SAINT VINCENT HEALTH CENTER

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CM Option

Technical Assignment 3

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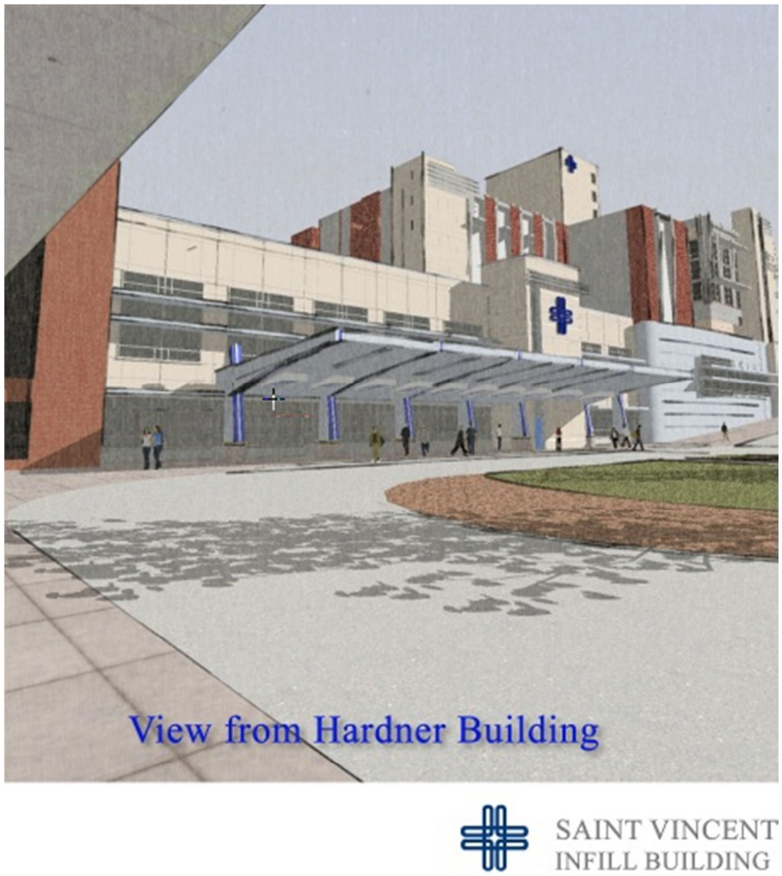
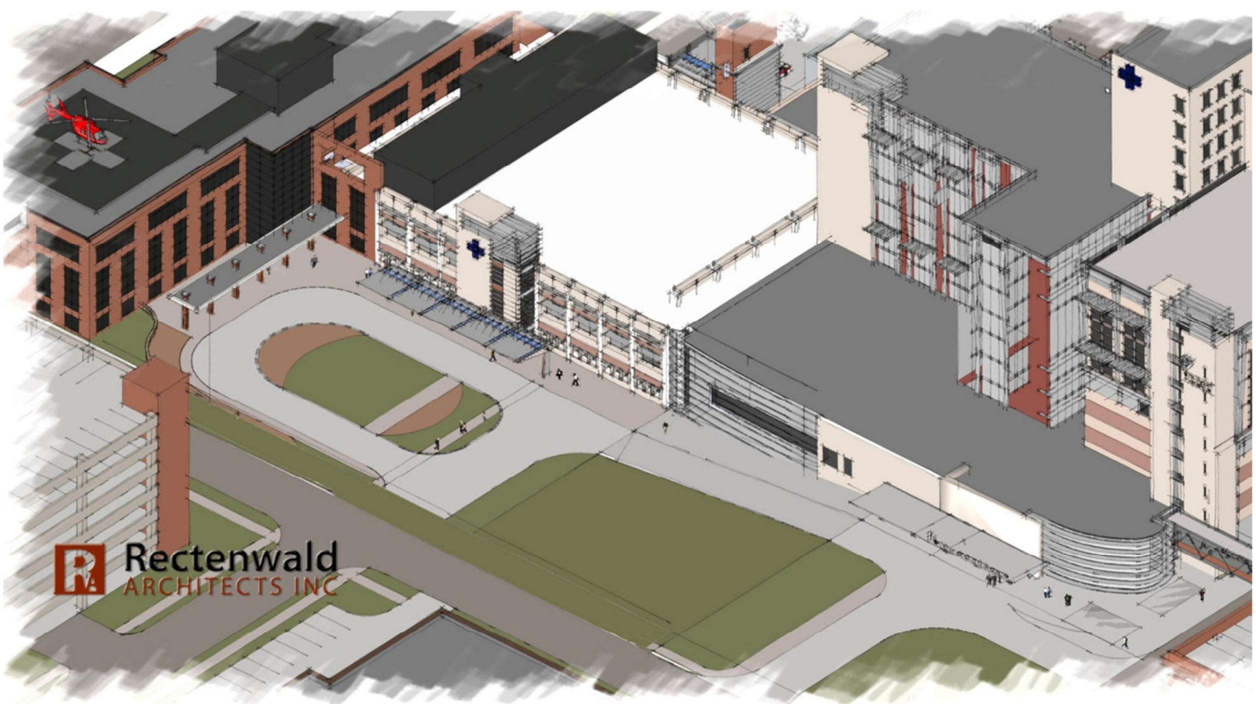

View from Hardner Building
SAINT VINCENT
INFILL BUILDING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Executive Summary

Technical Assignment Three is intended to identify areas of the project that are good candidates for research, alternative methods, value engineering and schedule compression for the Saint Vincent Health Center In-fill addition. This project includes a new Central MEP Plant for the Hospital Complex as well as new operating room and patient rooms. There is a detailed project summary schedule that gives a descriptive of the major project activities and milestones that take place during the design and construction of Saint Vincent Health Center Infill Building in Erie, PA located on the Saint Vincent Health Center complex. The largest challenge associated with this project is that the proposed site is located in between two existing structures (both of which are Saint Vincent's existing buildings) on an active private hospital complex.

The top ***constructability issues*** identified on this project are building alignment between two existing structures, new construction/demolition phase sequencing, worker and pedestrian safety and MEP coordination. Each issue presents different challenges that must be addressed by the project team. The critical path of the project is slated to run through phase 1 construction, phase 2 construction and demolition of connecting corridor, then on to the superstructure of the infill building (phase 3), watertight milestone, mechanical systems installation and finally building interior finishes. Several ***schedule acceleration scenarios*** are identified and include extended work hours, increased crew sizes and re-sequenced work flow. ***Value engineering topics*** that were accepted or denied on the project are described and include construction methods and material selection ideas that maintain the expected quality of the project at a lower cost.

Through the in-depth analysis of the constructability challenges, schedule acceleration scenarios and value engineering topics along with the Project Management interview with Chuck Jenkins from EE Austin, several features were identified as potential problematic areas on the phasing of the project. Several of the identified problem areas are further discussed in the four construction management analysis activities that include re-sequencing of renovation phases, elimination of site congestion, climate controlled requirements and sustainable techniques. Each of the methods discussed provide insight into possible research topics for the spring thesis proposal.

CONSTRUCTABILITY CHALLENGES

Since the project has only just begun construction on Phase 1, the actual site team hasn't faced all of these challenges yet.

CONSTRUCTION PHASING

This is a three phase project: Phase I is new Ambulance Entrance Addition, which is currently under construction. Phase II is Temporary connector corridor along the west side of the site so the existing connector can be removed to allow for access to the new building. Phase III is the new inlet building itself. With three phases, a lot of coordination must be done to not fall behind schedule. A critical sequencing issue is not to interrupt flow of hospital operations at ED and movement between the existing hospital and the MOB (Medical Office Building / Hardner Building) to the North.

The new emergency ambulance entrance (Phase I) is being constructed now so until it is complete, ambulances and patients will continue to use the existing emergency department entrance off of 24th Street. During Phase II, when Phase I is all complete, all ED traffic (patients and ambulances) will use the new Ambulance Entrance for access to the Emergency Department (ED), down the connector corridor. During Phase III, after the temporary connector on the west side is complete at the end of Phase II, pedestrian ED traffic will use the entrance at the southwest corner of that new temporary connector. Ambulance traffic will continue using the new Ambulance Entrance.

The proposed sequence has multiple phases with demolition work overlapping new construction activities throughout the entire project schedule. Phased occupancies are planned for the Emergency entrance, connecting corridor and In-Fill Addition and the Existing Hospital to accommodate Saint Vincent's requirements. This scenario creates potential problems with trade coordination, contractor delays. There will be several contractors switching between renovation, demolishing and new construction work which will make coordination and schedule understanding extremely difficult. Ultimately, the overall project schedule starts with work on the new entrance for the emergency department and ends with the construction of the In-Fill Building, along with temporary construction and demolition in between.

FIG. 1: PHASE 1

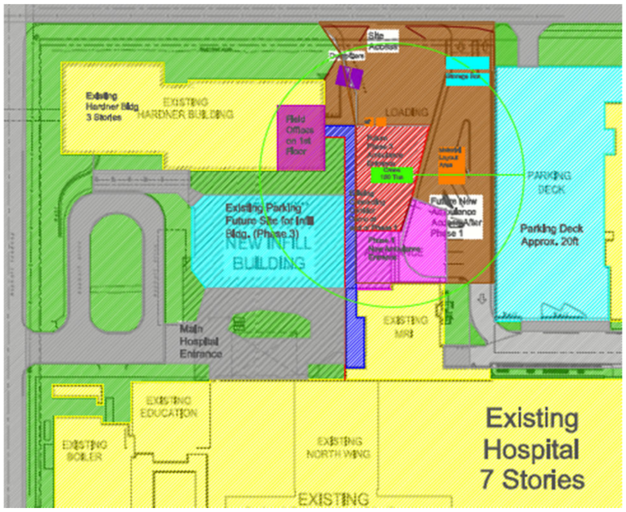


FIG. 2: PHASE 2

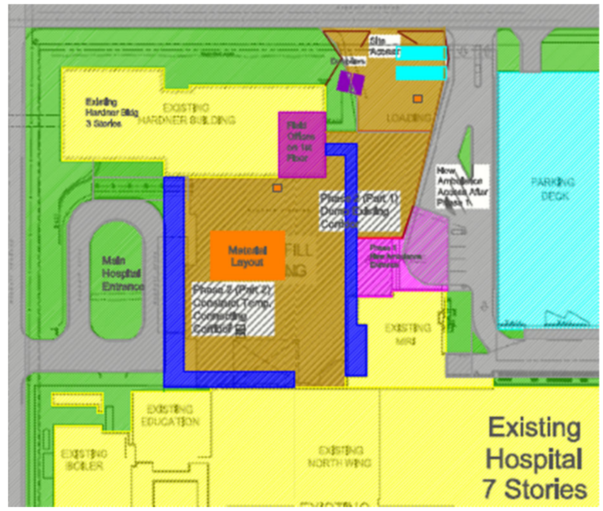
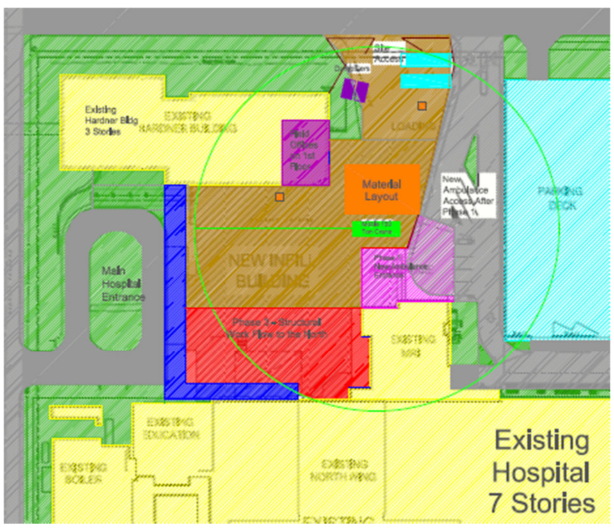


FIG. 3: PHASE 3



SITE CONGESTION

Site congestion is a major concern identified on this project. This issue has impacted several trades and caused delays in excavation, geo-pier installation and masonry work. The lack of material storage and lay-down space has caused contractors to work inefficiently and unsafely. More than once, a trade had to demobilize until the site cleared up to allow for productive work.

As shown in the figures above, the site is surrounded by two existing and running hospital buildings. Material layout, crane placement, and equipment paths makes the site very congested. With many workers and equipment moving around safety and coordinating is a construction challenge. The project team has limited the amount of congestion by having field trailers inside the Hardner Building; this saves more space on site for material storage as well as space for equipment mobility.

PUBLIC SAFETY

Safety is one of the biggest concerns on any job. Since this project is located on an active hospital complex, several problems exist with ensuring the safety of the patients/employees while maintaining a productive site. Several measures must be in place to separate hospital and construction activities without sacrificing hospital operations. The fact that the two adjacent structures that the addition will be attached to will be occupied during construction presents a challenge to public safety. Items such as crane swing, emergency egress, vehicular traffic and ED entrance must be considered for all phases of the project schedule. No one wants any of the workers or the public getting hurt or possibly losing their lives. Material delivery and unloading can be one of the most dangerous activities on a job site since it includes trucks and material which are outside the construction site perimeter, and cranes which are moving over the heads of many lives carrying tons of material. Fencing and safety awareness is the primary ways the project team is handling this safety challenge. They have weekly safety meetings to inform workers. They also have a safety director that often visits the site and supervises/informs workers on safe work practices, such as correct scaffolding layouts and proper tie-off systems.

MEP COORDINATION

Hospitals typically have a lot of coordination that is need between the MEP trades. A projects success is usually heavily weighted on the success on the MEP construction/coordination. Improving the coordination and reduce the delay time with the MEP work that will be done on this project is crucial. There are multiple systems involved and many will be the new complex's plant.

The new boiler plant will serve the existing hospital and for future expansion. A new chiller plant will serve this addition and be set up for future expansion. The Central Plant will leave room for even more possible future expansions. The control system will be an automated system. All systems described will be designed with the intent of reaching the LEED "Silver" Certification. All this being said the mechanical system is very detailed and will need to be tied back into the existing buildings. This will be a huge challenge for everything to run smoothly. The project team has already drilled borings to get access to the existing utilities. This will allow access to later tie back into the new Central Plant.

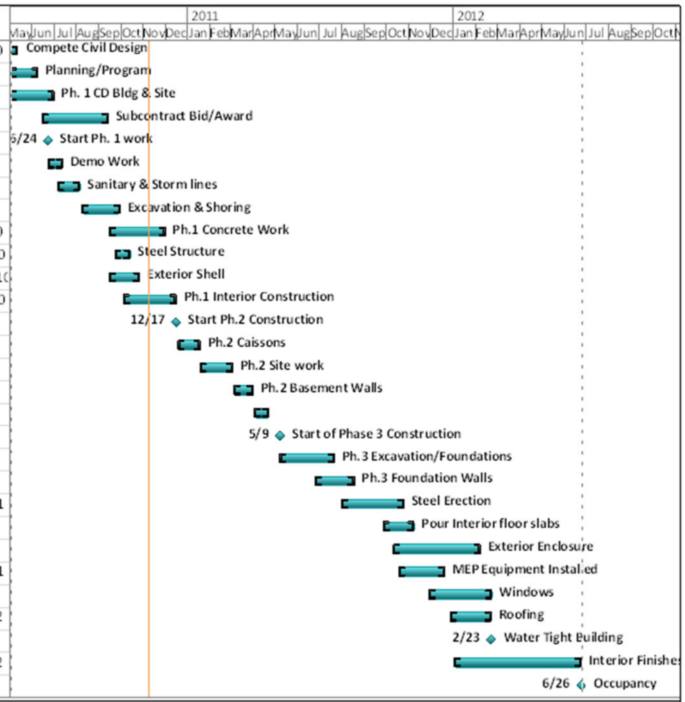
SCHEDULE ACCELERATION SCENARIOS

Currently, this critical path runs as shown below, from phase 1 to phase 2 then to phase 3. The biggest risks associated with completing the project on schedule it that the temporary corridor(phase 2) mucst be constructed before the demolishing of the existing corridor can take place, which then will grant access to the site for Phase 3. So if either Phase 1 or 2 gets behind schedule, phase 3 will also fall behind schedule.

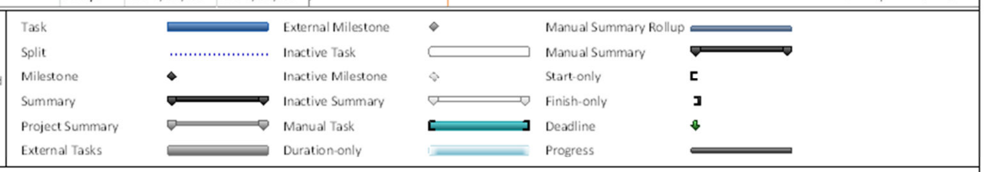
Task Name	Duration	Start	Finish
Compete Civil Design	8 days	Mon 5/3/10	Wed 5/12/10
Planning/Program	28 days	Mon 5/3/10	Wed 6/9/10
Ph. 1 CD Bldg & Site	44 days	Mon 5/3/10	Thu 7/1/10
Subcontract Bid/Award	65 days	Wed 6/16/10	Tue 9/14/10
Start Ph. 1 work	0 days	Thu 6/24/10	Thu 6/24/10
Demo Work	14 days	Thu 6/24/10	Tue 7/13/10
Sanitary & Storm lines	23 days	Wed 7/7/10	Fri 8/6/10
Excavation & Shoring	38 days	Tue 8/10/10	Thu 9/30/10
Ph.1 Concrete Work	54 days	Fri 9/17/10	Wed 12/1/10
Steel Structure	15 days	Fri 9/24/10	Thu 10/14/10
Exterior Shell	29 days	Fri 9/17/10	Wed 10/27/10
Ph.1 Interior Construction	52 days	Wed 10/6/10	Thu 12/16/10
Start Ph.2 Construction	0 days	Fri 12/17/10	Fri 12/17/10
Ph.2 Caissons	22 days	Mon 12/20/10	Tue 1/18/11
Ph.2 Site work	33 days	Wed 1/19/11	Fri 3/4/11
Ph.2 Basement Walls	20 days	Mon 3/7/11	Fri 4/1/11
Temp. Connector to Ext. Bldg	15 days	Mon 4/4/11	Fri 4/22/11
Start of Phase 3 Construction	0 days	Mon 5/9/11	Mon 5/9/11
Ph.3 Excavation/Foundations	55 days	Mon 5/9/11	Fri 7/22/11
Ph.3 Foundation Walls	39 days	Mon 6/27/11	Thu 8/18/11
Steel Erection	61 days	Tue 8/2/11	Tue 10/25/11
Pour Interior floor slabs	30 days	Wed 9/28/11	Tue 11/8/11
Exterior Enclosure	85 days	Wed 10/12/11	Tue 2/7/12
MEP Equipment Installed	45 days	Wed 10/19/11	Tue 12/20/11
Windows	62 days	Wed 11/30/11	Thu 2/23/12
Roofing	40 days	Thu 12/29/11	Wed 2/22/12
Water Tight Building	0 days	Thu 2/23/12	Thu 2/23/12
Interior Finishes	125 days	Tue 1/3/12	Mon 6/25/12
Occupancy	0 days	Tue 6/26/12	Tue 6/26/12

Critical Path Project Schedule

ID	Task Name	Duration	Start	Finish
1	Compete Civil Design	8 days	Mon 5/3/10	Wed 5/12/10
2	Planning/Program	28 days	Mon 5/3/10	Wed 6/9/10
3	Ph. 1 CD Bldg & Site	44 days	Mon 5/3/10	Thu 7/1/10
4	Subcontract Bid/Award	65 days	Wed 6/16/10	Tue 9/14/10
5	Start Ph. 1 work	0 days	Thu 6/24/10	Thu 6/24/10
6	Demo Work	14 days	Thu 6/24/10	Tue 7/13/10
7	Sanitary & Storm lines	23 days	Wed 7/7/10	Fri 8/6/10
8	Excavation & Shoring	38 days	Tue 8/10/10	Thu 9/30/10
9	Ph.1 Concrete Work	54 days	Fri 9/17/10	Wed 12/1/10
10	Steel Structure	15 days	Fri 9/24/10	Thu 10/14/10
11	Exterior Shell	29 days	Fri 9/17/10	Wed 10/27/1
12	Ph.1 Interior Construction	52 days	Wed 10/6/10	Thu 12/16/10
13	Start Ph.2 Construction	0 days	Fri 12/17/10	Fri 12/17/10
14	Ph.2 Caissons	22 days	Mon 12/20/1	Tue 1/18/11
15	Ph.2 Site work	33 days	Wed 1/19/11	Fri 3/4/11
16	Ph.2 Basement Walls	20 days	Mon 3/7/11	Fri 4/1/11
17	Temp. Connector to Ext. Bldg	15 days	Mon 4/4/11	Fri 4/22/11
18	Start of Phase 3 Construction	0 days	Mon 5/9/11	Mon 5/9/11
19	Ph.3 Excavation/Foundations	55 days	Mon 5/9/11	Fri 7/22/11
20	Ph.3 Foundation Walls	39 days	Mon 6/27/11	Thu 8/18/11
21	Steel Erection	61 days	Tue 8/2/11	Tue 10/25/11
22	Pour Interior floor slabs	30 days	Wed 9/28/11	Tue 11/8/11
23	Exterior Enclosure	85 days	Wed 10/12/11	Tue 2/7/12
24	MEP Equipment Installed	45 days	Wed 10/19/11	Tue 12/20/11
25	Windows	62 days	Wed 11/30/11	Thu 2/23/12
26	Roofing	40 days	Thu 12/29/11	Wed 2/22/12
27	Water Tight Building	0 days	Thu 2/23/12	Thu 2/23/12
28	Interior Finishes	125 days	Tue 1/3/12	Mon 6/25/12
29	Occupancy	0 days	Tue 6/26/12	Tue 6/26/12



Project: Tech 3 Critical Path Sched
Date: Mon 11/8/10



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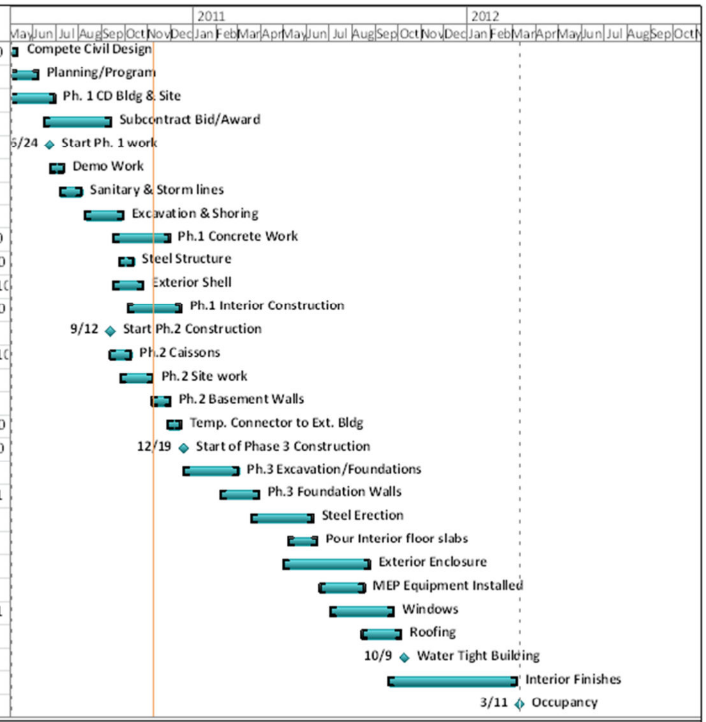
Potential Acceleration Scenarios

The best way to accelerate the schedule would be by working on two phases simultaneously. This could be done during phase 1 and 2. They could start constructing the temporary corridor (Phase2) during the construction of the new emergency entrance (Phase 1). That could save up to a few months if Phase 1 and 2 were being worked on simultaneously.

The only cost that would be involved is dealing with being more workers on an already congested site. I still believe that this would be worth the accelerated schedule. Below is what the schedule could look like if Phase 1 & 2 were being construction simultaneously. This schedule allows the project to finish 3 months earlier than the original turnover date. That would help both Saint Vincent and EE Austin.

Potential Accelerated Schedule

ID	Task Name	Duration	Start	Finish
1	Compete Civil Design	8 days	Mon 5/3/10	Wed 5/12/10
2	Planning/Program	28 days	Mon 5/3/10	Wed 6/9/10
3	Ph. 1 CD Bldg & Site	44 days	Mon 5/3/10	Thu 7/1/10
4	Subcontract Bid/Award	65 days	Wed 6/16/10	Tue 9/14/10
5	Start Ph. 1 work	0 days	Thu 6/24/10	Thu 6/24/10
6	Demo Work	14 days	Thu 6/24/10	Tue 7/13/10
7	Sanitary & Storm lines	23 days	Wed 7/7/10	Fri 8/6/10
8	Excavation & Shoring	38 days	Tue 8/10/10	Thu 9/30/10
9	Ph.1 Concrete Work	54 days	Fri 9/17/10	Wed 12/1/10
10	Steel Structure	15 days	Fri 9/24/10	Thu 10/14/10
11	Exterior Shell	29 days	Fri 9/17/10	Wed 10/27/1
12	Ph.1 Interior Construction	52 days	Wed 10/6/10	Thu 12/16/10
13	Start Ph.2 Construction	0 days	Sun 9/12/10	Sun 9/12/10
14	Ph.2 Caissons	22 days	Sun 9/12/10	Mon 10/11/1
15	Ph.2 Site work	33 days	Sun 9/26/10	Tue 11/9/10
16	Ph.2 Basement Walls	20 days	Sun 11/7/10	Thu 12/2/10
17	Temp. Connector to Ext. Bldg	15 days	Sun 11/28/10	Thu 12/16/10
18	Start of Phase 3 Construction	0 days	Sun 12/19/10	Sun 12/19/10
19	Ph.3 Excavation/Foundations	55 days	Sun 12/19/10	Thu 3/3/11
20	Ph.3 Foundation Walls	39 days	Sun 2/6/11	Wed 3/30/11
21	Steel Erection	61 days	Sun 3/20/11	Fri 6/10/11
22	Pour Interior floor slabs	30 days	Sun 5/8/11	Thu 6/16/11
23	Exterior Enclosure	85 days	Sun 5/1/11	Thu 8/25/11
24	MEP Equipment Installed	45 days	Sun 6/19/11	Thu 8/18/11
25	Windows	62 days	Sun 7/3/11	Mon 9/26/11
26	Roofing	40 days	Sun 8/14/11	Thu 10/6/11
27	Water Tight Building	0 days	Sun 10/9/11	Sun 10/9/11
28	Interior Finishes	125 days	Sun 9/18/11	Thu 3/8/12
29	Occupancy	0 days	Sun 3/11/12	Sun 3/11/12



Project: Tech 3 Accelerated Sched
Date: Mon 11/8/10

Task · Split · Milestone · Summary · Project Summary · External Tasks · External Milestone · Inactive Task · Inactive Milestone · Inactive Summary · Manual Task · Duration-only · Manual Summary Rollup · Manual Summary · Start-only · Finish-only · Deadline · Progress

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VALUE ENGINEERING TOPICS

Through conversations with members of the project team it has be repeatedly mentioned that value engineering was not used extensively on this project. One person mentioned the alternates that the owner had built into the bidding as a possible source for value engineering but unfortunately that is a simple case of cost cutting. The alternates are selected base upon what the owner can afford to purchase while staying within their budget. A few of the more reasonable ideas presented throughout the interviews are represented in the paragraphs below. Also, please understand that cost data was not attainable for any of the mentioned scenarios.

CHANGING OF EXTERIOR WALL PANELS

Since the project has only just begun, there haven't been many value engineering changes. The only one the project team has come up with is changing the exterior wall panels on the ambulance entrance canopy. This change was done to provide the building with more economical and thinner panels. From changing this panels this could improve the building thermal efficiency and could possibly decrease the structural load, which could lead to reducing the structural member size.

RESEQUENCING OF CONSTRUCTION PHASES

The proposed sequence has multiple phases with demolition work overlapping new construction activities throughout the entire project schedule. Phased occupancies are planned for the Emergency entrance, connecting corridor and In-Fill Addition and the Existing Hospital to accommodate Saint Vincent's requirements. This scenario creates potential problems with trade coordination, contractor delays. There will be several contractors switching between renovation, demolishing and new construction work which will make coordination and schedule understanding extremely difficult. Ultimately, the overall project schedule starts with work on the new entrance for the emergency department and ends with the construction of the In-Fill Building, along with temporary construction and demolition in between.

In order to do this there would be an in-depth re-structuring of the project schedule to group similar activities in the temporary corridor and the existing corridor, along with construction in the Infill building. I proposed that they begin construction on the new Emergency Entrance (Phase I) and the temporary corridor (Phase II) simultaneously. This will reduce the total length of the project. It is believed that this re-structuring will reduce the overall schedule and turn-over the project earlier to Saint Vincent. This would allow Saint Vincent to start filling/using the new operating and patient rooms.

PROBLEM IDENTIFICATION

Through the in-depth analysis of the constructability challenges, schedule acceleration scenarios and value engineering topics along with the Project Manager interview, several features were identified as potential problematic areas on the Saint Vincent Health Center project. The following issues may possibly be pursued in upcoming research topics.

PHASE SEQUENCING

The proposed sequence has multiple phases with demolition work overlapping new construction activities throughout the entire project schedule. Phased occupancies are planned for the Emergency entrance, connecting corridor and In-Fill Addition and the Existing Hospital to accommodate Saint Vincent's requirements. This scenario creates potential problems with trade coordination, contractor delays. There will be several contractors switching between renovation, demolishing and new construction work which will make coordination and schedule understanding extremely difficult. Ultimately, the overall project schedule starts with work on the new entrance for the emergency department and ends with the construction of the In-Fill Building, along with temporary construction and demolition in between.

PUBLIC SAFETY

Since this project is located on an active hospital complex, several problems exist with ensuring the safety of the patients/employees while maintaining a productive site. Several measures must be in place to separate hospital and construction activities without sacrificing hospital operations. The fact that the two adjacent structures that the addition will be attached to will be occupied during construction presents a challenge to public safety. Items such as crane swing, emergency egress, vehicular traffic and ED entrance must be considered for all phases of the project schedule.

SITE CONGESTION/CRANE USAGE

The building pad for the In-fill addition is small and situated between existing structures. There is only one access point to the site with minimal space for storage and layout. Having multiple trades working within the pad presents problems with efficiency and safety. This project has space for one crane and requires multiple trades to coordinate usage and rental expenses. Coordinating trades and crane usage is crucial to minimize delays during construction.

WATER-TIGHT MILESTONE

The major milestone for the Saint Vincent Health Center project is meeting the water-tight date. This is identified as a potential problem because it requires all exterior masonry walls, windows, doors and roof to be completed in order to allow for HVAC equipment start-up. Extensive trade coordination is required to install all of the required components, many of which must utilize the same scaffolding system. This milestone is on the critical path and crucial for the overall success of the project.

LEED CERTIFICATION

The LEED Certification process is identified as a problem because the sustainable features of the project are not being pursued to the fullest potential. Whether it is lack of interest, information or time, the owner and project team have not investigated all of the techniques that can make the In-fill addition project sustainably beneficial to Saint Vincent and the environment. This project is ideal to pursue a high level of sustainable features since Saint Vincent will own and operate the facility for many years to come.

IMPLEMENTING BIM

This project didn’t use BIM. The architect is using 3D modeling for architectural purposes such as rendering and for owner approval. If BIM would have been implemented on this project things could have been done to improve productivity and efficiency. Since this project is a “design-build” this could have help out with design coordination. I want to research how things could have went if Saint Vincent addition would have implemented BIM into this project.

TECHNICAL ANALYSIS METHODS

TECHNICAL ANALYSIS METHOD #1: RESEQUENCING OF CONSTRUCTION PHASES

This is a three phase project: Phase I is new Ambulance Entrance Addition, which is currently under construction. Phase II is Temporary connector corridor along the west side of the site so the existing connector can be removed to allow for access to the new building. Phase III is the new inlet building itself. With three phases, a lot of coordination must be done to not fall behind schedule. A critical sequencing issue is not to interrupt flow of hospital operations at ED and movement between the existing hospital and the MOB (Medical Office Building / Hardner Building) to the North.

As described in the previous section, the new emergency ambulance entrance (Phase I) is being constructed now so until it is complete, ambulances and patients will continue to use the existing emergency department entrance off of 24th Street. During Phase II, when Phase I is all complete, all ED traffic (patients and ambulances) will use the new Ambulance Entrance for access to the Emergency Department (ED), down the connector corridor. During Phase III, after the temporary connector on the west side is complete at the end of Phase II, pedestrian ED traffic will use the entrance at the southwest corner of that new temporary connector. Ambulance traffic will continue using the new Ambulance Entrance.

The proposed sequence has multiple phases with demolition work overlapping new construction activities throughout the entire project schedule. Phased occupancies are planned for the Emergency entrance, connecting corridor and In-Fill Addition and the Existing Hospital to accommodate Saint Vincent's requirements. This scenario creates potential problems with trade coordination, contractor delays. There will be several contractors switching between renovation, demolishing and new construction work which will make coordination and schedule understanding extremely difficult. Ultimately, the overall project schedule starts with work on the new entrance for the emergency department and ends with the construction of the In-Fill Building, along with temporary construction and demolition in between.

The analysis will include an in-depth re-structuring of the project schedule to group similar activities in the temporary corridor and the existing corridor, along with construction in the Infill building. I proposed that they begin construction on the new Emergency Entrance (Phase I) and the temporary corridor (Phase II) simultaneously. This will reduce the total length of the project. It is believed that this re-structuring will reduce the overall schedule and turn-over the project earlier to Saint Vincent.

To perform this analysis, research will need to be performed on resource of workers and material layout availability to ensure that all construction work can be completed simultaneously. Close consideration will be taken to ensure that all Saint Vincent's functions are not inconvenienced. If a reduction in overall schedule is determined, the savings in general conditions and management fees will be calculated to further prove the benefit to the owner. Also with a reduced schedule will allow the new Hospital addition to open up earlier, which creates more patient and operating rooms which can open up more jobs and create larger profits weeks before originally expected.

TECHNICAL ANALYSIS METHOD #2: BIM

The use of the 3D model is an analysis that I would like to pursue further. Since the model was only used for design purposes it would be interesting to learn what results can be obtained by using a model for clash detection and also using it to create a 4D sequencing model. This has the potential to yield results that would help the project team with future installations. Also, the use of the 4D sequencing could provide results that would have better prepared the team for the installation of the concrete wall that has caused to building to be constructed in two parts.

This analysis would require research into best practices for creating a set of models that can be easily utilized for coordination and scheduling purposes. I also want to look into the possibilities of using the model for prefabrication purposes. I heard of projects using prefabbed MEP ceiling plans in hallways, and prefabbed restrooms. This may also work in prefabbing some of the patient and operating rooms. A possible source of information will be the recently developed BIM Execution plan that was created by the CIC research group here at Penn State. My research could be focused on developing a project specific BIM Execution plan for use on the Saint Vincent Health Center new addition.

TECHNICAL ANALYSIS METHOD #3: ELIMINATION OF SITE CONGESTION

Site congestion is a major concern identified on this project. This issue has impacted several trades and caused delays in excavation, geo-pier installation and masonry work. The lack of material storage and lay-down space has caused contractors to work inefficiently and unsafely. More than once, a trade had to demobilize until the site cleared up to allow for productive work.

This analysis will include careful considerations of activity durations and sequences to determine the most efficient progression of work. Several activities on the original project schedule had unrealistic durations and overlaps that made it impossible for the contractor to meet expectations. These problem areas will be identified and techniques will be suggested to eliminate the issues and ensure a logical schedule.

Another analysis will be to explore pre-fabricated systems that may be applicable on the Centennial Gymnasium project to reduce the amount of on-site material storage and labor durations. One system that will be analyzed is precast brick panels. This trade was chosen due to the extensive amount of onsite labor required for the masonry operations. The project has already experienced delays due to this trade. Areas that will need to be researched include production capabilities, erection sequences and durations, quality control issues with interfaces and aesthetic requirements of the Architect and EHS. Also, the availability of the crane will need to be considered to ensure that the panels will be able to be erected efficiently. This analysis can provide the opportunity for a structural breadth study to determine the required connection and loading details for the panels and impacts they will have on the superstructure. It is believed that this technique will reduce the amount of site congestion and eliminate the encountered delays between different trades.

TECHNICAL ANALYSIS METHOD #4: MEP Coordination

Hospitals typically have a lot of coordination that is need between the MEP trades. I want to improve the coordination and reduce the delay time with the MEP work that will be done on this project. There will be two parts to my research. First, how could the process used been improved to return better results. Second, are there any new types of MEP coordination processes that might have worked for this project. Using Building Information Modeling (BIM) for MEP coordination and clash detection could be a possible tool to improve the results of coordination. I will look at the costs, schedule, potential results, and the ability of the project team to decide how the MEP coordination process could have been conducted more efficiently.

TECHNICAL ANALYSIS METHOD #5: SUSTAINABLE TECHNIQUES

The Saint Vincent Health Center project is slated to achieve LEED Certification upon completion. However, the project has utilized very few sustainable techniques that could provide a financial benefit to Hospital. Features such as photovoltaic roof panels could be identified as possibilities in the initial design phases of the project, but could be eliminated from scope due to financial restrictions. This analysis will include an in-depth investigation into the financial feasibility of installing a PV array on either the existing Hardner building roof or the new In-Fill building addition. Research will be performed to determine the optimal array layout and equipment size. Also, a life-cycle feasibility study will be performed to allocate for grants and incentives that may make the use of the PV technologies financially attractive for Saint Vincent.

Solar shades are another way to reduce the heat entering the building from direct sunlight. With windows all around the buildings, heat can be gained all day long and it will cause discomfort to the tenants of the buildings. This will also dive the energy bill up since more cooling is needed to keep the indoor area at the desired temperature.

This method will require calculating the amount of heat that could be gained from the direct sunlight all year long. Researching the sun angles at all directions of the buildings should be done to accurately know where solar shades are required and most effective.

TECHNICAL ANALYSIS METHOD #6: SIMPLIFYING THE FAÇADE

The façade is currently a combination of many different materials including brick, stone, a curtain wall, and metal panels: white and stainless steel. The details for all of these connections are very time consuming and difficult to comprehends. Simplifying the materials to more consistent materials would allow for less details and more consistency allowing the construction to run more smoothly. The materials would need to be researched to see if there are alternatives that have easier connections. The materials also need to have similar properties to perform the same. I would need to contact manufacturers to understand the properties and connections of the different materials. After that is understood, I would analyze the pros and cons along with the cost of each and make a decision as to whether it would be a viable option. It would also be possible to use BIM technology to assist in a number of ways including the visual aspects using a virtual mockup, the cost of the changes using quantity takeoff and the schedule implications using 4D modeling.

TECHNICAL ANALYSIS METHOD #7: INTERIOR WALL PREFABRICATION

The interior wall system can take a very long time to construct and could delay the project. One way to prevent that would be to prefabricate the walls to shorten the duration of the task to speed up the schedule. The walls are typically metal studs with drywall and some conduit for the electrical and controls systems. Because the walls are similar throughout the entire building it would be easy to prefabricate due to the repetitiveness and simplicity of the walls.

The process of the prefabrication would need to be studied and analyzed for the prefabrication and installation on site as well as the process for onsite construction. Once the processes have been studied a list of pros and cons would need to be developed. The cost would need to be analyzed and compared to the original costs. One thing to keep in mind with prefabricating the walls would be shipping the pieces to the site and how to move them once they are in the building. Will they be light enough to move by manpower or will machinery be required to move them. Additional planning will also be required to ensure that the prefabrication is successful.

TECHNICAL ANALYSIS METHOD #8: SAFETY / MATERIAL DELIVERY

Safety is one of the biggest concerns of any job. No one wants any of the workers or the public getting hurt or possibly losing their lives. Material delivery and unloading can be one of the most dangerous activities on a job site since it includes trucks and material which are outside the construction site perimeter, and cranes which are moving over the heads of many lives carrying tons of material.

I could research what are the best ways to increase the safety standards, and how to do so without affecting the project schedule of changing the cost. Some of the ideas to achieve that are by increasing the manpower at certain times when there is less public traffic, or using different locations of delivery and unloading.

TECHNICAL ANALYSIS METHOD #9: CHANGING OF EXTERIOR WALL PANELS

The only change the project team has come up with is changing the exterior wall panels on the ambulance entrance canopy. This change was done to provide the building with more economical and thinner panels. The Saint Vincent project had multiple types of exterior facades that are being used in these new additions. Some to match the existing Hardner Building and others are a new look that breaks up the brick look. There are multiple materials used for the façade which are comprised of most brick, some exterior panels and sheet metal panels.

I could research different materials that would be more economical with thermal resistant. I could also possible use this as one of my possible Breadth topics. I would look into the structural implications because of the switch in façade weight. With lighter more economical efficient panels this could improve the thermal loads, possibly decrease the structural members, and possibly increase workers efficiency if these panels are used throughout the building. Instead of having 3 different types of façade which creates complications in the connecting of these systems, having one common façade for the whole building would improve workers efficiency and decrease the scheduled work time thus leading to money saved.