GOUVERNEUR HEALTHCARE SERVICES

227 MADISON STREET, NEW YORK, NY, 10002

FINAL PROPOSAL

ALEX D DESPOTOVICH

FACULTY ADVISOR: DR. JOHN I. MESSNER

REVISION ONE

FRIDAY, JANUARY 13, 2012

EXECUTIVE SUMMARY

The purpose of the Final Proposal is to discuss four technical analyses and two breadth studies in preparation for compiling a final report on the Gouverneur Healthcare Services project. The studies performed are based on a central theme of efficient design and construction involving four core investigation areas including Critical Issues Research, Value Engineering Analysis, Constructability Reviews, and Schedule Reduction/Acceleration Proposal.

TECHNICAL ANALYSIS I: THE USE OF BUILDING INFORMATION MODELING

The project faced many challenges involving the schedule phasing of the active facility, site logistics, and the coordination of the high volume of mechanical, electrical, and plumbing systems that will support the buildings function. The goal of this analysis is to determine how this healthcare facility can benefit through the use of BIM methods through design, construction, and operations including site utilization planning; phase planning and 4D modeling; 3D modeling and coordination; existing condition modeling; field technologies; and energy analysis.

TECHNICAL ANALYSIS II: SCHEDULE RE-SEQUENCING AND TENANT OCCUPANCY

The design for residential floors six through eleven contain identical floor layouts and share a phasing relationship where the completion of each floor affect the dates in which the other floors are turned over by the owner to construction. This phasing relationship is also affected by the duration in which it takes the owner to transfer occupants from existing to completed spaces. The goal of this analysis is to perform in-depth schedule re-sequencing to accelerate the schedule by grouping identical floor turnovers to construction, increasing the efficiency in which the owner transfers occupants from existing to completed spaces, and increasing the efficiency of construction flow between floors.

TECHNICAL ANALYSIS III: MATERIAL STAGING AND SYSTEM PREFABRICATION

The site logistics of this project served as a challenge for the project team due to the complex phasing of the schedule and the fact that the facility will remain active during the entire duration of construction. The goal of this analysis is to perform an in-depth analysis to explore options for a "lean" construction approach to material delivery and material storage for the project. Another goal for this analysis is to explore the idea of implementing prefabricated MEP systems to the job and understand its impact on constructability of the systems.

TECHNICAL ANALYSIS IV: SUSTAINABLE GREEN ROOF GARDEN

An alternate to the building design included a sustainable green roof garden on the 6th floor of the new building. Due to financial restrictions, it was decided that it was not in the owner's best interests to implement the green roof garden into the design. The goal of this analysis is to perform an in-depth study related to implementing the sustainable green roof garden to the 6th floor roof and determine the benefits to the owner and occupants of the facility, as well as the effects on construction related to costs, schedule impacts, and constructability issues. Additionally, out of option breadths will be arise during this analysis to determine how implementing a green roof to the 6th floor will effect structural and mechanical systems that support the buildings function.

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PROJECT BACKGROUND

The Gouverneur Healthcare Services facility is an existing healthcare facility that is undergoing a major modernization which includes complete renovation of the existing thirteen story building, modernization of the existing mechanical infrastructure, and a new addition to the building. The healthcare facility is located on 227 Madison Street in New York City, NY, 10002. The existing building is about 328,665 square feet which is comprised of a sub-cellar and cellar below grade, thirteen stories above grade, and mechanical penthouse. The new addition to the building is designed to be 109,336 square feet which is comprised of a cellar below grade, five stories above grade, an eight story "bump out" above, and a mechanical penthouse on the sixth and fourteenth floor.

The preconstruction for the Gouverneur Healthcare Services building began in 2007 and the job broke ground in January of 2009. Substantial completion for the entire project is scheduled for December of 2013. The cost for the overall project is currently estimated to be $207 million. The project is being delivered as a Design-Bid-Build with a CM Agency. Listed below is the project team directory.

TABLE 1: PROJECT TEAM DIRECTORY

Project Team Member	Project Team Member Name
Owner	New York City Health and Hospitals Corporation
Client	Dormitory Authority of the State of New York
Construction Manager	Hunter Roberts Construction Group
General Contractor	J. Petrocelli Contracting, Inc.
Architect	RMJM Architects
Landscape Architect	EKLA
Structural Engineer	Greenman-Pedersen, Inc.
MEP Engineer	AKF Engineers
Civil Engineering and Land Surveying	Hirani Engineering
Food Service, Laundry, and Waste Management Consultants	Marrack + Associates Inc.
Telecom / Security Consultants	McCorp

The existing building has been designed by RMJM Architects to allow for the hospital to expand their long term bed count from 210 to 295 beds. Many of the floors will function as residential floors where patients will reside in suites that share a bathroom. These floors will feature a welcoming fireplace area, two country style kitchens, a spa room, and other amenities.

The new building will be a five story building that will house ambulatory care departments for the hospital which include Surgery, Podiatry, OB/Gyn, Adult Behavioral Program, WIC, and Pharmacy departments. The new building also features an eight story "bump out", floors 6-13,

that is connected to the existing building and will serve as added square footage achieve the hospitals long term bed count goal. The new main entrance, located on Madison Street, will feature a storefront glazing system and revolving door which enters into a four story atrium featuring a one story marble staircase and two skylights.

The building enclosure for Gouverneur Healthcare Services contains a variety of building materials that compose the building façade. The existing buildings façade is composed of an existing brick veneer, concrete columns, and punch-out windows. The existing 2' x 4' windows will be replaced with new 3' x 6' punch windows. The new eight story tower façade is comprised of fabricated wall panel assemblies, structural sealant glazed curtainwall, brozne tinted low-e insulating glass, and a flat resin panel screen up on the penthouse level. The new five story building façade is comprised of bronze tinted low-e insulated glass, glazed aluminum curtainwall, fabricated wall panel assemblies, and flat resin panel screen on the 6th floor penthouse. The described façade can be seen in Rendering 1 and Rendering 2, both courtesy of RMJM Architects. The new main entrance will feature a bronze tinted glazed revolving door and glazed aluminum storefront doors. The roofing system of the building consists of a hot fluid-applied, rubberized asphalt waterproofing membrane, elastomeric flashing sheet, fiberglass reinforced rubberized asphalt sheet, insulation drainage panels, filter fabric, and stone ballast.

Rendering 1: Exterior View

Rendering 2: New Main Entrance

The Gouverneur Healthcare Services building will not be constructed as a LEED project. Design consultants implemented the use of lighting motion sensors as replacement to manual switches for a majority of areas throughout the building. Additionally, as required by code, mechanical infrastructure upgrades will feature energy efficient systems. An alternate to the design, which is to be decided at a later time, is to feature a green roof garden for the use of patients of the hospital on the 6th floor roof.

TECHNICAL ANALYSIS I: THE USE OF BUILDING INFORMATION MODELING

PROBLEM IDENTIFICATION

The Gouverneur Healthcare Services project faced many challenges involving the schedule phasing of the active facility, site logistics, and the coordination of the high volume of mechanical, electrical, and plumbing systems that will support the buildings function. Through studies involved in Technical Assignment 2 and Technical Assignment 3, it was determined that Building Information Modeling methods were not applied to the Gouverneur Healthcare Services facility for the design, construction, or facilities management phases of the project. Due to the occupancy phasing requirements and complexity of the MEP systems in the facility, the use of BIM methods could benefit the project in delivering safer and more efficient construction.

RESEARCH GOALS

The goal of this technical analysis is to determine how a healthcare facility of this magnitude and complexity can benefit through the use of a variety of BIM methods through design, construction, and operations. Particularly, the goal of the analysis is to determine the cost impacts, schedule impacts, and overall benefits related to implementing the following BIM methods:

- Design Authoring
- Site Utilization Planning
- Phase Planning and 4D Modeling
- 3D Modeling and Coordination
- Existing Conditions Modeling
- Field Technologies - VELA
- Energy Analysis

Upon completion of this analysis, the information discovered through research will be integrated throughout the other technical analyses.

METHODOLOGY

- Gain understanding for why BIM methods were not initially applied to the project by interviewing project team and understanding requirements of the owner when the project was bid in 2007
- Gain understanding of BIM experience of the owner and construction management team through research of past projects performed by both
- Research case studies related to a project of this magnitude and understand the impact of BIM methods on those projects in terms of cost and schedule

- Interview Hunter Roberts Construction Group project team and other personnel to gain insight on the specific BIM methods that have been successfully applied to past healthcare projects
- Perform a cost and schedule impact analysis by understanding the costs associated with applying certain BIM methods and performing a cost comparison of initial costs to potential savings that have resulted in data collected from past case studies of similar projects

RESOURCES AND TOOLS

- Industry Professionals - Hunter Roberts BIM Coordinator
- Historical Data of Past BIM Projects from Hunter Roberts
- Department of Architectural Engineering Faculty
  - Dr. John Messner
  - Dr. Craig Dubler
  - Dr. Robert Leicht
  - Dr. Chimay J. Anumba
- Penn State BIM Project Execution Planning Guide V2.0
- Applicable Case Studies and Literature

EXPECTED OUTCOMES

The results of the research performed will provide one with a better understanding to applicable BIM methods that the Gouverneur Healthcare Services project could potentially benefit from. Through the research of past case studies and the process of conducting interviews with industry professionals, it is expected that the information collected will provide accurate data to show positive cost and schedule impacts of implementing BIM methods on a project of this magnitude.

TECHNICAL ANALYSIS II: SCHEDULE RE-SEQUENCING AND TENANT OCCUPANCY

PROBLEM IDENTIFICATION

The Gouverneur Healthcare Services facility will remain fully operational for staff and patients throughout six major phases from the beginning of construction to project substantial completion. Because of these circumstances, demolition and renovation of the existing thirteen story building is highly phased, where the owner turns over floors to construction in a scattered ordered. The order in which floors are turned over to construction reduces flow efficiency because subcontractors mobilize and demobilize individual, random floors throughout the duration of construction of the existing building. The design for residential floors six through eleven contain identical floor layouts and share a phasing relationship where the completion of each floor affect the dates in which the other floors are turned over by the owner to construction. This phasing relationship is also affected by the duration in which it takes the owner to transfer occupants from existing to completed spaces.

RESEARCH GOALS

The goal of this analysis is to perform an in-depth schedule re-sequencing in order to make it possible for the owner to turn over floors to construction in a more efficient and grouped manner. The ultimate goal is to accelerate the schedule by grouping identical floor turnovers to construction, increasing the efficiency in which the owner transfers occupants from existing to completed spaces, and increasing the efficiency of construction flow between floors.

METHODOLOGY

- Interview James Palace, Senior Project Executive, at Hunter Roberts Construction Group and owner representatives to better understand the approach for the schedule phasing of the project
- Re-sequence the schedule based on identical floor relationships and develop an understanding for why durations are different between these floors
- Evaluate how the project team currently strategizes the mobilization and demobilization of trades throughout the duration of construction for the existing building and compare to proposed schedule re-sequencing
- Assess the schedule impact as a result of re-sequencing and the cost savings associated with re-sequencing the schedule

- Research and apply methods related to facilities management such as FM:Systems software for a more efficient process of moving occupants into new spaces
- Develop a 4D model to display the proposed schedule sequencing and relationship between construction and occupant move-in

RESOURCES AND TOOLS

- Project Staff of Hunter Roberts Construction Group
- Owner Representatives for the Gouverneur Healthcare Services facility and the New York City Health and Hospitals Corporation
- Representatives of FM:Systems
- Microsoft Project 2012 for Schedule Re-Sequencing
- Revit Architecture and Navisworks 2012 for 4D Modeling
- Department of Architectural Engineering Faculty
  - Dr. John Messner
  - Dr. Craig Dubler
  - Dr. Robert Leicht
  - Dr. Chimay J. Anumba
- Penn State BIM Project Execution Planning Guide V2.0
- Applicable Literature

EXPECTED OUTCOMES

Upon completion of this analysis, it is expected that a more efficient phasing sequence can be implemented for the demolition and renovation phases of existing thirteen story building. Through an in-depth analysis of the schedule, it is expected that the owner can turnover identical floors to construction by grouping them together during turnover based on their relationship to one another. Research on facilities management tools, such as FM:Systems, related to occupancy move-in is expected to display more efficient and organized methods for transferring occupants from existing to completed spaces. The organized floor turnover sequence and occupancy move-in is expected to reduce the overall duration of the schedule, thus reducing overall costs for the project.

TECHNICAL ANALYSIS III: MATERIAL STAGING AND SYSTEM PREFABRICATION

PROBLEM IDENTIFICATION

The site logistics of this project served as a challenge for the project team due to the complex phasing of the schedule and the fact that the facility will remain active during the entire duration of construction. The overall footprint of the new and existing building upon the completion of construction will consume four city blocks of space, spanning close to the streets in both the north-south and east-west direction. During all phases of the project, site access for material laydown is a challenge the project team faces on a daily basis. Particularly, during demolition and renovation, the project team faces issues related to site congestion because of how the schedule is phased by the owner to turnover one floor at a time to construction. Additionally, there is a high volume of MEP equipment to support the function of the newly constructed healthcare facility. The idea of implementing prefabricated MEP systems throughout the new and existing building has the potential to save both time and money to the project.

RESEARCH GOALS

The goal of this analysis is to perform in-depth research by exploring options for a "lean" construction approach to material delivery and material storage for the project. Another goal for this analysis is to explore the idea of implementing prefabricated MEP systems for the job and understand its impact on constructability of the systems.

METHODOLOGY

- Explore the idea of implementing a mass off-site material staging plan where multiple subcontractors can store material in a warehouse and deliver material to the site in an integrated way by researching facilities around the Tri-State area that would support such methods of staging and delivery
- Perform an analysis involving labor laws for New York City unions and possible limitations on the previous methodology statement
- Research lean practices such as Just-In-Time delivery and production to eliminate waste on site and determine how these practices can be applied to this specific project
- Contact industry professionals that have experience implementing prefabricated systems and perform literature reviews to better understand the advantages and disadvantages of prefabrication based on constructability issues, associated costs, and schedule impacts

- Determine the location for the utilizing prefabricated MEP systems and determine its impact on the job in terms of delivery, installation, cost, schedule, safety, quality, and manpower

RESOURCES AND TOOLS

- Project Staff of Hunter Roberts Construction Group
- Industry Professionals
- NYC Union Representatives
- Prefabrication Manufacturers
- Department of Architectural Engineering Faculty
  - Dr. John Messner
  - Dr. Craig Dubler
  - Dr. Robert Leicht
  - Dr. Chimay J. Anumba
- Applicable Literature

EXPECTED OUTCOMES

Upon completion of this analysis, it is expected that a more efficient method of delivering site materials and utilizing space on the jobsite will be determined. It is expected that there may be concerns with the mass-off site staging in relationship to the New York City unions but other potential options may be determined for a more efficient method of delivery. Upon completion of the analysis it is expected that prefabricated MEP systems can potentially eliminate site congestion related to these trades and reduce the number of system clashes in the field. This analysis will be integrated with studies performed related to Technical Analysis I. It is expected that there will be a substantial savings in schedule, quality, and worker efficiency, but may add additional costs which can be covered by cost savings through schedule reduction.

TECHNICAL ANALYSIS IV: SUSTAINABLE GREEN ROOF GARDEN

PROBLEM IDENTIFICATION

The Gouverneur Healthcare Services building renovation and addition will not be constructed as a LEED project, therefore no efforts will be put forth to acquire a LEED rating. However, one alternate to the design included a sustainable green roof garden on the 6th floor of the new building. The intentions of the green roof were to provide access for use of patients of the hospital and would feature multiple benches and a variety vines, shrubs, and perennial herbs. Due to financial restrictions, it was decided that it was not in the owner's best interests to implement the green roof garden into the design. However, the green roof design had potential to provide an area for use of occupants, increase energy efficiency, and potentially save the owner long term money.

RESEARCH GOALS

The goal of this analysis is to perform an in-depth study related to implementing the sustainable green roof garden to the 6th floor roof. The ultimate goal is to determine the benefits to the owner and occupants of the facility, as well as the effects on construction related to costs, schedule impacts, and constructability issues. Additionally, out of option breadths will be arise during this analysis to determine how implementing a green roof to the 6th floor will effect structural and mechanical systems that support the buildings function.

METHODOLOGY

- Research various types of green roof system technologies and compare advantages and disadvantages of the systems
- Contact green roof manufacturers for design consultation and pricing of system
- Analyze current design and propose alternate design to gain maximum energy efficiency from the system
- Analyze how the green roof will affect mechanical loads related to decreasing thermal roof loads
- Determine constructability issues, schedule impacts, and perform an in-depth life cycle cost analysis
- Analyze how the existing structure will be affected with the added load of the system

RESOURCES AND TOOLS

- Industry Professionals
- Project Drawings and Specifications
- Material from AE 308, AE 404, and AE 310
- Department of Architectural Engineering Faculty
  - Dr. John Messner
  - Dr. Robert Leicht
  - Dr. David Riley
  - Dr. Craig Dubler
  - Dr. Chimay J. Anumba
  - Dr. Linda M. Hanagan
  - Dr. Jelena Srebic
- Applicable Literature

EXPECTED OUTCOMES

Upon completion of this analysis, it is expected that implementing a sustainable green roof garden to the 6th floor roof will provide a welcoming, outdoor space to the occupants and result in future cost savings to the owner related to reducing the thermal roof and mechanical load for the sixth floor. It is expected upon completion of detailed research, a green roof system will be implemented that would least impact the project schedule and projects costs. The mechanical breadth should show that by implementation of a green roof, the thermal roof load will decrease, therefore decreasing the mechanical load for the floor below.

WEIGHT MATRIX ANALYSIS AND SPRING SCHEDULE

WEIGHT MATRIX ANALYSIS

The four technical analyses that are described in this proposal involve studies based on four core thesis investigation areas including Critical Issues Research, Value Engineering Analysis, Constructability Review, and Schedule Reduction/Acceleration Proposal. The weight matrix depicted in Table 2 show the percentages in which the technical analysis areas incorporate these core investigation areas.

TABLE 2: WEIGHT MATRIX

Description	Research	Value Engineering	Constructability Review	Schedule Reduction	Total
Building Information Modeling	15%	-	5%	5%	25%
Schedule Re-Sequencing	-	-	5%	20%	25%
System Prefabrication	5%	5%	10%	5%	25%
Sustainable Green Roof	5%	10%	10%	-	25%
Total	25%	15%	30%	30%	100%

SPRING SCHEDULE

Located in Appendix B of this proposal is a preliminary schedule which will be used to achieve the analysis goals for the spring semester. It is essential to use this table as a guideline to schedule items to be completed and the major milestones that should be achieved in order to efficiently complete four technical analyses and two out of option breadths. Maintaining this schedule will assist in remaining on task and organized throughout the Spring 2012 semester.

CONCLUSIONS

Upon completion of the four technical analyses described in this proposal, alternative methods for delivering this project based on a central theme of efficient design and construction will be determined. The analyses will be performed involving four core investigation areas including Critical Issues Research, Value Engineering Analysis, Constructability Reviews, Schedule Reduction/Acceleration Proposal. Technical Analysis I will explore how this healthcare facility can benefit through the use of BIM methods through design, construction, and facility management including site utilization planning; phase planning and 4D modeling; 3D modeling and coordination; existing conditions modeling; field technologies; and energy analysis. Technical Analysis II will explore a schedule re-sequencing scenario to accelerate the schedule by grouping identical floor turnovers to construction, increasing the efficiency in which the owner transfers occupants from existing to completed spaces, and increasing the efficiency of construction flow between floors. Technical Analysis III will explore options for a "lean" construction approach to material delivery and material storage for the project, as well as the idea of implementing prefabricated MEP systems to the job. Technical Analysis IV will explore the feasibility of implementing the sustainable green roof garden to the 6th floor roof and determine the benefits to the owner and occupants of the facility, as well as the effects on construction related to costs, schedule impacts, and constructability issues. Additionally, out of option breadths will be arise during this analysis to determine how implementing a green roof to the 6th floor will effect structural and mechanical systems that support the buildings function.

APPENDIX A

BREADTH TOPICS

BREADTH TOPICS

In order to demonstrate a breadth of understanding in Architectural Engineering, two breadth studies will be performed to display competency in other disciplines. The following breadths are related to the impacts on the structural and mechanical system due to the addition of a sustainable green roof to the new 6th floor roof.

STRUCTURAL BREADTH

The current designed roof for the new 6th floor roof consists of a hot fluid-applied, rubberized asphalt waterproofing membrane, elastomeric flashing sheet, fiberglass reinforced rubberized asphalt sheet, insulation drainage panels, filter fabric, and stone ballast. With the addition of a green roof to the 6th floor roof, the current design of the structural system to support this roof may not be sufficient to support the added load of the green roof.

This analysis will satisfy a structural breadth requirement by illustrating skills to perform a structural analysis and redesign of the 6th floor roof. The structural analysis will consist of determining if the existing system is sufficient and redesigning the system if necessary. If changes to the design must occur, the impact on project schedule and costs will also be determined.

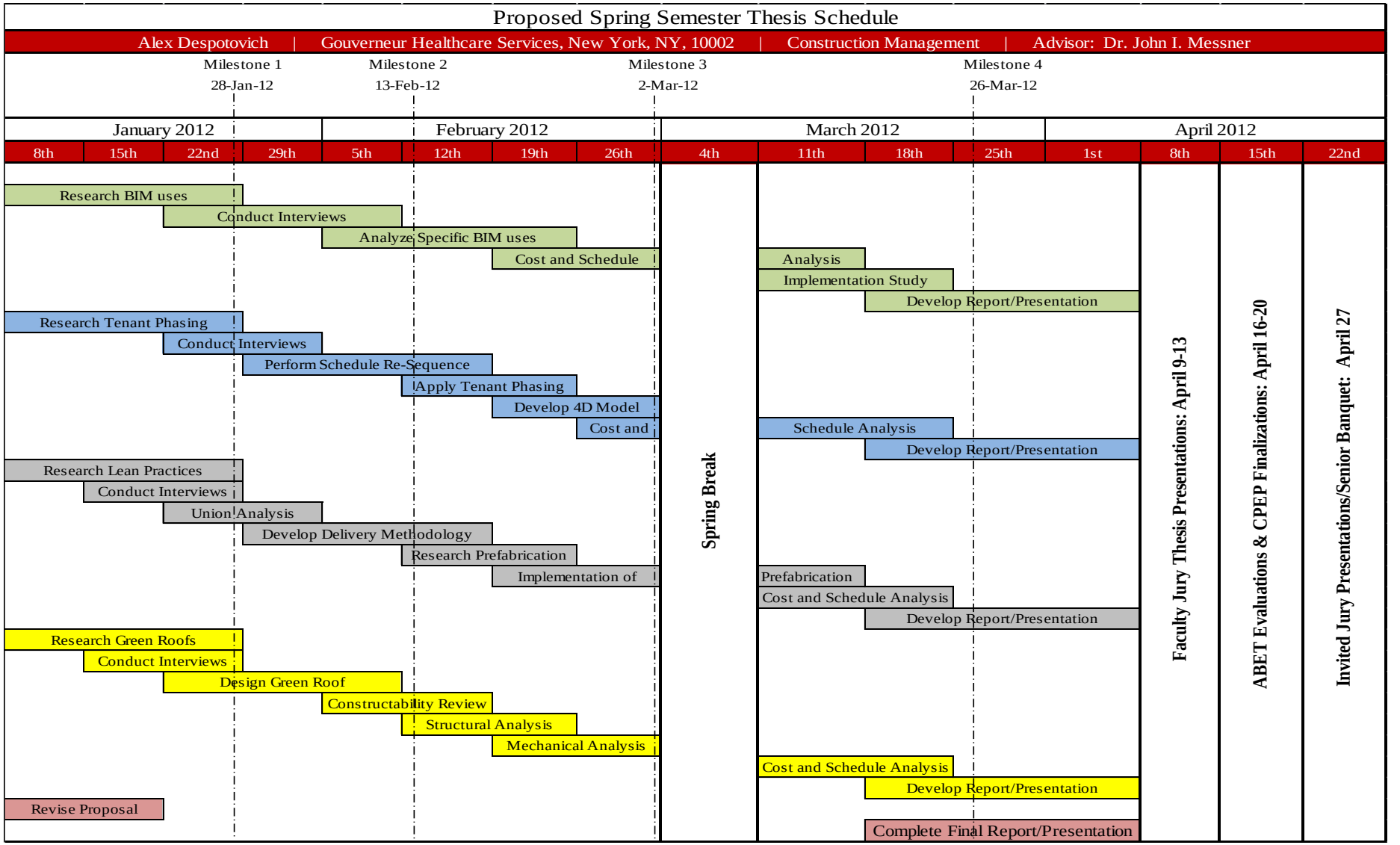
MECHANICAL BREADTH

The current designed roof for the new 6th floor roof consists of a hot fluid-applied, rubberized asphalt waterproofing membrane, elastomeric flashing sheet, fiberglass reinforced rubberized asphalt sheet, insulation drainage panels, filter fabric, and stone ballast. With the addition of a green roof to the 6th floor roof, the current design of the mechanical system may be affected due to the thermal properties of the green roof system.

This analysis will satisfy a mechanical breadth requirement by illustrating skills to perform a mechanical analysis of the current roof system compared to the green roof system. The impact of the system will be analyzed in terms of thermal resistance between the two roof systems and their impact on the mechanical load for the floor below. After determining any changes to the heating or cooling loads, mechanical system resizing and load reduction calculations will occur. A cost analysis for the savings involved in the reduction of the mechanical load will be calculated and used as evidence to support the addition of the green roof system.

APPENDIX B

SPRING SEMESTER THESIS SCHEDULE



	Technical Analysis I: The Use of Building Information Modeling
	Technical Analysis II: Schedule Re-Sequencing and Tenant Occupancy
	Technical Analysis III: Material Staging and System Prefabrication
	Technical Analysis IV: Sustainable Green Roof Garden

Milestone 1	All Research Complete
Milestone 2	Thorough Development of Analyses
Milestone 3	Begin Cost and Schedule Analyses
Milestone 4	All Analyses Complete