Final Proposal

January 13, 2012

Courtesy of RLPS Architects

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Masonic Village at Sewickley

Sewickley, PA

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Construction Option

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Project Background

Masonic Villages of Pennsylvania is an institution that has been in business for over 130 years. Committed to satisfying the needs of their clients, a vision of excellence is the driving force behind the longevity of the company. Over the course of the last century the organization has established 5 separate campuses throughout the state of Pennsylvania. Campus locations include Lafayette Hill, Elizabethtown, Warminster, Sewickley, and their recently founded Dallas location.

The history of Masonic Village at Sewickley is relatively young. The organization has occupied the property since 1999 when the campus was purchased from the Valley Care Association. Masonic Village has long envisioned establishing a superior retirement care community. Quality service for its residents is of top priority. Since the possession of the property, a 60 apartment personal care facility and a 227 unit retirement living apartment building with 43 villas has been constructed. Each expansion indirectly proves their exceptional ability to satisfy the needs of residents and their families. In September of 2010, Masonic Village has once again chosen to expand, with two 30,000 SF additions to their retirement living center.

The time of construction has been slated from September 13, 2010 – September 27, 2012. However, weather and other external factors may pose an issue with reaching the completion date on time. As the construction manager of the project, it is up to Weber Murphy Fox to adequately oversee the project and keep things on schedule. The total cost of construction for Masonic Village at Sewickley is roughly $22.8 million and was delivered to the owner through a GMP contract. The structure contains two floors completely above grade with one much smaller floor partially submerged in the hillside. The primary function of the building is to serve as a retirement home/health care facility for the greater Sewickley area. Construction will expand across roughly 100,000 SF of building area. However only 66,455 SF will be new construction, whereas the remaining 40,000 SF will be dedicated to interior renovations of the existing building.

The overall purpose of the project is to expand the total number of bed spaces within the facility. The existing assisted living center has a maximum capacity of 64 residents. Upon completion of the additions and renovations, the allowable occupancy will be doubled in size and care will be provided for up to 128 patients. Given that the additions will house a total of 96 bedrooms, many of the existing resident rooms will be demolished during renovations and replaced with lounges, dining, and social gathering spaces to better suit the needs of residents.

Analysis #1: Masonry Acceleration

Problem Identification:

Masonry work is undoubtedly one of the most critical factors dictating the final completion date of the project. The building's entire superstructure is comprised of CMU load bearing walls. The current erection sequence progresses with one story of CMU bearing walls, topped with precast plank, and followed by the next story of walls. Furthermore, the assembly is finished off with brick veneer that concurrently chases CMU erection up the wall. Tracking and documenting progress is a critical part of the construction process. Any part of the trade that becomes delayed would result in drastic implications to the final project completion date. Finding innovative ways to speed up the erection process could lead to weeks' worth of progress. Such improvements in work flow might be the best answer to regaining lost time in other activities as well.

Research Goal:

The goal of analyzing masonry acceleration is to conduct in-depth research on various methods and techniques that can decrease the overall time needed to perform the activity. Researching different scenarios will help provide the best combination of construction practices that result in an efficient, yet quality controlled outcome.

Methodology:

Background research in the following areas will provide a better understanding of the assembly process and form a solid perception of influential factors on durations:

- Get familiarized with other trades that may have an impact on masonry
- Use the PM as a source for coming up with innovative ways to make changes
- Contact Weber Murphy Fox and use their experiences to identify alternative processes that would be implemented on similar projects in the future
- Interview masonry subcontractors on key procedures used in the field
- Compare data on various construction techniques/sequencing
- Understand the flow of work and expected timeframes

Potential Solutions:

Each of the following potential solutions will be researched to determine its overall benefit to the project schedule:

- Remove precast planking from in between exterior walls (i.e. change the critical path)

- Modify other trades and activities that impact masonry
- Regulate mortar mixing procedures
- Reposition mixing station locations
- Alter crew tasks/sizes for maximum productivity
- Determine the most efficient flow of work

Expected Outcome:

Each potential solution listed above provides an adequate opportunity for advancing masonry by means of time dependent circumstances. Setting precast planks consumes almost 2.5 weeks of the schedule, in which masonry activity is consequently delayed. Considering block construction is completely stopped to set precast planking, removing its critical path dependency will probably have the largest impact on the schedule. Other critical improvements will likely involve new mortar mixing procedures and adjusting individual crew activities for maximum productivity. However, a combination of advancements to each proposed solution will expectedly provide the best result.

Analysis #2: Façade Dimensioning

Problem Identification:

Masonic Village at Sewickley's irregularly shaped façade has been identified as an exceptionally challenging and costly characteristic of the building. With numerous insets and protrusions around the perimeter, the building layout was simply not designed to be compatible with block construction. An example of this can be viewed in Figure 1. Considering measurements do not match up well with dimensions commonly used for masonry, the site generates an enormous amount of waste. Nearly every corner requires blocks to be cut at the ends of each row going up the building. Modifying blocks to fit proper dimensions not only adds cost in material waste but also in labor and manpower. This process has proven to become extremely time consuming and labor intensive. Making minor adjustments to wall dimensions has the potential to generate unprecedented cost savings. If dimensions are altered to matchup with standard CMU increments, there would be far less project cost associated with material waste, manpower, and time needed to perform work.

(Figure 1: Façade Irregularity)

- Courtesy of Weber Murphy Fox

Research Goal:

The intent of this study is to optimize savings for the owner by making minor alterations to façade dimensions. Adjusted measurements will be made on a scale of inches, in which cost savings in material waste, manpower, and time will be researched.

Methodology:

Background research will be performed in the following areas in order to fully grasp the effects various alterations have on the topics of interest:

- Research the cost of masonry work though RS Means
- Investigate expenses created by a given quantity of material waste
- Identify various block sizes available for construction
- Examine ways to reduce manpower without impacting productivity
- Interview tradesman to learn time saving techniques and methodologies
- Explore how much time is needed to perform specific activities

Potential Solutions:

Possible solutions to the costly features of the façade are as follows:

- Adjust façade dimensions
- Implement different size blocks
- Optimize block cutting to reduce waste

Expected Outcome:

Considering wall dimensions will have been modified to be more compatible with standard masonry sizes, far fewer blocks are expected to be cut. This alteration should result in reduced manpower for equivalent work-in-place. Crews will no longer need additional laborers to produce irregularly shaped units. Essentially eliminating much of this portion of the erection process begins a ripple effect. As workers encounter unconventional dimensions, it takes more time and effort to construct an assembly than it otherwise would in a “line” formation. Taking advantage of façade dimensioning can create a situation that readily upholds such a rhythm. Time is money in the construction industry and should be handled judiciously when planning a sequence of events. The ripple effect in savings should further advance by permitting a smaller amount of material to go to waste. The cost of wasted material adds up quickly on this particular project, given the majority of its superstructure is composed of masonry units. It is critical to mitigate waste not only from a cost perspective but also from an environmental standpoint as well. The results of this study will hopefully provide insight to future designers as to simple techniques in reducing project costs.

Analysis #3: Façade Redesign

Problem Identification:

Understanding the importance of brickwork is critical to project development on this particular job. Considering 9% of the total cost of new construction is solely dedicated to the implementation of masonry construction, exterior wall assemblies should be analyzed for value engineering opportunities. Design alterations that provide major advancements in cost savings should be seriously considered. Furthermore, schedule impacts also need to be taken into account during early conceptual redesign processes. Some goals may not be worth pursing if newly implemented ideas prolong the project schedule by too much. Nevertheless, most significant value engineering ideas are often largely favored by owners. Due to the fact there has been no value engineering performed on the project at all, there is certainly a potential for improvements to be made.

Research Goals:

The purpose of this investigation is to *value engineer* the building façade using embossed brick-faced CMU blocks. Brick-faced blocks provide aesthetics similar to that of brick veneer without incurring additional material and labor costs associated with assembly. An example of the proposed units can be seen in Figure 2.

(**Figure 2:** Embossed Brick-Faced CMU Block)

- Courtesy of www.thenagambricks.com

Methodology:

Background research will be performed in the following areas prior to beginning the analysis:

- Individual cost per unit
- Cost for coloring options/painting
- Unit sizes and patterns
- Differentiation in assembly
- Schedule benefits and impacts
- Special maintenance needs

Potential Solutions:

- Reduce wall assembly cost by using embossed CMU's
- Advance the schedule by eliminating the need to add brick veneer
- Optimize performance by examining differing block heights
- Take advantages of processes that provide an ease of constructability
- Construct bearing walls with standard bricks

Expected Outcome:

Value engineering the exterior façade has the capacity to greatly reduce both cost and schedule. Brick veneer accounts for nearly half of the 9% of new construction costs designated for masonry work. Eliminating veneer altogether should amount to an enormous savings, despite the added cost of using embossed CMU's over standard blocks. Due to a thinner wall assembly, the system will also provide additional value to the facility by creating more net usable square feet of floor space. Furthermore, constructability should also be drastically improved. Masons no longer have to worry about tying veneer back into the structure. Value engineering the exterior wall assembly provides advantages in all three aspects of construction (i.e. schedule, cost, and constructability) and should offer a highly advantageous alternative to the system currently being installed.

Analysis #4: Masonry Sustainability

Problem Identification:

Sustainability of design is a critical issue currently facing the construction industry. With an ever growing amount of public activism, society continues to move toward a culture that wishes to counteract the effects of global warming. Considering buildings are the number one source responsible for greenhouse gas emissions, there is no better place to start taking action. Many highly renowned organizations, such as college campuses, are taking initiative to require all new construction to be sustainable in design. Such roles of leadership will hopefully set precedence for others to follow. Even if new buildings do not achieve a LEED rating, any form of ecofriendly construction is a step in the right direction. On Masonic Village at Sewickley, masonry is the most abundant material used on a pound per pound basis. Therefore, taking action in regard to sustainable aspects of masonry construction has the potential to reduce emissions as well as potentially earn LEED points for the project.

Research Goals:

The goal of sustainability in masonry is to explore construction methods and techniques that would allow for a more environmentally friendly design. All methods employed will also be analyzed under the LEED rating system to determine if improvements are worthy of earning additional points for the facility.

Methodology:

In order to conduct research for analysis #4, the following procedures will need to be performed:

- Research USGBC requirements for masonry sustainability
- Understand the present conditions of the project and decide where improvements can be made
- Determine which LEED points the project can obtain with minimal effort
- Consider other ecofriendly actions that do not lead directly to LEED points.
- Conduct a final analysis to consider all improvements made

Potential Solutions:

- Incorporate material reuse from previous demolition
- Use recycled content
- Buy local material to reduce emissions from transportation

- Reduce material waste
- Take advantage of brick pavers to reduce the amount of concrete or asphalt
- Incorporate weep holes and other forms of moisture control to increase the longevity of the material

Expected Outcome:

Considering the project team is not pursing any sort of LEED rating, there is likely room for several improvements to be made. Taking advantage of material reuse and recycled content are certainly two of the most ecofriendly choices to pursue. Also, the ability to utilize brick pavers in place of concrete or asphalt offers a porous surface capable of reducing storm water runoff. Another way to benefit from a sustainability standpoint is to increase the durability of the material itself. It is crucial to protect brick from erosion so that the building is able to endure a longer lifecycle. Components such as weep holes or moisture barriers help ensure adequate protection against the elements. Judging from its current method of construction, Masonic Village at Sewickley has the potential to earn roughly five additional LEED points through advancements solely related to masonry.

Weight Matrix

The weight matrix analysis is intended to provide a distribution of research amongst the four technical analysis areas within the spring proposal. Each of the analyses is contrasted with all of the core thesis investigation areas in which they are expected to represent. Table 1 shows a distribution of anticipated research.

(**Table 1:** Weight Matrix of Analysis Areas)

Analysis	Critical Issue Research	Value Engineering	Constructability Review	Schedule Reduction	Total
Masonry Acceleration	-	-	10%	20%	30%
Façade Dimensioning	-	10%	10%	5%	25%
Façade Redesign	5%	15%	10%	5%	35%
Masonry Sustainability	10%	-	-	-	10%
Total	15%	25%	30%	30%	**100%**

Breadth Topics:

Both breadth topics have been accounted for and represented amongst the distribution of work load within the weight matrix. One study has been devoted to a structural analysis, whereas the other is intended to be a mechanical breadth. The respective analyses for each breadth topic are derived from analysis #1 and analysis #3. A more detailed explanation of both breadth studies can be found in **Appendix A**.

Proposed Work Schedule:

In order to properly meet research goals, a proposed work schedule has been developed. Each analysis has been outlined on a step-by-step breakdown of events and illustrates the expected time needed to attain individual research goals. Four milestone dates have also been set to ensure all studies are moving at an adequate pace. **Appendix B** displays a completed timetable of proposed thesis work.

Appendix A
Breadth Topics

Breadth Topics

Breadth studies are intended to display competency in other relevant option areas within Architectural Engineering. Each breadth corresponds to an effect created by one of the in-depth analysis areas.

Structural Breadth:

- *Applies to Analysis #1*

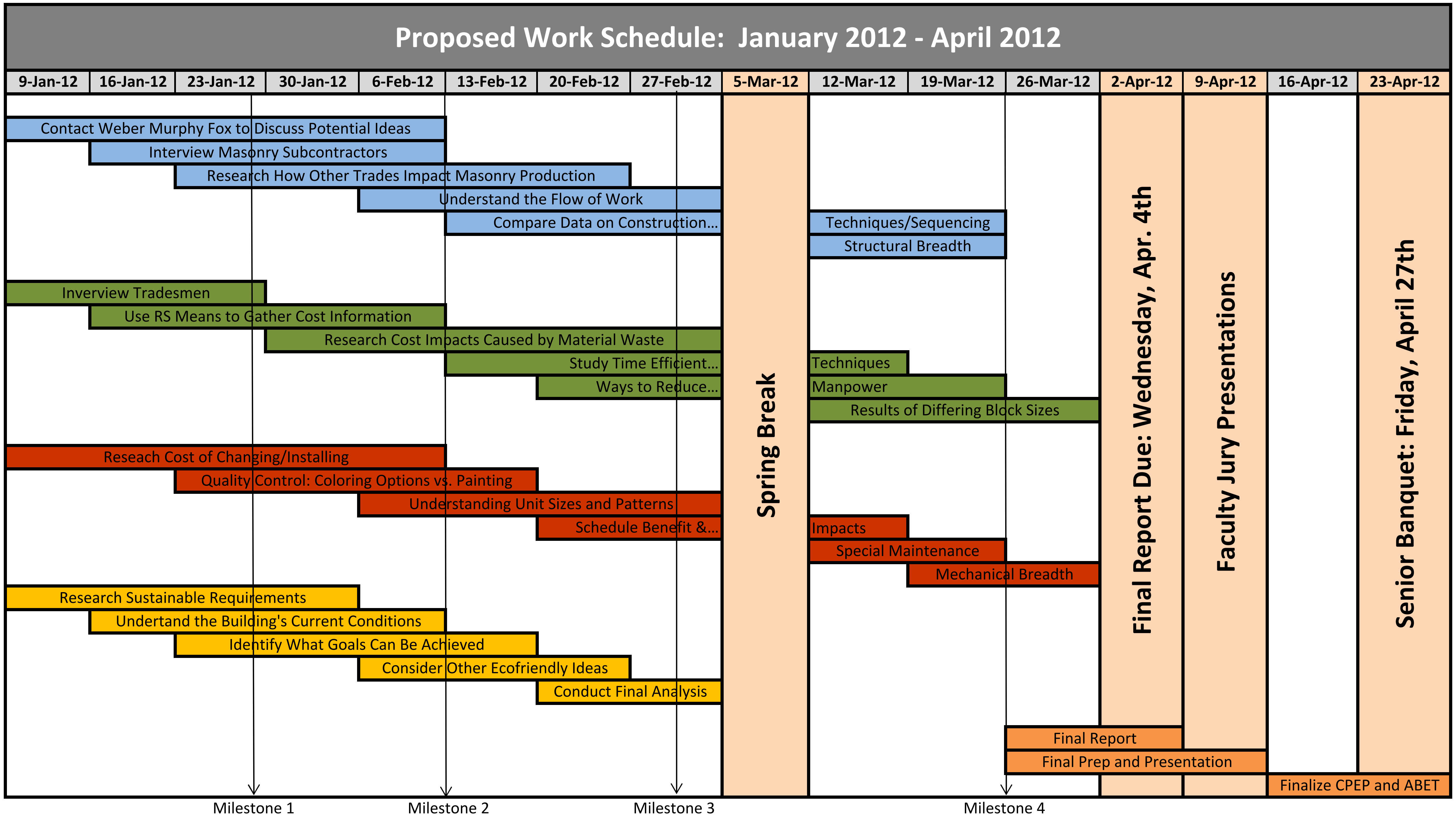
In researching ways to accelerate masonry work, one major idea was to remove precast planking from in between exterior walls. The modification would require floor slabs to be supported differently than previously designed and would provide an opportunity to present a structural breadth study. Considering precast slabs would no longer be an integral part of the wall assembly, steel wide flanges would serve as an effective alternative to provide the necessary support. Masonry pilasters are currently located at regular intervals along the exterior walls. Steel wide flanges that span from pilaster to pilaster can be used as the primary means of supporting precast floor slabs. Each plank will need to have weld plates mounted to them when as they are fabricated. Once they are set, the plates are welded to the wide flanges to create a connection. The intent of the study is to design a new connection for the planks as well as determining proper beam sizes needed to span various distances around the interior perimeter.

Mechanical Breadth:

- *Applies to Analysis #3*

Analysis #3 involves value engineering the building's exterior walls by utilizing embossed brick-faced CMU blocks to eliminate the need for brick veneer. However, making these changes negatively affects the assembly's ability to resist thermal heat flow. The current system has a hollow cavity located between CMU's and brick veneer. Project specifications have detailed the cavity to be filled with 2" foam board insulation. Removing the application of brick veneer to the outside walls also eliminates the current methods of insulation. The purpose of this breadth study is to research alternative means of insulating the exterior. Given that the intent of analysis #3 is to value engineer the system, cost of each method will also influence the final technique employed. However, insulation values must achieve or exceed the R-value previously dedicated to the walls. Finding effective ways to insulate the new façade system will contribute added value to the overall research conducted in analysis #3.

Appendix B
Proposed Work Schedule



Analysis #1: Masonry Acceleration	Structural Breadth: Floor Slab Supports
Analysis #2: Façade Dimensioning	
Analysis #3: Façade Redesign	Mechanical Breadth: Thermal Heat Loss
Analysis #4: Masonry Sustainability	

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