Executive Summary

The focus of the Proposal Presentation document is to identify five potential areas for analysis of the Mount Nittany Medical Center Perioperative Services Expansion and Renovation. Each analysis attempts to identify different problems on the project and solve or lessen the impact of these problems using alternative or innovative systems and techniques. Each proposed solution attempts to implement additional areas of value engineering, constructability consideration, or schedule acceleration.

Significant consideration needs to be paid to the challenges and special requirements of completing construction and facility renovations in accordance to the Department of Health regulations. In addition to these stringent guidelines, additional attention is required to minimize the impact or disruptions to medical professionals and facility personnel. This is especially prevalent when addressing areas of facility renovations.

The first proposal attempts to address these concerns by utilizing 3D laser scanning in these renovation areas to document the existing conditions digitally. This documentation can be consulted by any member of the project team in lieu of the lengthy inspection process currently in place. Additional research will be required to identify when laser surveying could be conducted. Industry professionals from SSM Group Inc. will be interviewed as well as technical publications will be consulted to develop an ideal procedure to allow for the efficient use of 3D laser scanning.

By altering the soil retention system in the south west corner of the project over 1,000 square feet of usable space could be added to the project. Analysis two is proposed to address this concern and compare cost and schedule savings associated with altering this design. The construction manager indicated the tedious nature of constructing the existing system due to engineered fill and compaction requirements. Design calculations are to be performed as the basis of the structural breadth.

Due to the extensive and complicated phasing of the Perioperative Services Expansion and Renovation project any potential for schedule acceleration is greatly valued by the owner. Analysis three attempts to identify the potential time savings associated with the construction of the mechanical chases and pipe shafts off site during the course of steel erection. Additional consideration is to be given to the local inspection regulations and what would be required for offsite inspections as the basis of the mechanical breadth.

The fourth proposal analysis attempts to address significant schedule delays due to the unique design of the new stair tower. By converting the structural steel tower enclosed by metal framing and gypsum wall board to one constructed of precast concrete panels considerable schedule acceleration could be achieved. This would allow for the temporary scaffold stair required for personnel access to be removed opening up enclosure work in this area.

The last proposed analysis is designing a new state of the art paperless database system that could be implemented by the construction manager. The basis of this network and database design will be advised by an industry contact that specializes in custom built touchscreen network input devices. Although the upfront cost tends to be significantly higher than the printing costs, crucial quality control and efficiencies of this paperless infrastructure will be considered.
Table of Contents

Problem & Analysis Identification ........................................................................................................ 4

I. Analysis 1 | 3D Laser Scanning Utilization (Critical Industry Issue) ............................................... 4
   a. Problem Identification .................................................................................................................. 4
   b. Critical Industry Issue ................................................................................................................ 4
   c. Research Goals .......................................................................................................................... 4
   d. Methodology ................................................................................................................................ 4
   e. Expected Outcome ...................................................................................................................... 4

II. Analysis 2 | Alteration of Large Soil Retention Structure to Provide Additional Usable Space (Structural
          Breadth) ................................................................................................................................. 5
   a. Problem Identification .................................................................................................................. 5
   b. Research Goals .......................................................................................................................... 5
   c. Structural Breadth Consideration .............................................................................................. 5
   d. Methodology ................................................................................................................................ 5
   e. Expected Outcome ...................................................................................................................... 5

III. Analysis 3 | Prefabrication of Multiple Mechanical Chases to Accelerate Project Schedule (Mechanical
                Breadth) ............................................................................................................................... 5
   a. Problem Identification .................................................................................................................. 5
   b. Research Goals .......................................................................................................................... 5
   c. Mechanical Breadth Consideration ............................................................................................ 6
   d. Methodology ................................................................................................................................ 6
   e. Expected Outcome ...................................................................................................................... 6

IV. Analysis 4 | Utilization of Concrete Precast Stairwell Enclosure Panels In Lieu of Metal Framed System ....6
   a. Problem Identification .................................................................................................................. 6
   b. Value Engineering Consideration ............................................................................................... 7
   c. Research Goals .......................................................................................................................... 7
   d. Methodology ................................................................................................................................ 7
   e. Expected Outcome ...................................................................................................................... 7

V. Analysis 5 | Implementation of Paperless Drawing System Database to Curb Printing Costs ....................... 7
   a. Problem Identification .................................................................................................................. 7
   b. Research Goals .......................................................................................................................... 7
   c. Methodology ................................................................................................................................ 8
   d. Expected Outcome ...................................................................................................................... 8

Conclusion ............................................................................................................................................. 8

Appendices ........................................................................................................................................... 9
Problem & Analysis Identification

I. Analysis 1 | 3D Laser Scanning Utilization (Critical Industry Issue)

a. Problem Identification
The development of past technical assignments has identified several problems and complications to the successful completion of the Mount Nittany Center Perioperative Services Expansion and Renovation. As the name indicates, the project is segmented into two sections. The second of these sections, known as the facility renovation, required extensive on-site investigation to correctly and adequately identify the existing building systems within the occupied areas of the hospital. These investigations were limited to after normal operating hours, and to satisfy Department of Health regulations only permitted limited access to above ceiling mechanical spaces. This caused complications in project phasing, new system design, as well as specific sequencing of the renovation work.

b. Critical Industry Issue
Through investigation is to be done on how 3D laser scanning works and what benefits it can provide a construction project. Due to the new unknown nature these benefits each benefit will be coupled with potential opportunities to use this technology and what negative impacts this could have on the project if not done correctly.

c. Research Goals
The goal of this analysis topic is to provide extensive insight on how 3D laser scanning practices can be utilized on the Mount Nittany Medical Center Expansion and Renovation project to facilitate better understanding of the existing building conditions. Detailed analysis will also be conducted on what extents 3D laser scanning can be used for. These uses will be evaluated in addition to how they can be implemented into the existing project schedule.

d. Methodology
The following steps will be taken to ensure successful analysis of this topic:
- Conduct research on uses and implementation of 3D laser scanning on modern construction projects.
- Conduct interviews with laser scanning professionals on how they utilize this technology as well as what they require for the successful implementation of laser scanning.
- Additional interviews will be conducted with the project and design teams to gauge what exposure they have with 3D laser scanning technology as well as their goals for successful implementation.

e. Expected Outcome
It is expected that the successful implementation of 3D laser scanning early in the project duration will provide valuable information to system designers as well as the construction manager when developing the complicated phasing sequence required on medical renovation projects. It is expected that laser scanning some areas may not be
possible or of great value due to inaccessibility due to gypsum wallboard ceilings required in sterile portions of the facility.

II. Analysis 2 | Alteration of Large Soil Retention Structure to Provide Additional Usable Space (Structural Breadth)

a. Problem Identification
   As identified in Technical Report 3 a large soil retention structure in the basement reduces the usable floor area of the basement by over 1,000 square feet. In addition, great measures had to be taken to ensure proper soil compaction and structure construction. This took a great deal of time of all parties involved and greatly inflated costs.

b. Research Goals
   By excavating this area down to basement elevation and installing a traditional foundation system along the south wall and a retention wall structure along the west, over 1,000 square feet of usable space can be added to the basement level. This analysis will further explore the required changes to the formerly elevated slab on grade that sat on top of the soil retention structure.

c. Structural Breadth Consideration
   Structural calculations resulting in the appropriate design for the soil retention wall will be performed for the redesigned west elevation. Additional calculations will be performed to establish the additional loading exerted on the column by converting the elevated slab on grade to an elevated slab typical of this floor.

d. Methodology
   The following steps will be taken to ensure successful analysis of this topic:
   - Calculations and designs will be performed as taught in CE 397a and AE 404.
   - Analysis of the duration of work required to install the original soil retention system and elevated slab on grade and comparison of that of the new system.
   - Cost differences between these two systems will be considered.

e. Expected Outcome
   By analyzing and comparing the two structural retention systems it is expected that the existing system which requires soil retention systems to be installed on three sides will cost much more than that that would only require a soil retention system on one side. Additionally the redesigned system is expected to take less time for instillation resulting in significant schedule acceleration.

III. Analysis 3 | Prefabrication of Multiple Mechanical Chases to Accelerate Project Schedule (Mechanical Breadth)

a. Problem Identification
Due the complex phasing of the project, the mechanical chases and pipe shafts were one of the first areas of focus of both the construction manager and mechanical subcontractor. These areas had to be completed, inspected, and enclosed early in the duration of the project as some of these chases were located within a sub-phase that had to be turned over much earlier than the remainder of the building addition.

b. Research Goals
Establish and locate key areas within the building that could utilize mechanical prefabrication. Research would need to be conducted on local inspection policy to perform building inspections off site and the fabrication location. Additional consideration would also be required for establishing a fabrication facility in close proximity to the project.

c. Mechanical Breadth Consideration
Due to the limited exposure of local code and inspection officials have to offsite mechanical prefabrication in depth analysis will be performed on the required mechanical inspections in market areas where mechanical prefabrication is more frequently used.

d. Methodology
The following steps will be taken to ensure successful analysis of this topic:
- Interviews will be conducted with local code and inspection officials to determine how offsite fabrication would be inspected.
- Detailed research of existing buildings that utilized prefabrication will be conducted.
- Consultation with the mechanical and plumbing subcontractor will be conducted to determine this subcontractor’s ability to perform offsite mechanical prefabrication.

e. Expected Outcome
The innovative nature of this type of scope delivery may introduce a significant challenge to the traditional nature of central Pennsylvania building construction. The basis for most of the required inspections and code jurisdiction will be based off of major metropolitan areas where mechanical prefabrication is much more common.

IV. Analysis 4 | Utilization of Concrete Precast Stairwell Enclosure Panels In Lieu of Metal Framed System

a. Problem Identification
Efficient material and personnel access are crucial to the success of a construction project. During the course of the Perioperative Services Expansion Alexander Building utilized a temporary scaffold stair to provide access to the four different stories of construction. The duration of this temporary stair was greatly extended due to design complications with the permanent stair tower. Fire separation for this stair tower was achieved by utilizing a complicated system of gypsum wallboard and metal framing. In addition the structural support for the stair structure itself had to be cantilevered from the existing steel structural system requiring extensive calculations due to this eccentric loading condition.
b. Value Engineering Consideration

Tremendous cost savings is available by eliminating temporary conditions earlier in the course of the project. To facilitate personnel and material logistics a temporary scaffold stair tower as well as the omission of a curtain wall panel were utilized by Alexander Building. Several complications to the stair tower design as well as shop drawing approval caused these temporary provisions to be required much longer than originally intended. This cost much more than anticipated as well as prevented work both on the interior and exterior of the project from being completed as expected.

c. Research Goals

The goal of this analysis would be to determine the feasibility of utilizing a precast concrete stair tower system to both lower cost as well as accelerate the installation schedule. Additional analysis of the required fire protection requirements for a stair tower of the designed capacity and how each system intends to meet these requirements is also to be performed. Determination and study of when and how the precast system should be constructed and any potential schedule impacts that this may cause on what was the expected project sequence (prior to the delay of the original stair design).

d. Methodology

The following steps will be taken to ensure successful analysis of this topic:

• Detailed review of returned stair shop drawings to identify structural concerns with the original stair design and how this may be avoided with a more traditional design
• Investigation into the governing fire code and regulations as well as product data for each system.
• Interviews will be conducted with members of the design team with past experience with precast stair tower systems.

e. Expected Outcome

The precast system upfront cost may be marginally higher than that of the original design but early installation of the system will allow for better personnel and material logistics. This increase in productivity due to the removal of the temporary stair and material access will allow for significant project acceleration.

V. Analysis 5 | Implementation of Paperless Drawing System Database to Curb Printing Costs

a. Problem Identification

Excessive and frequent document revisions caused for a great deal of confusion during the course of the expansion phase of the project. Official document revision sets were issued as rapidly as one every eight days. This rapid succession of revisions created quality control issues that had to be closely controlled and monitored by Alexander Building.

b. Research Goals
Analysis and identification of potential cost savings attributed to lowered or eliminated costs of physically printing construction documents will be documented. Additional analysis will be performed on cost savings due to potential decrease of rework due to construction activities being based on previous outdated drawings following the implementation of a paperless drawing system. With the aid touchscreen adapter manufacturer a custom infrastructure can be designed and analyzed.

c. Methodology
The following steps will be taken to ensure successful analysis of this topic:
- Work with an industry professional to develop and build a paperless network.
- Interviews with the project team as well as subcontractors will be conducted to determine the projected favorability of said system.

d. Expected Outcome
Minor cost savings from not printing documents will be offset by the purchasing of the required equipment needed for the implementation of the system. The custom built system, although costly, may provide the required technology required for the successful complete adoption of such a system that may have failed otherwise.

Conclusion
By identifying and paring five key problems or complications with potential analysis topics these complications can more easily be identified on future projects. In addition, the interviews conducted as well as the research performed provides a foundation for the educated discussion of key industry topics. At the core of the analysis conducted are fundamental topics such as value engineering, constructability consideration, as well as schedule acceleration that are key to the successful management of construction projects. Further development of these ideas will be required for the appropriate presentation of these ideas during the spring semester.
Appendices

Appendix 1: Breadth Topics .......................................................... 10
Appendix 2: Presentation Slides ....................................................... 11
Appendix 1: Breadth Topics

Structural Breadth

Analysis 2 | Alteration of Large Soil Retention Structure to Provide Additional Usable Space

By redesigning the large soil retention structure located in the basement of the project over 1,000 square feet can be added as usable space to the basement of the project. What little additional excavation this would require would eliminate the need for engineering fill and align this area to that of the rest of the basement level. Structural calculations would be performed to design an appropriate soil retention structure that would be required to support the existing soils along the west elevation. Additional calculations would be required to determine if additional provisions would be required to support the additional load due to the conversion of an elevated slab on grade to an elevated slab similar to what is found on the remainder of this level.

Mechanical Breadth

Analysis 3 | Prefabrication of Multiple Mechanical Chases to Accelerate Project Schedule

Complicated project phasing requires the early turnover of key areas within the floor plan of the addition of the project. Utilization of mechanical prefabrication of the chases and pipe shafts in these areas allow for project schedule acceleration. Considerable analysis of local building inspection and code jurisdiction will be required. As part of the breadth of study further analysis is to be given to mechanical inspection policies of offsite prefabrication based on the policies of other geographic areas that have used mechanical prefabrication.
Appendix 2: Presentation Slides

Mount Nittany Medical Center
Perioperative Services Expansion

Lucas Manos 12/04/13

AE 481W | Proposal Presentation | Construction Option | Rob Liecht

Analysis 1 | 3D Laser Scanning Utilization

- DOH Restrictions Limit Access To Mechanical Areas Of Occupied Hospitals Which Inhibited Existing System Inspections
- Interview With a Laser Scanning Professional Indicated 3D Scanning Could Aid In:
  - Facilitating Building System Design of The Renovation Area
  - Better Existing Conditions Investigation
  - Aid in Constructability and Project Phasing
- Critical Industry Issue Analysis

Key:
- Addition
- OR 4-7 Renovations
- Support Space Renovations
- Overbuild
- OR 1-3 Renovations
- Prep Recovery Remodel

Mechanical Phasing Model
Analysis 2 | Alteration of Soil Retention Structure

- Extensive Time Was Spent On The Construction Of The Soil Retention System
- Project Manager Advised Redesigning the Soil Retention System Which Would Also:
  - Potential Schedule Acceleration
  - Potential Cost Savings
  - Addition Of Over 1,000 Usable Square Feet
  - Address Steel Connection Complications Due To Cast In Place Wall
- Structural Breadth
  - Revised Soil Retention System Calculations
  - Additional Loading Of Steel Column Due To Elevated Slab Calculations

Analysis 3 | Prefabrication Mechanical Chases

- Pipe Chases and Mechanical Shafts Were A Large Threat To Early AHU Start Up And The Completion Of Work Required For Early Turn Over Of Key Phases
- Project Manager Indicated:
  - Potential For Significant Schedule Acceleration
  - More Efficient Sequencing Of Work
- Mechanical Breadth
  - Code Analysis Of Offsite Prefabrication In Other Areas
Analysis 4 | Prefabricated Stairwell System

- Stair Attachment To Steel Structural System Created Eccentric Loading Condition Which Greatly Delayed Shop Drawing Approval And Installation.
- Project Manager Indicated 4 Month Schedule Delay Due To This Approval Process.
- Additional Input From Other Industry Professionals Indicated Additional Schedule Acceleration By Converting The Metal Framed Stair Tower To Precast Concrete Style Stair Tower.
- Eliminate Temporary Conditions Earlier To Allow Access To Work In These Areas.