2009

Final Proposal

Marymount University 26th St Project

Arlington, VA

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Executive Summary

The final proposal will provide a guide for the research and analyses that will be performed on the Marymount University 26th Street Project throughout the spring 2010 semester. The topics include the development of a Short Interval Production Schedule, MEP coordination techniques, implementation of a green roof, and incorporating an Energy Education Plan. All of the research topics have been chosen to revolve around the critical industry issue relating to increasing efficiencies.

Analysis I:

The first analysis involves implementing Short Interval Production Scheduling into the interior finishes of the Residential Facility. The repetitive nature of the activities that are involved with this phase of the project provide a perfect opportunity to try to bring the efficiencies of the "manufacturing process" to the construction industry.

Analysis II:

The second analysis involves the investigation into the MEP coordination process. All of the MEP coordination on the Marymount University Project was done "traditionally" with two-dimensional drawings. The rise of three-dimensional coordination has introduced another option but has yet to become widely accepted. The acceptance of the 3D MEP coordination process will be evaluated through a survey of the General Contractor and their subcontractors.

Analysis III:

The third analysis involves incorporating a green roof into the design of the facilities at Marymount University. This will require supplementary evaluations on both the structural and mechanical systems of the building. In addition, Analysis III will satisfy the M.A.E. requirement.

Analysis IV:

The fourth analysis involves developing an Energy Education Plan that will be specific to the residents/occupants of Marymount University. The university has proven their commitment to sustainability as the 26th Street Project is aiming for a LEED Certified rating. Along with this rating, Marymount University is actively looking to maintain the efficiency of their building over time. The Energy Education Plan will help to accomplish this by keeping everyone on the entire campus involved.

1.0 Project Background

The 26th Street Project is situated on 1.45 acres and will provide Marymount University with additional dormitory units, a new academic facility, and underground parking. The project site is located at the corner of 26th Street, Yorktown Boulevard, and Old Dominion Drive in Arlington, VA.

The residential building will add 62 units, situated in four and five unit suite configurations. The academic building will provide state of the art scientific laboratory space, lecture halls, and office space for Marymount University personnel. The academic and residential buildings will be constructed on top of the four levels of underground parking and separated by outdoor gathering space.

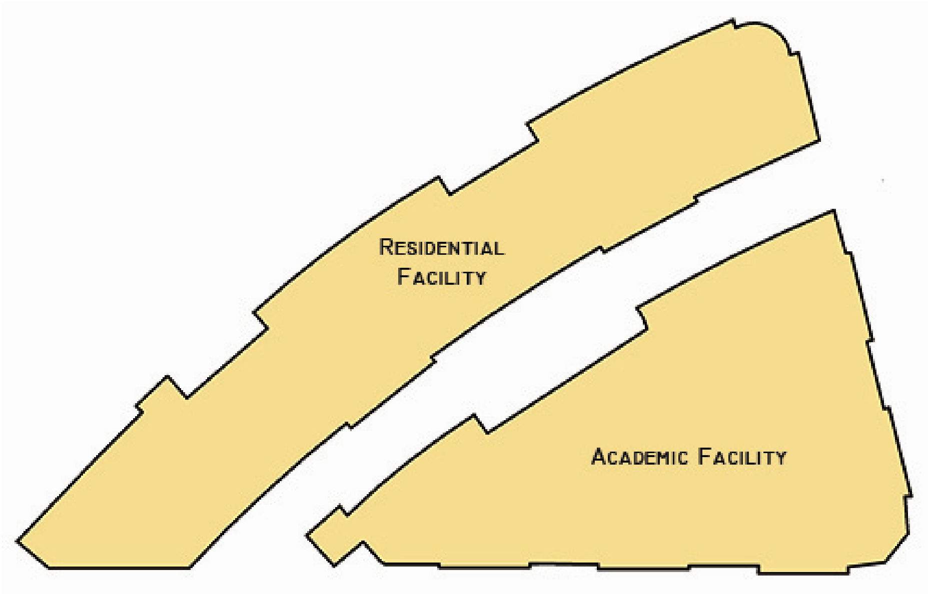

Figure 1: Building Footprint

To complete the construction of the $42,000,000 facility, Marymount University contracted James G. Davis Construction Corporation as the General Contractor in April of 2008. Construction on the 267,000 square foot facility began in February of 2009 and is scheduled to commence in September of 2010.

2.0 Analysis I: Short Interval Production Schedule Development

Problem Statement:

One of the additions to the campus of Marymount University is a Residential Facility. The new facility will provide suite-style housing for 239 students. There are 62 units situated in four and five person configurations. The interior finishes that are involved with the completion of the Residential Facility are extremely repetitive from unit to unit and from floor to floor.

This particular phase of the project is extremely important to both Marymount University and the entire project team. In order to generate the highest quality of work in the optimal amount of time, the interior finishes schedule will be required to be extremely consistent and predictable.

Proposed Solution:

The repetitive nature of the work that is involved with the interior finishes in the residential facility provides an ideal location to implement Short Interval Production Scheduling (SIPS). This particular scheduling technique has traditionally been used in areas that are repetitive in nature.

Solution Method:

1. Gain a full understanding of the original finishes schedule.
2. Identify the project milestones and interior finishes timeframe.
3. Establish each of the individual trades that are involved in the sequence.
4. Determine the specific trades that will be driving the critical path of the schedule.
5. Define specific activity durations and basic crew sizes.
6. Establish the project specific sequence of work for a typical unit.
7. Determine the standardized work durations for all of the activities.
8. Ensure the resources are level to attain consistent work durations.
9. Develop the Short Interval Production Schedule.
10. Compare the SIP schedule duration with the existing detailed CPM schedule.
11. Evaluate the cost implications of any changes in resources.

Resources:

- ✓ Critical Path Project Schedule
- ✓ Marymount University Project Manager and Project Superintendant
- ✓ RS Means Cost Data
- ✓ Penn State Architectural Engineering Faculty Members

- ✓ Contact from PACE Roundtable with previous SIPS experience
- ✓ AE 473: Building Construction Management & Control

Expected Outcome:

The development of Short Interval Production Schedule will result in an overall reduction in the project schedule. The work associated with the finishes schedule is extremely repetitive, which in turn will lead to a more efficient workforce. The implementation of this scheduling technique will also help to optimize activity durations, while maintaining the highest quality of work.

The expected benefits of SIPS include optimizing activity durations, while maintaining the highest quality of work. Additionally, the schedule is much more predictable, which makes it easier to track and communicate the progress of the schedule.

3.0 Analysis II: MEP Coordination

Problem Statement:

As with most projects, the coordination of the mechanical, electrical, and plumbing systems are extremely problematic. This remains true for the coordination of the MEP systems at Marymount University. All of the equipment and components required extensive amount of coordination, both vertically and horizontally, to avoid clashes in the field. The MEP coordination was done traditionally by incorporating each of the individual trades into one drawing.

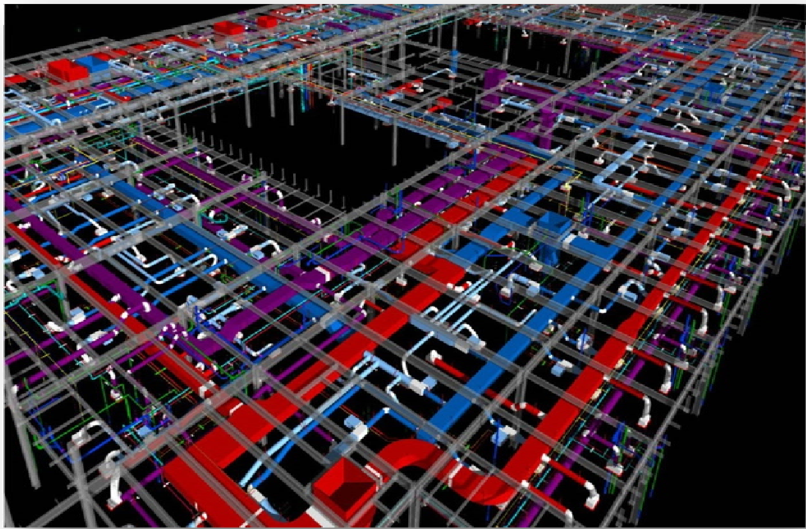

Figure 2: 3D Model (www.mediacad.net)

To help eliminate overlooking major conflicts within the MEP coordination process, the industry has begun to adopt the practice of MEP coordination. This practice will help to increase the efficiency of MEP coordination meetings, increase the productivity in the field, and help to ensure the project remains on schedule. However, the project team and Marymount University chose to disregard this option.

Proposed Solution:

Conduct interviews with the Marymount University Project Team to establish why this practice was not utilized on the project. The participants of the study will include the Project Manager, who was a major part of the MEP coordination process, Project Executive, and Vice President. Additionally, other participants of the interview will include representatives from each of the major trades involved in the coordination process.

Solution Method:

1. Acquire the Meeting Minutes from all of the MEP coordination meetings.
2. Obtain the MEP coordination drawings.
3. Model all of the components in a specific area of the building.
4. Identify the key subcontractors involved with MEP coordination.
5. Generate a questionnaire that will be distributed to all the participants of the survey.
6. Compile the results and establish any common themes.
7. Compare the 3D MEP coordination process to the traditional MEP coordination process.
8. Evaluate the cost and schedule impacts of 3D MEP coordination.

Resources:

- ✓ MEP Coordination Meeting Minutes
- ✓ MEP Coordination Drawings
- ✓ AE 473: Building Construction Management & Control
- ✓ Autodesk Revit & Autodesk Navisworks

Expected Outcome:

The results of the survey should present some of the challenges and motives as to why this practice was not utilized on the project. Even though the participants are a small representative sample of the industry, it is felt that the results will provide a realistic sample of the industry. The positive cost and schedule impacts that are expected to be generated will provide the project team with a more efficient MEP coordination practice to consider in the future.

4.0 Analysis III: Green Roof Design

Structural Breadth/Mechanical Breadth

Problem Statement:

The implementation of a green roof will help further enforce the university's commitment to sustainability. Altering the design of the current white thermoplastic polyolefin (TPO) roofing membrane will generate additional LEED points in both the sustainable sites and energy categories of LEED New Construction Version 2.2.

Proposed Solution:

Design a green roof that helps to increase the thermal efficiency of the building envelope, improve storm water management, and increase the durability of the roof. Additionally, these objectives will help Marymount University achieve LEED points.

Solution Method:

1. Research various types to green roofs to determine which is the most appropriate.
2. Investigate all of the potential advantages and disadvantages of each type.
3. Select the most appropriate green roof for Marymount University.
4. Redesign the current concrete roof structure to meet the newly introduced loads of the green roof.
5. Evaluate the thermal efficiencies and resize the mechanical equipment accordingly.
6. Determine which LEED New Construction Version 2.2 points have been achieved.
7. Assess the cost and schedule implications of a green roof addition.

Resources:

- ✓ Structural drawings for the roof
- ✓ White TPO roof product data
- ✓ Whole Building Design Guide (www.wbdg.org)
- ✓ AE 597D: Sustainable Building Methods
- ✓ AE 404: Building Structural Systems in Steel & Concrete
- ✓ AE 310: Fundamental of HVAC

Expected Outcome:

The addition of a green roof is expected to increase the thermal performance of the building and thus reduce the loads of the HVAC system. However, this system will carry significant schedule impacts and most likely be more expensive than the specified white TPO roof. These negative cost and schedule impacts are anticipated be offset by the extended lifecycle and increased thermal efficiency.

5.0 Analysis IV: Energy Education Plan

Problem Statement:

The Marymount University 26th Street Project has incorporated sustainable features into the design of their new facility and they are looking to achieve a LEED Certified rating. One of the sustainable features the university is looking to achieve includes reducing their overall energy consumption. In order to accomplish this, every member of the Marymount University campus will need to be involved.

Proposed Solution:

Produce an Energy Education Plan for the residents/occupants of the building to help maintain ongoing efficiencies. This plan will provide energy saving guidelines to students and university personnel.

Solution Method:

1. Determine all of the occupancy patterns in both of the buildings.
2. Investigate other Higher Education facilities that have created similar plans.
3. Generate a list of "Best Practices" based off the needs of the university.
4. Evaluate the potential cost savings through a Life Cycle Cost Analysis.

Resources:

- ✓ Aramark Technical Services (Building Commissioning)
- ✓ Penn State Office of the Physical Plant
- ✓ World Wide Web

Expected Outcome:

The implementation of this plan is expected to reduce the overall energy consumption by increasing the energy awareness of faculty, staff, and students. This plan will also encourage the involvement from every member of the Marymount University campus. In addition, the development of such a plan has the potential to generate additional LEED points in "Innovation and Design".

6.0 Weight Matrix

The Weight Matrix that is shown below illustrates the time and effort that will be distributed amongst the different topics.

Weight Matrix					
Description	**Research**	**Value Engineering**	**Constructability Review**	**Schedule Reduction**	**Total**
Analysis I: SIPS	0%	0%	0%	25%	25%
Analysis II: MEP Coordination	5%	5%	15%	0%	25%
Analysis III: Green Roof	5%	10%	15%	0%	30%
Analysis IV: Energy Education Plan	20%	0%	0%	0%	20%
Total	30%	15%	30%	25%	100%

Appendix A: Breadth Studies

Structural Breadth:

Altering the current roof from a white thermoplastic polyolefin (TPO) roofing membrane to a green roof will require an evaluation of the structural system. The redesign of the reinforced concrete roof will need to account for the additional loads that a green roof will introduce. Knowledge of structural design will be displayed through numerous hand calculations and the development of new structural drawings.

Mechanical Breadth:

The addition of a green roof will also alter the thermal performance of the building envelope. To take this into account, the mechanical equipment requirements will be further evaluated. Knowledge of mechanical systems and building envelopes will be demonstrated through various hand calculations and checked with energy modeling software.

MAE Requirements:

Knowledge gained in 500-Level Architectural Engineering classes will be displayed through the design and incorporation of a green roof. The addition of a green roof will increase the building's sustainability and significantly improve the thermal performance of the building's envelope.

- ✓ AE 597D: Sustainable Building Construction
- ✓ AE 542: Building Enclosure Science & Design

Appendix B: Production Schedule