIPS scheduling is typically most advantageous on projects with highly repetitive spaces. By breaking these repetitive spaces down into small tasks, contractors have a better understanding of how the project is progressing. SIPS places intense demands and small margins on subcontractors, but is a very effective tool when all members of the construction team understand and buy in. Thorough planning must be done to ensure that realistic productivity levels are projected.

POTENTIAL SOLUTIONS

SIPS will be used to reschedule certain tasks. Initially, the floor plan of the building will need to be analyzed to determine which spaces are similar enough to be grouped under a single schedule. Next, interior systems will be broken into major construction sequences and attributed certain durations. By involving multiple trades in the schedule, work teams can follow one another throughout the space and minimize unproductive time on site. These offices are relatively small, so it is critical to clear workers out as efficiently as possible.

ANALYSIS PROCEDURE

The following procedure should be completed to successfully analysis the use of SIPS on the Housing and Food Services Warehouse and Bakery Expansion.

1) Develop SIPS
    a) Categorize Activities
        i) Specific scopes
    b) Durations
        i) Length to accomplish each scope
    c) Logic
        i) Sequencing of detailed scopes
        ii) Understand how each activity relates to each other
2) Work the Plan
    a) Review the SIP Schedule
        i) Establish critical relationships or dependencies
    b) Commitment
        i) Project Team
            (1) Consultants
            (2) Local Jurisdictions
            (3) Third Party Inspectors
        ii) Subcontractors
            (1) Manpower
            (2) Materials
            (3) Positive Attitude

PREDICTED OUTCOME

By investigation and applying a SIP Schedule for the interior renovation of the Housing and Food Services office space, the project schedule should be accelerated to alleviate office downtime.

ANALYSIS 2: BIM PROCESS

PROBLEM

The HFS Building did not have an as-built model or utilize BIM in any manner. Because of this, a large contingency was held in case any problems occurred during construction. Utilizing BIM processes such as clash detection, context capture, or laser scan will aid in creating a model that can be used to solve field problems before construction starts.

RESEARCH

BIM has many uses in the construction industry. BIM can be used for 3D coordination, site utilization planning and analysis, structural analysis, digital fabrication, and facilities management. Since the drawings were never put into 3D format, clash detection could not be used and this resulted in the increased amount of RFI's on the project.

My main focus will be utilizing 3D coordination. BIM could assist in the coordination of the different systems and would have been able to find errors in the as-built drawings a lot earlier for the project.

POTENTIAL SOLUTIONS

After completing the analysis there are several potential solutions that could occur.

1) The cost of creating the 3D model is too high and outweighs the costs saved from the use of BIM. If this is the case, BIM will not be utilized.

2) The amount of time saved by limiting RFI's is substantial and therefore BIM should be utilized.

3) The amount of time added by the creation of the 3D model is more than the time saved and therefore BIM should not be utilized.

ANALYSIS PROCEDURE

The following procedure should be completed to successfully analysis the use of BIM on the Housing and Food Services Warehouse and Bakery Expansion.

1) Determine the different uses of 3D models for coordination.

2) Research reasons the owner decided to not use BIM initially.

3) Evaluate the costs of a 3D model.

4) Look into the estimated costs associated with change orders.

5) Evaluate the duration of creating the 3D model.

6) Determine possible schedule savings by limiting the number of RFI's

PREDICTED OUTCOME

With the use of 3D coordination the predicted outcome for this analysis is that BIM will be very useful. A 3D model of the existing building will help substantially by preventing RFI's and change orders. With the 3D model complete, clash detection software could be used which will again limit the amount of RFI's and will save time for the project.

ANALYSIS 3: BUILDING ENVELOPE

PROBLEM

Food-safe environments require the building envelope and system to be maintainable, cleanable, and durable, but for years building envelopes and building systems of bakeries were minimally maintained and otherwise ignored. However, today's bakeries are requiring tighter controls of the manufacturing environment. The Food Safety Modernization Act (FSMA) is driving food manufacturers to take a closer look at their facilities and systems to make sure the manufacturing environment is sanitary and well-maintained. Design changes could be made to the building in order to make it more maintainable, cleanable, and durable.

RESEARCH

When properly considered and designed as part of the whole, the building envelope and building systems can have a significant, positive impact on bakery processes. These components can enhance food safety, personnel safety and productivity by working together to provide a maintainable, cleanable, and durable envelope around the plant's process areas. Additionally, a properly designed and maintained facility works hand-in-hand with FSMA requirements, BEMA Equipment Sanitary Design, and basic Good Manufacturing Practices (GMP) design principles to provide an overall sanitary and productive design solution for any bakery process.

My main focus will be to make certain areas of the building a "Class A: Intense Hygiene" category. This can be done by slopping the floors, installing floor drains, and coating the concrete floor of the bakery and warehouse. This will also include mounting IMP or tile to the interior of the bakery and warehouse, and creating a grid ceiling in the warehouse. This will make the bakery and warehouse more efficient, maintainable, cleanable, and durable.

POTENTIAL SOLUTIONS

The final analysis is the pursuit of a Class A: intense hygiene in the warehouse and bakery. These areas will be evaluated through the Good Manufacturing Practice (GMP) Area Classification and USDA's Food Safety and Inspection Service (FSIS).

Research of insulated metal panels and grid ceilings evaluate the benefits and efficiency of the newly redesigned bakery and warehouse. New systems and methods will be researched to maximize energy and cost savings along with construction efficiency.

ANALYSIS PROCEDURE

1) Determine the thermal properties, efficiency, durability, and maintainability of floor finishes, IMP, and Grid Ceiling

2) Analyze the current materials and proposed systems

3) Determine the areas where floor finishes, IMP, and grid ceiling will be most effective

4) Evaluate the costs of these materials and installation

5) Determine the schedule for installation

6) Develop an execution strategy and plan of project revisions

7) Evaluate the sustainable benefits and longevity of the materials

PREDICTED OUTCOME

The Housing and Food Services Warehouse and Bakery expansion already has some areas with IMP, but with the installation of IMP and Grid Ceiling, the bakery and warehouse will have increased thermal properties, will be easier to clean, and have increased durability. The evaluation of the project after the changes have been made should result in categorizing areas as "Class A: Intense Hygiene". The cost and schedule of the project should stay relatively similar, but will create a more advanced and efficient bakery and warehouse.

ANALYSIS 4: LEED CERTIFIED

PROBLEM

The original project took no considerations to pursue a LEED certification. After reviewing the current design, renovation and addition, it became evident that the project already would be capable of acquiring a LEED certification. With only minor changes in the project is capable of acquiring at least 40 LEED points deeming it suitable for a LEED Certified rating.

RESEARCH

With the process of a LEED certification comes many other benefits to the construction and lifespan of the project at hand. The process offers rigorous third party commissioning to enhance the design and construction in many different ways. The certification of a sustainable projects lets the owner as well as the users of the building know that effective measures were taken to ensure an environmentally conscientious building was produced.

The decision to pursue a LEED certified and green building can result in many different benefits. Lower operating costs and higher asset value, reduced project waste, energy conservation, a healthier, safer, and more productive environment for all future users, reduced greenhouse gas emissions, and tax rebates are just a few of the incentives to choose a green project.

POTENTIAL SOLUTIONS

The final analysis is the pursuit of a LEED Certification and a more sustainable project. The current project plans and methods will be evaluated through the LEED Certification process along with rational changes to acquire the most LEED points and highest LEED certification.

Research of the new green buildings systems will evaluate the benefits of a sustainable and LEED certified project. New systems and methods will be researched to maximize energy and cost savings along with construction efficiency.

ANALYSIS PROCEDURE

The following procedure should be completed to successfully analysis the LEED Certification on the Housing and Food Services Warehouse and Bakery expansion.

1) Define the project restrictions and opportunities such as site, code, and preferences.

2) Analyze the current project and proposed systems to optimize the effectiveness.

3) Develop an execution strategy and plan of project revisions

4) Analyze LEED scorecard and sustainable benefits

PREDICTED OUTCOME

The Housing and Food Services Warehouse and Bakery expansion already has potential LEED points, but with the implementation of the proposed systems; there is even more prospective points to be gained. The evaluation of the project after the changes have been made should result in a least a LEED Certified accreditation.

CONCLUSION

The investigation of these design and construction revisions will not only provide important experience of the current trends of the construction industry, but also provide the opportunity to improve the design and construction of the Housing and Food Services Building.

Together, thesis analyses will reduce the duration of the project schedules producing significant returns in time and money. BIM will be utilized to decrease or eliminate the large contingency for the project by alleviating problems before they're encountered I the field. Creating "Intense Hygiene" areas within the bakery and warehouse will increase the efficiency of the workers. It will also provide an easier to clean and productive work space. The minor changes to acquire LEED Certified accreditation will produce a more sustainable building, a higher quality work environment, and less expensive life cycle costs in the future.

These analyzed concepts will increase the buildings sustainability, quality, and decrease the project's schedule duration.

APPENDIX A: BREADTH TOPICS

Structural Breadth

This breadth will incorporate Analysis 3. The focus of this analysis will be structures related. As a result of the selection of an alternative building envelope, the dead loads imposed by the exterior wall on the concrete superstructure will change. In order to determine the feasibility of the selected alternative, a load analysis must be performed to ensure the ability of the original design to carry the substituted loads. This will be accomplished by selecting and analyzing a "typical bay" containing the most significant portions of the alternative system. In addition, a cost analysis will be performed on both the alternative and the original systems in order to compare the costs per bay to ensure the best option is implemented. If the current strength of the columns is not sufficient to carry the imposed loads, another alternative system will have to be selected.

Mechanical Breadth

This breadth will incorporate Analysis 3 and Analysis 4. Specifically, the mechanical study will focus on determining the difference in cooling / heating loads based upon the change in thermal resistance properties. These two systems will intrinsically have differing thermal resistance factors, or R-values, which in turn will result in differing cooling / heating loads handled by the terminal units. A comparative energy model analysis will be performed to ensure that the use of the proposed system will not prompt a redesign of the current mechanical system. In other words, the mechanical breadth analysis will ensure that the capacities of the typical freezer and bakery units are sufficient in handling the alternative loads.