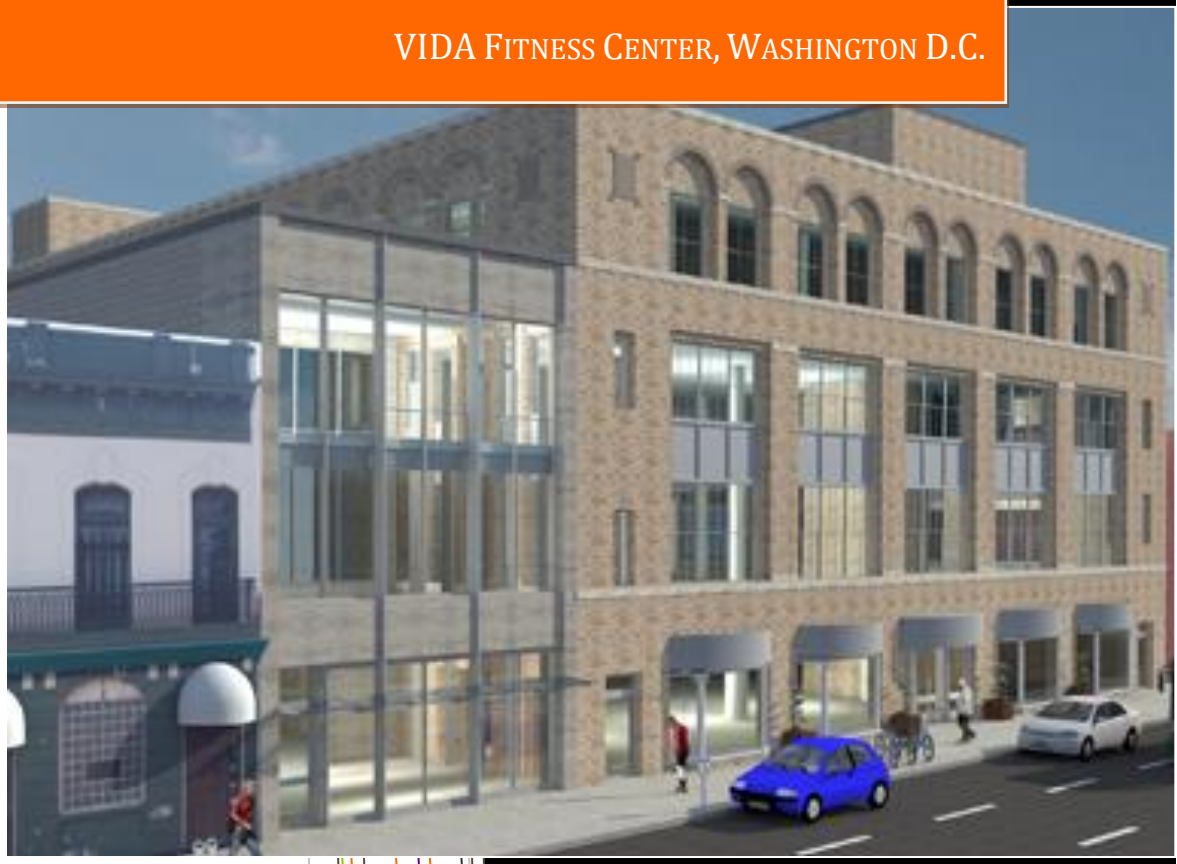
2011

FINAL PROPOSAL

VIDA FITNESS CENTER, WASHINGTON D.C.



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Construction Option
Faculty Advisor: Dr. Leicht
12/9/2011

VIDA™ FITNESS

EXECUTIVE SUMMARY:

The following proposal is a comprehensive report detailing the proposed four topics for which technical analyses will be performed on the VIDA Fitness Center. Owned by David von Storch of Urban Adventures, this VIDA will be the largest of his fitness centers and will serve as the new flagship location on 1612 U Street. This building will also include a new high end restaurant, Aura Spa, Bang Salon, and office space for his company, Urban Adventures. The 60,370 square foot project includes a 10,920 square foot, three-story addition and the renovation of an existing 49,450 square foot building.

The first technical analysis in this report includes an electrical breadth and proposes the introduction of a ReRev energy harvesting system that captures the DC energy generated from cardio equipment and converts it to AC power. This system is specified for fitness centers alone and affords a unique and trendy approach to commercial sustainability application. Applying this system with the cardio equipment could provide potential energy and long-term cost savings for VIDA, along with a "green" feature that would promote a positive, sustainable image to the public which would, in turn, increase the value for the Owner.

The second technical analysis investigates the effects of scheduled overtime use during the construction of VIDA. Research has proven that this extended use of overtime can negatively affect worker productivity and quality on a project. Investigations on this topic will be conducted in order to properly analyze whether it is possible that the overtime costs, decreased quality, and efficiency losses of working overtime outweighed the costs of working a traditional, 40-hour week.

The third analysis discusses Job Order Contracting (JOC) and how it can be applied in a unique manner to the VIDA project by studying the benefits associated with Forrester Construction holding a Job Order Contract with a steel subcontractor. With this idea in mind, procurement and delivery times could be decreased, substantial cost savings could be reaped for both the steel subcontractor and Forrester, and quality could be increased, all of which support improved efficiency and value.

The fourth and final analysis, which includes a mechanical breadth, proposes relocating the two exterior duct lines and redesigning the ductwork on each floor for a more efficient layout. Moving the main supply and exhaust lines from the exterior of the building could alleviate several constructability issues associated with them and could also provide the opportunity for the redesigned layouts to increase constructability and decrease both material and labor costs. Because of the variables associated with a layout change, a metrics measuring chart will be developed for each ductwork redesign and can be implemented to determine the optimum ductwork layout that will provide the best value to the Owner.

Each of the four possible areas that have been analyzed could prove to be either feasible or unpractical with their engagement on the project. The results obtained are expected to provide potential solutions to some of the construction problems at VIDA and are intended generally to improve the overall quality and value for the Owner, as his high reputation and company branding demand both.

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PROJECT BACKGROUND:

Owner David von Storch is launching his new flagship building at 1612 U Street which will include the largest of his VIDA Fitness Centers, along with a new high end restaurant, Aura Spa, Bang Salon, and office space for his company, Urban Adventures. The 60,370 square foot project includes a 10,920 square foot, three-story addition and the renovation of an existing 49,450 square foot building.

Figure 1: Cardio Area, Photo Courtesy of VIDA Fitness

Originally a parking garage, the architect utilized the building's existing structure as architecture, allowing for exposed concrete columns, ductwork, beams, and exiting brick walls (see Figure 1). The monumental stairwell in the center of the gym is a signature statement to all VIDA Fitness Centers: an exposed steel stairwell that disconnects at every floor and raises five floors to the roof penthouse. This industrial feeling, coupled with over 15,000 square feet of glazing, promotes a bright, exposed, and spacious area in which to work out.

Figure 2: Cardio Area, Photo Courtesy of VIDA Fitness

Each floor of the Fitness Center was designed so as to promote a differing function or workout focus. The first floor will eventually house the future restaurant and spa, both of which are planned for completion in summer 2012. It also houses the gym's main entrance, along with a Fuel Bar and salon. The second floor houses the main cardio workout area (shown in Figure 2), along with sales offices, endless pools (swimmers' treadmills), saunas, tanning facilities, a steam room, and luxurious locker room facilities. The third floor of the facility encompasses the equipment area, personal training desks, and the Group Fitness studio, where many fitness classes are held. The fourth floor of the facility holds the Inner Fitness studio and Pilates studio, but is most notable for its access onto the lower roof, which will house a sun deck and bar area. The main roof of the building is accessed through the fifth floor penthouse and contains a pool, bar, fire pits, and cabanas for all guests (see Figure 3).

Figure 3: Roof Bar, Rendering Courtesy of SvS

Located in the center of D.C., the constraints of a restricted site and tight schedule coupled with unforeseen hurdles that come with renovating a 100+ year old building created a unique and challenging project for Forrester Construction. This gym is located on the U Street Corridor, an area that not only houses

many residential row houses, but also various nightclubs, restaurants, bars, shops, galleries, and music venues. Because the majority of the area was developed between 1862 and 1900 and most of the architecture is considered Victorian, it has been designated as part of the historic district (Ault). It is for this reason that the project architect had strict guidelines both for designing the exterior façade of the new building addition and for renovating the existing building façade. The original existing building is shown in Figure 4 below.

Figure 4: Original Existing Building, Photo Taken by Luis Ortiz

In addition, the expansion began construction while the building was still occupied, as the existing Results Gym remained open and still had an active lease. When the gym closed and construction consumed the entire facility, parts of the building opened in phases. Bang Salon was first to open, followed by two separate phases of the VIDA Fitness Center, with plans for the restaurant and spa to open in May 2012.

TECHNICAL ANALYSIS 1: APPLICATION OF REREV ENERGY HARVESTING SYSTEM

The electrical breadth associated with this technical analysis can be found in Appendix A.

Problem Identification

No specific sustainable practices or technologies were incorporated into the VIDA Project, due mainly to the fact that it was not a priority of the Owner. However, with the large consumption of electricity from the building, great potential exists to incorporate sustainability to decrease monthly utility bills. Over 100 pieces of cardio fitness equipment and two endless pools (swimmers' treadmills) contribute to the massive electricity use at the VIDA Fitness Center. With this immense amount of energy use, introducing a sustainability feature that could potentially result in a net decrease in electricity usage could provide substantial long-term cost benefits to an Owner with intentions of remaining in the downtown U Street location indefinitely.

Research Objectives

Various ways exist in which green practices can be integrated into a project this size, many of which would not only decrease electricity usages but could also aid in promoting a positive public image of the Fitness Center as an environmentally friendly building. A ReRev energy harvesting system captures the DC kinetic energy generated from cardio equipment and converts it to AC power. This system is specified for fitness centers alone and affords a unique and trendy approach to commercial sustainability application. Implementing this system with the cardio equipment could provide potential energy and long-term cost savings for VIDA, along with a "green" feature that would promote a positive, sustainable image to the public.

In order to properly analyze the employment of a ReRev system at VIDA, several key aspects must be thoroughly researched and considered. The initial equipment and installation cost must be measured against the payback period in a lifecycle cost analysis to evaluate the feasibility of installation. The VIDA General Manager can be interviewed not only to receive feedback on his opinion of implementing an energy harvesting system, but also to obtain information on the electricity usage and costs for VIDA.

Case studies for other similar fitness centers will be studied for feedback on the ReRev system along with the general public opinion before and after ReRev integration. The installation process for the ReRev system will be examined in conjunction with how best to incorporate the system to maximize its use; this evaluation will introduce an electrical breadth that will be needed for a partial system redesign with integration of the ReRev system.

Application Methodology

To properly analyze the employment of a ReRev energy harvesting system, the following steps will be taken:

- Additional research on ReRev systems and application with similar projects will be performed.
- The VIDA Fitness General Manager will be interviewed to provide further feedback on public opinions, feasibility, and related electricity use and cost information.
- The ReRev manufacturing company will be contacted to access detailed cost and energy generation numbers associated with the system.
- The ReRev system will be designed according to the project size and energy consumption.
- An electrical breadth analysis will be performed for a partial electrical system redesign due to the addition of the ReRev system (see Appendix A).
- A project implementation strategy will be researched to identify areas both before and after construction that will be affected by the addition of the ReRev system; once these areas are determined, the most beneficial approach for applying ReRev will be selected and explored.
- Varying project impacts due to the introduction of the ReRev system will be investigated.
- An overall return on investment and lifecycle cost analysis will be performed through the utilization of data collected from previous steps.
- Lastly, an overall feasibility analysis will be developed considering the lifecycle cost, return on investment, and electricity generation of the ReRev system against the Owner's likes and opinions.

Resources and Tools for Utilization

In order to develop a thorough and comprehensive analysis, the following resources will be utilized:

- VIDA Fitness General Manager and other VIDA employees
- Forrester Construction project team – Superintendent, Project Manager, and Assistant Project Manager
- ReRev Company manufacturers
- Penn State Architectural Engineering Faculty – Construction Management and Lighting/Electrical
- Interiors Architect - Stoneking von Storch
- MEP Engineer - Allen & Shariff Corporation
- Project Drawings
- Researched applicable literature

Potential Solutions

The expense of the system when compared with energy savings is one of the critical determinants to the success of utilizing the ReRev system at the VIDA facility. There are three main conceivable solutions to the technical analysis detailed above:

- The ReRev system will be used on every piece of cardio equipment at VIDA Fitness.

- Due to the cost and payback, only a portion of the cardio equipment will be used with a ReRev system.
- The ReRev system will not prove to be cost effective and the system will be deemed unfeasible.

Preliminary Analysis

Because of the initial expense of the ReRev system and challenges associated with other unknown variables, a cursory study on the feasibility of this technical analysis was performed. According to a USA Today article written on the ReRev system, the average cost to introduce ReRev per piece of cardio equipment is approximately $1,000 (Kioh). With roughly 100 pieces of cardio equipment, the overall cost of the system would be around $100,000.

The ReRev manufacturers claim a thirty minute workout can generate approximately 50 watts of power (ReRev). If each piece of cardio equipment were used for approximately 10 hours a day, nearly one kilowatt of electricity per machine would be generated. According to ReRev manufacturers, this could provide a potential payback period of 15 years (Parks). Though these numbers are estimates, they ensure at least partial feasibility for the employment of ReRev and lay the groundwork for a more detailed and technical study.

Expected Outcome

Though it will not be viable for the energy produced from the ReRev systems to cover all of the Fitness Center's electricity loads, it is reasonable to assume that the initial system cost will not outweigh the benefits associated with the ReRev utilization; this assumes that enough AC power will be generated to cover the cost of the equipment in a reasonable amount of time and eventually save the Owner in electrical utility costs. Due to the large number of cardio equipment machines, it is expected that the results of the technical analysis will provide a unique and attractive sustainable solution for decreasing electricity bills, promoting a positive public image, and increasing value for the Owner.

Critical Industry Issue

This analysis was chosen as the critical industry issue analysis because sustainability plays such a key role in today's AEC industry and because of the strong personal interest in the topic as a whole. Many owners are reluctant to pursue sustainability or LEED certification, either because they simply do not care or because they feel it is too expensive. What are generally overlooked are the long-term maintenance costs that come with buildings that are not designed to be sustainable. When a sustainable building is designed and built, the efficiency with which the building and its site use and harvest energy, water, and materials is increased. Building impacts on human health and the environment are reduced through better design, construction, operation, and maintenance (Green Buildings). Going "green" through energy-efficient construction results in lower energy consumption and decreased utility bills, both of which will be examined with the use of the ReRev system on the VIDA project.

TECHNICAL ANALYSIS 2: STUDY OF SCHEDULED OVERTIME EFFECTS ON WORKER PRODUCTIVITY AND QUALITY

Problem Identification

Schedule was an extremely critical factor on this project because it was the Owner's personal goal for groundbreaking on the new addition in August, 2010, followed by the opening of the entirely renovated gym along with the three-story addition in March, 2011. Though construction on the new addition began according to schedule and continued while the existing Results Gym remained open, the renovation of the entire existing 50,000 square foot building (and accessible roof) was left to be completed, along with the finish work of the new addition, in a mere three months. For every week that VIDA Fitness did not open on time, the company lost approximately $100,000, a fact that made it critical for the fitness center to open on time and according to the project's schedule. The extremely tight project schedule was made even more stressful when unforeseen structural conditions delayed the project. Keeping on schedule was further hindered when the installation of the monumental stairwell took more than twice as long as originally scheduled.

Due to the fact that the initially tight schedule was delayed early in the construction process, Forrester Construction began paying subcontractors to work six-day work weeks of 12-hour days. The crew productivity levels of trades working these extreme hours began to drastically decrease towards the end of the summer. The general opinion was that of frustration, exhaustion, and burn-out from working such long hours on the same project. It became difficult to motivate workers and keep them on schedule late in the project.

Research Objectives

Morale can often be key to a project's success, which is why this negative attitude towards the project could have adversely affected productivity and workmanship quality levels. It is possible that there was a point in the VIDA project when the additional overtime labor costs coupled with quality and productivity losses became more expensive than working a typical, 40-hour work week.

Scheduled overtime is traditionally utilized in construction to accelerate the project schedule, either to make up lost time on a delayed project or simply to ensure a project with an extremely constricted timeframe does not fall behind schedule. In the case of the VIDA project, scheduled overtime was used to combat both of these reasons. Research has proven that this extended use of overtime can negatively affect worker productivity and quality on a project. Investigations on this topic will be conducted in order to properly analyze whether it is possible that the overtime costs, decreased quality, and efficiency losses of working overtime outweighed the costs of working a traditional, 40-hour week.

These issues are extremely difficult to research, as it is challenging to gauge productivity or quality levels and how they are adversely linked to overtime on a project. Dr. Randolph Thomas, a Penn State researcher, thoroughly investigated this idea with the aid of numerous performed case studies. His research and publications provide data to consider and adjust for applicability on the

VIDA Fitness project. Information including average worker wages, overtime hours worked per subcontractor, and crew sizes can all be obtained through interviews with each of the major trade foremen on the project or from quantities found in monthly payment applications. Differences in initial and actual schedules can be determined by comparing the original project schedule to the actual construction schedule, provided by Forrester Construction.

Application Methodology

To properly investigate the effects of scheduled overtime work on the VIDA project, the following steps will be taken:

- Additional research on overtime effects will be conducted, with specific focus on Dr. Thomas' research.
- All major trade foremen will be interviewed and asked to provide average worker wages, overtime hours worked, and average crew sizes for the project.
- The applicability of the gathered research for the VIDA project will then be examined, along with the project specific impacts associated with the overtime work.
- A cost analysis will be performed to compare the costs of overtime labor, decreased quality, and loss of efficiency with the typical cost of working a 40-hour week.
- The project work schedule will then be revised to reflect these results.
- Lastly, an overall feasibility analysis will be developed evaluating the cost analysis and revised work schedule with the positive and negative implementation effects of each.

Resources and Tools for Utilization

In order to develop a thorough and comprehensive analysis, the following resources will be explored:

- Major trade foremen on the VIDA project
- Forrester Construction project team – Superintendent, Project Manager, and Assistant Project Manager
- Dr. Thomas – Penn State Researcher
- Penn State Architectural Engineering Faculty – Construction Management
- Thomas Horensky – Barton Mallow Assistant Superintendent
- Project Drawings
- Researched applicable literature

Potential Solutions

Only two major outcomes can result from the examination of scheduled overtime effects on VIDA: either the negative effects on quality, efficiency, and labor costs outweighed the costs of a traditional 40-hour week, or they did not. The first case would require the work schedule to be modified whereas the second would simply emphasize the fact that the scheduled overtime was worth the increased labor costs because of its acceleration of the project schedule.

Preliminary Analysis

Because the calculations associated with this technical analysis require significant time and research, a preliminary analysis was performed by researching common effects of scheduled overtime and identifying which effects could be considered specifically for the VIDA project. A Penn State AE Construction Management alum, Thomas Horensky, was also interviewed because of his experience with this topic on his own thesis project. He encouraged the idea by providing research guidance and stating how diminishing marginal returns on working continuous overtime is one of the most overlooked issues within schedule acceleration.

Expected Outcome

Upon completion of the research, calculations, and analyses detailed above, it is expected that a point in time during project construction will be identified when the additional overtime labor costs combined with worker efficiency and productivity losses becomes more expensive than working a typical, 40-hour work week. The adjusted work schedule developed from this point could provide an opportunity to not only save the Owner on indirect labor costs, but also increase efficiency and quality, both of which will increase the overall value of the finished product.

TECHNICAL ANALYSIS 3: IMPLEMENTATION OF JOB ORDER CONTRACTING

The MAE breadth associated with this technical analysis can be found in Appendix A.

Problem Identification

The monumental stairwell in the center of the gym is a signature statement of all VIDA Fitness Centers: an exposed steel stairwell that disconnects at every floor and raises five floors to the roof penthouse. The uniqueness associated with a custom designed stairwell with no standard sections created several challenges associated with constructability and schedule.

Because the stairwell differed in both shape and access points at each floor, the sizes and shapes of the slab cuts needed for its installation varied per floor. Saw cutting these openings for the stairwell took two and a half times longer than what was originally estimated by the subcontractor. Prefabricating the stairwell in sections saved installation time, but though the schedule was well planned and the process was thoroughly sequenced, this too took more than twice as long as originally estimated by the steel subcontractor. This subcontractor guaranteed finish dates that were never met and made little effort to gain back any lost time on the project schedule. The opening of the first phase of VIDA depended upon the completion of this stairwell, which made it a critical challenge throughout the first phase of the project.

Research Objectives

Instead of the traditional Design-Bid-Build process, Job Order Contracting (JOC) could be developed with a pre-qualified steel subcontractor to prevent the selection of inadequate subcontractors for VIDA projects. JOC is typically employed on smaller projects and permits an owner to achieve multiple smaller contracts under the umbrella of one large, competitively bid contract (Pulaski). Though this umbrella contract is typically held between the owner and contractor, a unique analysis could be performed to examine the benefits of Forrester Construction holding a Job Order Contract with a subcontractor on the VIDA project. This could be especially beneficial due to the fact that David von Storch, the Owner of VIDA, consistently uses Forrester for construction of all of his VIDA Fitness Centers, all of which possess the signature monumental stairwell and combine similar features and finishes. It would also allow for the subcontractor to be pre-qualified, a step that could later improve the quality and timeliness of the constructed stairwells.

Though JOC with any of the trades usually employed on VIDA projects could prove advantageous, it would be most valuable to focus on the steel subcontractor, as the monumental steel stairwell is typically a critical schedule issue and proved to be such a challenge for this particular VIDA project. With this idea in mind, procurement and delivery times could be decreased, substantial cost savings could be reaped for both the steel subcontractor and Forrester, and quality could be increased, all of which support improved efficiency and value.

Incorporating JOC in this unique manner will involve a process of gathering information and applying it in a specific way. After substantial research has been done on the topic, interviews will be conducted with the Project Superintendent and Project Manager to discuss the variables in preconstruction that would affect JOC use.

Application Methodology

To properly explore the effects of implementing JOC, the following steps will be taken:

- Research will be collected on implementation strategies along with positive and negative attributes associated with JOC.
- Additional research on other projects with this Owner will be compiled and considered.
- The Superintendent and Project Manager will be interviewed to provide insight on the variables that would need to be examined with JOC employment.
- The application strategies for the VIDA project (and other projects with this Owner) will then be examined, along with the project specific impacts.
- A cost analysis will be performed to determine savings in the preconstruction and construction project phases.
- The project schedule will be revised to determine changed durations.
- Lastly, an overall feasibility analysis will be developed evaluating all results.

Resources and Tools for Utilization

In order to develop a thorough and comprehensive analysis, the following resources will be exploited:

- Forrester Construction project team – Superintendent, Project Manager, and Assistant Project Manager
- Project Drawings
- Penn State Architectural Engineering Faculty – Construction Management
- AE570: Production Management in Construction
- Researched applicable literature

Potential Solutions

Solutions associated with this technical analysis are simple: JOC could provide Forrester with a cost savings and an overall strategic advantage associated with contracting a superior sub, or it could provide no benefit and prove to be an ineffective method for Forrester as a General Contractor.

Preliminary Analysis

Because there are no simple methods to determining the preliminary feasibility of this analysis (especially with this unique application), the idea was thoroughly discussed in-depth with Dr. Robert Leicht, Assistant Professor in Penn State's Architectural Engineering Department, who encouraged the idea because of the learning opportunities associated with the analysis.

Expected Outcome

After the above research has been concluded and project impacts have been examined, it is expected that there will be a substantial cost savings for Forrester Construction and that the procurement and preconstruction phase of the project will be drastically reduced. Though the cost savings for implementing JOC on this particular project may be minimal, the costs and benefits will likely compound with use on multiple projects. This, along with the fact that quality will be increased because of a superior pre-qualified subcontractor, will increase the overall value to the Owner.

TECHNICAL ANALYSIS 4: MECHANICAL SYSTEM LAYOUT CONSTRUCTABILITY AND VALUE EXAMINATION

The mechanical breadth associated with this technical analysis can be found in Appendix A.

Problem Identification

The process of getting the HVAC and mechanical system functional to allow the gym to open in the hot summer months also proved to be a problem on the VIDA project. The extremely congested site caused many trades to work in close quarters, a situation made more difficult by the confusing and congested duct layouts that caused the mechanical subcontractors to constantly move from one location to another.

To compound this, the main supply and exhaust ducts were run up the back exterior of the building. This was done to save floor space inside the gym, but merely created an eyesore and a schedule delay due to the large penetrations that had to be made through the exterior brick wall and the fact that the alley was constantly blocked by a lift required to complete the ductwork installation.

Research Objectives

Redesigning the ductwork on each floor and/or moving the exterior supply and exhaust ducts could potentially introduce several benefits. If the two exterior ducts were moved to an area inside the building, not only would this eliminate the issues associated with them being outside but it would also provide an opportunity to redesign the interior ductwork, which could open potentials for increasing constructability and decreasing material and labor costs. Moving the exterior ductwork would also eliminate the need for penetrations to be cut through the brick façade.

Moving the two exterior ducts and redesigning the layout could potentially serve as a mechanical breadth, with the constructability, schedule, and cost analyses associated with this redesign acting as the depth analysis. Because of the Owner's strict aesthetic requirements and because of the other variables associated with a layout change, a metrics measuring chart will be developed for each ductwork redesign. This chart will include categories such as aesthetics, layout, material use, schedule, cost, and constructability and will be used to evaluate each layout (including the existing one) on a 1-5 scale. The charts can then be compared to determine the best possible ductwork layout that will provide the best value to the Owner.

Application Methodology

To ensure each redesign is thoroughly evaluated, the following steps will be taken:

- Research and interviews will first take place on the variables associated with ductwork installation and constructability.
- The mechanical breadth analysis of moving the exterior duct lines and redesigning the interior layout will be developed (see Appendix A).
- The cost and schedule changes will then be determined for each layout redesign.

- Metric Measuring Charts will be created for each system along with an Integral Systems chart.
- The redesign with the highest Chart rankings will be chosen.
- Lastly, a feasibility analysis will be performed on the chosen layout redesign.

Resources and Tools for Utilization

In order to develop a thorough and comprehensive analysis, the following resources will be exploited:

- Forrester Construction project team – Superintendent, Project Manager, and Assistant Project Manager
- Penn State Architectural Engineering Faculty – Construction Management
- MEP Engineer - Allen & Shariff Corporation
- Project Drawings
- Researched applicable literature

Potential Solutions

Several ductwork redesigns may possibly be associated with moving the exterior exhaust and supply ducts inside the building, each of which will rank differently on the Metric Measuring Chart. Either one of these redesigns will rank higher on the Chart than the original ductwork design indicating a better option, or none of them will, proving the original system layout is a superior option.

Preliminary Analysis

Because there are no simple methods to determining the preliminary feasibility of this analysis, the idea was thoroughly discussed with Dr. Robert Leicht, Assistant Professor in Penn State's Architectural Engineering Department, who encouraged the idea because of the learning opportunities associated with the breakdown.

Expected Outcome

Though it is difficult to forecast the results associated with a ductwork redesign, it is reasonable to assume that there is a viable layout solution that will prove to be overall more effective than that of the original ductwork design. This layout will potentially save the Owner money, improve constructability and efficiency, and thus, increase the overall value to the Owner.

PROJECTED WEIGHT MATRIX AND TIMETABLE:

Analysis Weight Matrix

The weight matrix shown in Table 1 below depicts how effort will be distributed in the spring semester among the four different proposed analyses. The four core areas of investigation within these analyses are also addressed in the table below.

Table 1: Weight Matrix for Analyses and Core Investigation Areas

Description	Research	Value Engineering	Constructability Review	Schedule Reduction	Total
Application of ReRev Energy Harvesting Systems	10%	10%			20%
Study of Scheduled Overtime Effects on Worker Productivity and Quality	5%	5%		15%	25%
Implementation of Job Order Contracting	10%	10%		5%	25%
Mechanical System Layout Constructability and Value Examination			15%	15%	30%
TOTAL	25%	25%	15%	35%	100%

Timetable

Because of the significant research and effort required to complete these four proposed analyses, a timetable was developed to ensure all areas are completed in a timely manner. This schedule for the analyses is included in Appendix B.

PROJECTED CONCLUSIONS:

The four analyses previously discussed will provide the opportunity to investigate current industry topics and unique issues associated with improving certain areas of the VIDA Fitness Project. By implementing a ReRev system, it is reasonable to assume that enough AC power will be generated to cover the cost of the equipment in a reasonable amount of time and will, eventually, save the Owner in electrical utility costs. By examining the effects of scheduled overtime, it is expected that a point in time during project construction will be identified when the additional overtime labor costs combined with worker efficiency and productivity losses becomes more expensive than working a typical, 40-hour work week. It is also anticipated that implementing Job Order Contracting will decrease the length of procurement and preconstruction, increase overall quality, and provide a substantial cost savings for Forrester Construction. Finally, it is likely that there is a viable ductwork layout solution that will prove to be overall more effective than that of the original ductwork design. All of these areas will be examined with the ultimate goal of providing increased overall quality to the project Owner.

RESOURCES:

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Parks, Bob. "High-Voltage Workouts." *Bicycling Magazine* Nov. 2009. Web. 4 Dec. 2011.

Pulaski, Michael. *Job Order Contracting (JOC)*. Tech. Print.

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"Vida Fitness -- VIDA FITNESS OPENS ON U STREET." *Vida Fitness Washington DC Gym, Yoga & Personal Trainers - A Revolutionary Washington DC Gym!* Web. 06 Dec. 2011. <http://www.vidafitness.com/news/ustreet/open.html>.

APPENDIX A

BREADTH TOPICS AND MAE REQUIREMENTS

BREADTH TOPICS AND MAE REQUIREMENTS:

The first two of the following focuses involve demonstration breadths that contain a more detailed analysis of option areas outside of construction management: electrical and mechanical. The third breadth discusses how the advanced level coursework from the Master of Architectural Engineering (MAE) classes will be applicable. Each of these three breadths contributes to a technical analysis previously discussed.

Electrical Breadth

Technical Analysis 1 studies the integration of a ReRev energy harvesting system that will convert the DC energy produced by cardio equipment use to AC power that can be used to offset the electricity usage costs at VIDA. This electrical breadth examines the changes that must be made to the existing electrical system with the addition of the ReRev system.

The electrical system on VIDA ties into the grid from the existing connection, a 208/120, 3-phase, 4 wire, 1600 amp feed supplied by Pepco. The electrical system at VIDA will be studied to determine a connection location for the ReRev system and other electrical equipment and connection requirements. A constructability and feasibility review will additionally be performed to not only ensure that the existing system is properly suited for the ReRev system, but also to guarantee the changes made in the system are feasible for this particular construction project.

Mechanical Breadth

Redesigning the ductwork on each floor and/or moving the exterior supply and exhaust ducts could potentially introduce several benefits, as discussed in the fourth technical analysis. Moving the main supply and exhaust lines from the exterior of the building could alleviate several constructability issues associated with them and could also provide the opportunity to propose redesigned ductwork layouts for the interior of the building. These redesigned ductwork layouts will serve as the mechanical breadth for this analysis, and will require duct resizing and CFM calculations for a proper and effective redesign. Lastly, a constructability review will be performed to consider the practicality of the redesigned layouts and whether they are realistic options for the existing mechanical system.

MAE Breadth

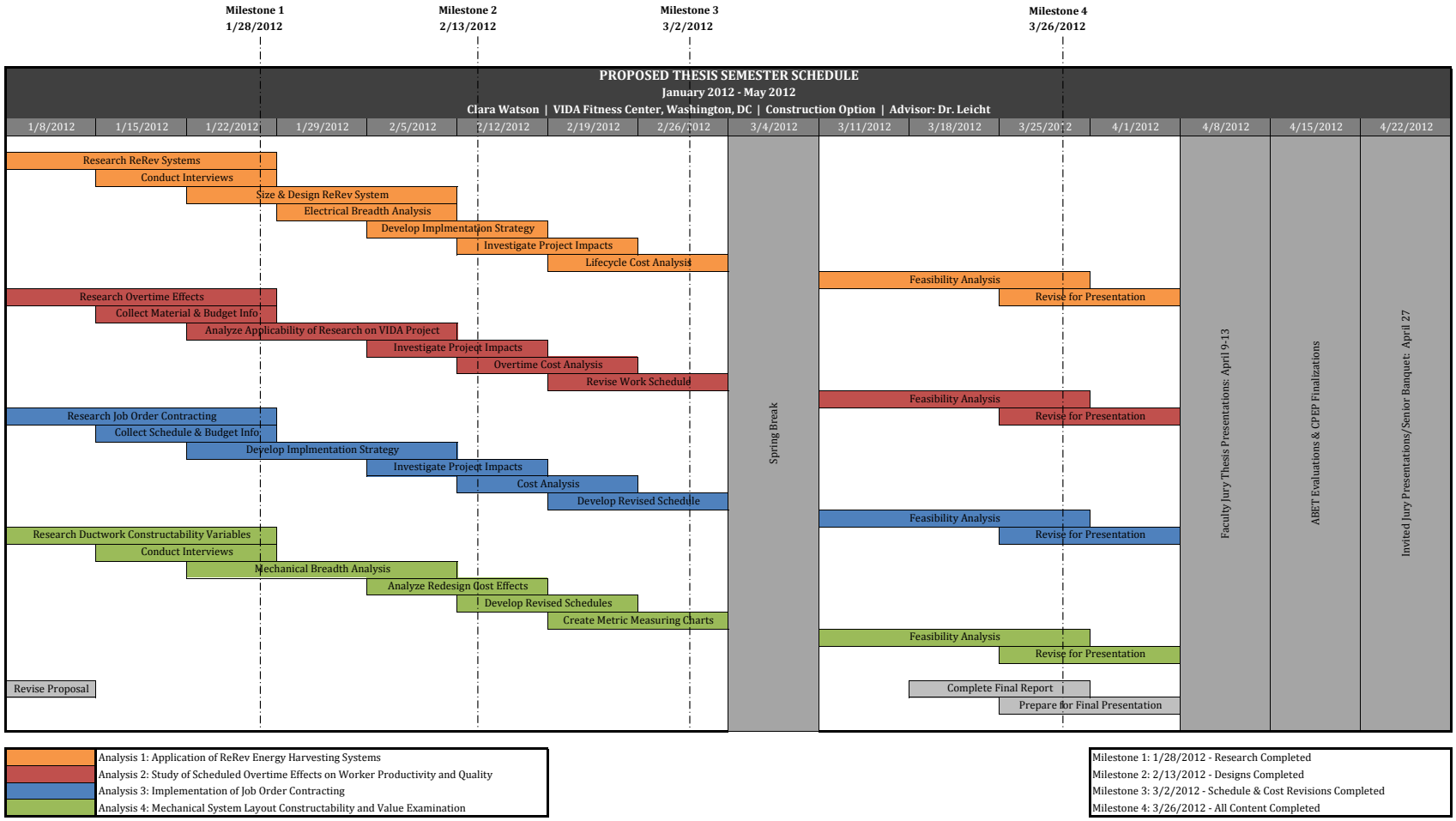
The MAE requirements for the senior thesis research will be fulfilled on the third technical analysis, Implementation of Job Order Contracting. JOC was introduced and discussed by Dr. Robert Leicht in AE570: Production Management in Construction. The knowledge gained from this will be incorporated into the third analysis in the determination of how JOC can decrease the length of procurement and preconstruction, increase overall quality, and provide a substantial cost savings for Forrester and the Owner.

Dr. Leicht also taught AE572: Project Development and Delivery Planning, which will be incorporated into the fourth analysis with the creation of the Integrated Decisions chart used for

decision making on mechanical system layouts. This chart will aid the choosing of a layout that will potentially save the Owner money, improve constructability and efficiency, and thus, increase the overall value to the Owner.

APPENDIX B

PRELIMINARY SPRING SEMESTER TIMETABLE


Milestone 1
1/28/2012
Milestone 2
2/13/2012
Milestone 3
3/2/2012
Milestone 4
3/26/2012
PROPOSED THESIS SEMESTER SCHEDULE
January 2012 - May 2012
Clara Watson | VIDA Fitness Center, Washington, DC | Construction Option | Advisor: Dr. Leicht
1/8/2012
1/15/2012
1/22/2012
1/29/2012
2/5/2012
2/12/2012
2/19/2012
2/26/2012
3/4/2012
3/11/2012
3/18/2012
3/25/2012
4/1/2012
4/8/2012
4/15/2012
4/22/2012
Research ReRev Systems
Conduct Interviews
Size & Design ReRev System
Electrical Breadth Analysis
Develop Implmentation Strategy
Investigate Project Impacts
Lifecycle Cost Analysis
Feasibility Analysis
Revise for Presentation
Research Overtime Effects
Collect Material & Budget Info
Analyze Applicability of Research on VIDA Project
Investigate Project Impacts
Overtime Cost Analysis
Revise Work Schedule
Feasibility Analysis
Revise for Presentation
Research Job Order Contracting
Collect Schedule & Budget Info
Develop Implmentation Strategy
Investigate Project Impacts
Cost Analysis
Develop Revised Schedule
Feasibility Analysis
Revise for Presentation
Research Ductwork Constructability Variables
Conduct Interviews
Mechanical Breadth Analysis
Analyze Redesign Cost Effects
Develop Revised Schedules
Create Metric Measuring Charts
Feasibility Analysis
Revise for Presentation
Revise Proposal
Complete Final Report
Prepare for Final Presentation
Spring Break
Faculty Jury Thesis Presentations: April 9-13
ABET Evaluations & CPEP Finalizations
Invited Jury Presentations/Senior Banquet: April 27
Analysis 1: Application of ReRev Energy Harvesting Systems
Analysis 2: Study of Scheduled Overtime Effects on Worker Productivity and Quality
Analysis 3: Implementation of Job Order Contracting
Analysis 4: Mechanical System Layout Constructability and Value Examination
Milestone 1: 1/28/2012 - Research Completed
Milestone 2: 2/13/2012 - Designs Completed
Milestone 3: 3/2/2012 - Schedule & Cost Revisions Completed
Milestone 4: 3/26/2012 - All Content Completed