

Square 320



Final Proposal

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Executive Summary

In light of the recent changes in the national economy, now more than ever companies are searching out new markets and lucrative job opportunities. The construction industry, while very different than most occupations in both project lengths and un-changing methods, is experiencing the same trends as other industries where new strategies are implemented to ensure business can continue as usual. In the age of steadily rising energy prices there has been a dramatic shift from new construction to historical renovation work where buildings can be reengineered to be efficient, finding long term energy cost savings.

For James C. Davis Construction Company and all construction firms alike, historical renovation work is the most promising rising market and significant effort should be made to alter their long-term strategies accordingly. The initial challenge with this comes from the considerable differences that exist between historical and new construction but those differences are believed to be small in comparison to the potential gains that can come from growing into that market.

This proposal will evaluate in four specific topics, the ways in which the Square 320 project can be developed and improved into the ideal historical renovation project in order to become a shining model to all of what opportunities lay ahead in this market. In order to plan ahead for construction in the appropriate manner this project could have implemented some modern surveying technologies and methods like selective explosive demolition and laser 3-D mapping. Additionally, the plan and execution of the basement excavation and redesign will be studied in order to understand the reasons behind the change, the engineering that went into the structural support system, and a cost benefit analysis of the decision change. This report poses the question what does a great renovation team look like, what kinds of people are successful, and what specific traits and qualities of emotional intelligence should leaders on a renovation possess. Finally, this report will investigate a design decision to tailor the HVAC system to the new structural system of the renovated buildings. The Square 320 project is an example of how renovation work should be approached intentionally, with all the necessary measures to optimize the performance of the building, its systems, and the teams that complete the work on it.

When construction companies look to the future with a strategy for investing their energy and attention in these financially difficult times, the hope is that this report will shed some light on the increasing benefits and growing necessity to rebuild and recycle historical buildings as an alternative to tearing them down and starting from scratch.

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Analysis Descriptions

Topic 1 – Surveying the Existing Conditions of Historical Buildings

Problem

The most significant challenge the entire Square 320 project has sustained has been the slow progression of the historic renovation work and how that considerably stretched the schedule at the early stages of the project and continues to make schedule acceleration very difficult. These delays were a direct result of minimum information in the existing conditions drawings and the considerable time wasted waiting for RFIs and the dissemination of information to the site.

It appears as though little was put forth initially in the research, understanding, and planning of this historical renovation to the Berry & Whitmore, Corcoran, and Nordlinger Buildings. Due to the age and deterioration of these buildings, considerable redesign of all systems was required. Unfortunately, a majority of these redesigns were made with only a portion of the necessary information. As a result, from the beginning, work in the historical buildings has become highly reactionary where that didn't need to be the case. What we've seen is subcontractors bid the project, plan their work, and arrive on site only to find that their plan won't entirely accommodate the existing conditions after some initial demolition. Due to the significance of these challenges, the entire Square 320 project has encountered delays and added cost as further resources have been directed towards expediting the renovation work. While the current work on site has drastically improved, those delays and costs could've been prevented with some alternative strategies to surveying.

Solution

The best strategy that would've avoided the challenges above would've been incorporating some of today's more modern technologies into the initial surveying of these buildings. There are many different techniques available that range from selective demolition to 3D Laser mapping. Early in the design phase, had a contractor gone into the buildings for some exploratory demolition of the building, the majority of the structures and interior spaces would've been fully surveyed providing ample existing conditions information to the design team. With more information their designs would've been far more detailed, easy to understand, and quicker to implement. Additionally, knowing more going into the project, regardless of the party, everyone would have been more likely to work efficiently, saving time and energy. The time savings of the subcontractor would result in cost savings for the GC.

Research Methods & Technical Analysis

The most important step would be to learn as much as possible about the different techniques currently in existence to survey existing buildings and arrive at the level of detail necessary for a redesign. There have been multiple projects in the Metropolitan DC area that I would evaluate as individual case studies. Each study would be an opportunity to learn about that technique, its cost implications, and the extent of its benefit on the project.

Laser mapping was most recently used in the restoration of the Smithsonian Project, and the new construction of both the Constitution Center and St. Elizabeth's hospital. WH Gordan was the contractor on that job in DC having routinely utilized this technology. Contact with this contractor would provide exactly the opportunity I had in mind to learn about how they estimate their projects, how they approach each job, and how their technique can save the project money. Not only just in regards to a contract, but I would investigate the overhead implications that purchasing equipment of that sorts and compare that to how much additional funding has gone into the historic restorations of Square 320. I would research the 3-4 contracts that would be most likely to benefit from the use of this technology and attempt to quantify the extent of the savings. If WH Gordan would be able to provide financial information, I could further investigate the benefit that DAVIS might find in purchasing the technology and self-performing the work at a considerable savings.

The bottom line is that these surveying alternatives cost money but it would be my research and analysis that would determine exactly how much extra each technology costs. Then, with the added knowledge of the existing conditions, I would perform a cost benefit analysis to determine how much time would be saved and understand how much money that would save in General Conditions costs at a minimum.

Desired Outcome

There is no question that more information will always lead to better designs and easier constructability. The desired solution would be for the use of these technologies to eliminate the guesswork in the designs. I would like to see both design teams and renovation teams to have access to the same information much sooner in the process. Collaboration between the two would likely result in designs tailored to the constructability concerns of the contractors eliminating challenge and confusion from the job. Hopefully, such collaboration would speed up the construction, lead to more efficient work, and bring the project closer to completion sooner. Then, it would be necessary to realize whether the time savings from a speedier project would counteract the cost of the new technologies. Even though there is an initial cost for the service of the equipment, it is likely that the product would pay for itself.

Topic 2 – Basement Expansion Below the Historical Buildings - Structural Breadth

Problem

In order to create additional rentable space, the owner and architect agreed to take advantage of the void space beneath the sidewalk that once housed the utility infrastructure in the days of the building's original construction. The design scheme was to lift the entire building off of its foundation, excavate beneath the sidewalk, pour the new basement and raise the structure four to six feet to create additional rentable square

footage. This prospective opportunity for additional revenue was very excited to the owner, Douglas Development, but it has appeared to require more time and money than originally planned. This design and construction decision was made with significant risk to the project financially while offering little gain in the grand scheme of the project. Unfortunately the work has required a significant amount of time and money to be thrown at it to fix the challenges the construction team was encountering and avoids further delays and frustration. Additionally, excavating adjacent to major roadways and under pedestrian walkways comes with a lot of unknown risk; disrupting soil in that manner has significant effects on everything around it.

Solution

The first solution would be to remove this design decision from the project, but if we are truly going to analyze the decision to better understand it and avoid decisions like it, we will need to investigate the whole process closer. Considering the design decision wouldn't change, the best solution is to research alternative structural support systems and excavation techniques to minimize disruption to the existing building and bearing soil. It is imperative that more research is done to understand how the loads are transferred from the building to the earth while the excavation and foundation work is being performed. Then we can design a structural support system that would have prevented the schedule delays and challenges this project encountered throughout the process.

Research Methods & Technical Analysis

The first phase will be to understand the process with which the building was raised, supported, and excavated while it was still standing. This research will demand a lot of time and many conversations with the onsite superintendants, PMs, and APMs because little to no information regarding this plan was ever indicated in the drawings. Initially, it will be vital to determine the structure of the bracing that held the building off of its foundation and the exact process they went through. Further investigation and understanding of the structural support system will be necessary for the completion of the structural breadth portion of this report. It will be imperative to study and understand the building loads, how they are transferred to the earth, and how structure remained un-hindered during the entire time the earth beneath it was being excavated. Extensive research will go into what excavation support systems were used on the building itself and with the soils beneath it. After various load calculations with the structural system they used I plan to research, collect data, and determine if any alternative structural support systems would have been acceptable and even cost saving in the process.

The second phase of researching this process would be to determine the total cost implications that the decision to move forward with this idea had on the entire project. At first thought, it might have appeared as a brilliant strategy for increasing the rentable space and owner revenue, but with the unknown nature of dealing with soils this process added much more cost than had been budgeted. I plan to try to nail down a total cost estimate of the basement expansion and then compare that with the potential revenue that could come from the additional rentable square footage. By contacting Douglas Development and learning their square footage rate for similar Class A buildings in DC and determining the exact additional square footage in the new basement, we can analyze whether the decision to expand was wise or not and the degree to which Douglas would either make or lose money. This simple comparison between the invested funds in the

construction and the potential gains from rental would be an adequate enough group of data to comment on whether the basement expansion is a wise or a poor investment and how long it would take for Douglas Development to break even.

Desired Outcome

It is very unlikely that the basement expansion will turn out to be a positive investment in the near term for Square 320 and Douglas Development. And as such, at the end of the cost benefit analysis, I expect this portion of the project to result in a financial loss for the owner. For that reason alone, had there been this sort of analysis ahead of time, they might have decided against the expansion from the beginning. However, I believe that through the research, analysis, and redesign of the structural support system we will discover opportunity for savings through the use of alternative systems and/or strategies. For that reason, this portion of the report is exciting and has the opportunity to be very informative. There have to be ways that through more extensive planning and the use of innovative structural supports this process could have been expedited with considerably safer circumstances. It will be the focus of my breadth study to determine if time and cost savings are achievable in this circumstance.

Topic 3 – Forming an Effective Renovation Team Based on Emotional Intelligence

Opportunity

Today's construction markets are noticing an increasing shift to renovation work. With the large financial risks of unforeseen conditions in soils, having a project with a foundation intact, a considerable amount of risk is mitigated at the start. However, historical renovation work is so drastically unlike new construction, without the proper training or years of onsite experience, successful individuals from many companies run into severe challenges with renovation projects. As companies transition to historical renovation work they take their successful employees from the past and put them in charge but there are some distinct differences required in the types of individuals who find great success in renovation work.

G. Brent Darnell, in his book *The People-Profit Connection*, discusses the inherent importance that emotional intelligence plays in the success of your company and more specifically in the management of your people. Through his research and more specifically the research of the AE department, studies have been targeted to explain what type of people are best for each job. On the Square 320 project, a renovation team should be put together based on how well their personalities and emotional intelligences match the demands of the job.

So the opportunity for research and question stands: What kinds of people are fit for renovation work? How do you firm up a team and bond them together for the challenges that renovation work will throw at them? What personality traits are most important in one's Emotional Quotient (EQ) score? How would one go to assess it?

Solution

In order to optimize performance, save money, and energy one must incorporate their EQ traits into everything they do. The ultimate goal is to discover what makes people successful and then learn how to embody those traits. The Square 320 project would be considerably improved if significant effort had been made to form teams based

on their emotional intelligence competencies and basic leadership instruction. On site the responsibility falls mainly on the superintendant to define the project's expectations and to set the tone for the work early. Requiring a series of early project orientation meetings would clearly articulate those expectations and empower the workers and project team to rise to the occasion. One has to be proactive about leadership to ensure that people unite as they work for a common goal. A focus must be kept to deliver on time and individuals should be held accountable for not doing so.

Research Methods & Technical Analysis

Researching for this subject will be split between readings, observations, and interviews. The most important task will be to investigate the skills and traits that differentiate team on renovation projects. There have to be common threads between construction teams and their individual leaders and it will be the purpose of this research to discover what they are. From different companies, successful with renovation work, I would ask their construction leaders to create a list of important qualities vital to a teams' success on the construction site. Based on their responses I would connect those with one of Darnell's 15 EQ traits. Then I would suggest different traits and define them based on the 15 EQ traits and have the industry professional's rate them based on their relative importance on a construction site. Now I would be able to compare current industry data with Darnell's research to determine which characteristics are most important to successful renovation teams. In closing I would offer any of the professionals the opportunity to take an EQ profile test and determine how close the 'test subjects' are to their pre-described requirements of successful project teams. Furthermore, working with the AE department's representatives from the research performed in EQ I would determine whether or not my data is acceptable or skewed. In the end, there will be a list compiled of EQ traits in the order of their importance on renovation projects, followed by a system for the formation of these teams.

Desired Outcome

I am especially passionate about the leadership and management of those around you. Specifically, in regards to this topic, the study of team dynamics and emotional intelligence are crucial to the proper functioning of a team. That's not to say that these things can't be overcome, but in regards to creating a highly productive and efficient team, there are very specific but common traits that each of us should work towards developing. In light of my career path as a naval flight officer I am extremely concerned with high 'op-tempo' work and forming the teams to make that happen. While I am not presumptuous to believe that I know or possess all of these traits, I do believe that they can be learned and developed in each one of us. I hope that through discovering the most important EQ traits I can begin to incorporate them into my own life and my own leadership in the United States Navy.

To add a sense of legitimacy to this research, I also desire to see a stronger appreciation of EQ in the workplace because the company culture will allow employees to constantly develop and seek self-improvement. Future growth will come from better performance today – EQ can have a significant impact in an organization's future.

Topic 4 – Mechanical Implications of a Structural Change for Constructional Reasons **– Mechanical Breadth**

Opportunity

The original heating system in the Berry & Whitmore, Corcoran, and Nordlinger Buildings used your basic radiator heating system where steam was distributed through piping to individual radiators in rooms. Steam radiators remain some of the oldest heating technologies and as such are highly inefficient as they require the boiling and condensing of water to function. Furthermore, these systems provide little opportunity to the inhabitant to control the comfort and temperature of the space. Steam radiators are generally located on exterior walls and can cause further heat loss by sending heat through the wall of the building. For those reasons and more traditional heating systems are highly inefficient and need to be redesigned with the renovation. Thus, the decision is made to redesign the system but which alternative HVAC system is best for a renovation project.

Solution

The historical renovation of the Berry & Whitmore, Corcoran, and Nordlinger Buildings encompassed the redesign of their structural support system by adding steel members to support the flooring levels. While this is a solution to the structural challenges of the buildings it makes the design of the HVAC system very difficult and effectively lowers the plenum height with the need for ductwork to run below the beams. The solution to the constructability challenge is to incorporate a raised floor system in the renovation. The under floor distribution system will still minimize the ceiling height by raising the floor, but since there will be no need to hang a ceiling grid. The space will remain open to the beams and in an architectural sense will appear to feel considerably more open than before.

Research Methods & Technical Analysis

The first step of the process will require considerable research of raised floor systems and their output levels to ensure they meet the requirements of the demand loads. Then, using simulations, I will begin to collect data on how the energy consumption is impacted by the transition from a forced air ductwork to an open floor system. Secondly, the aspect of personal comfort and the degree to which a space's current levels can be controlled will be taken into account. It will be vital to determine if the tenants of these newly renovated spaces would have the same room controls of an overhead heating system. Further research will need to be done in order to learn more about the versatility of raised flooring heating and the degree to which it would satisfy all of the occupant's desires and expectations for comfort. For example, it doesn't matter how capable the raised floor system is when compared to an overhead system if the tenant's perception is in conflict. In the end, customer satisfaction and approval is the owner's (Douglas') main concern for the project. If necessary, it would be fascinating to analyze the impact of the system to the coordination of the renovations and whether or not any considerable schedule compression could be pulled from this new raised floor system.

Desired Outcome

Initial research indicates that when comparing raised floor versus overhead air systems, the raised floor cooling system provides cooler average temperatures. Considering the various niches of construction this design change would affect, we have to pinpoint one specific topic we want to address and what desired solution we want to come if the design change. Hopefully the change of design to accommodate the structural design will effectively result in smaller energy consumption and benefit the project in both ways. Based on an IBM study of their data centers that use raised floor heating, with chillers operating at 100% and 80% levels, raised-floor cooling resulted in cooler rack intake temperatures. Therefore, the desired outcome would be for the chillers working at 80% or less of their regular operating levels to minimize energy consumption.

Conclusion

The most important outcome of this report should be the new appreciation for renovation and restoration work as a lucrative market within the construction industry. The emergence of the market has come from many secondary economic pressures like the high cost of energy coupled with the lack of credit from lending institutions. In this day and age, everyone has become highly risk adverse and everything is done to mitigate risk. If a client doesn't have enough money to completely design and build a new structure then they can investigate their ability to refurbish the one they currently own where the risk of unforeseen conditions in the soils, as an example, is effectively nothing. Or if they can't find a lending institution to empower them to buy new, then they can at least take what they already own and improve it. The only caution that needs to be heeded as these markets flourish is that the type of work demanded in renovation projects is very different than in new construction and that it needs the proper people, personalities, and planning to be successful. Whereas one might have been a successful home builder by turning on 'auto-pilot' and manufacturing tons of replicated units, that person will fail in the renovation market if they attack each project with the same strategy. In the same way, if someone was a successful superintendant because 15 years in the field showed him exactly how to sequence a building site, then they will fail in this market if they don't take the proactive steps to prevent problems before they occur. The very nature of renovation work requires a different attitude, a combined sense of foresight and pessimistic belief to search out the problems that inherently exist before they arise. Using the Square 320 Project as an example to all, there is hope that the industry will soon discover that significant changes need to be made to the entire process of renovation work to ensure the success of similar projects in the future. We must take the initiative and plan ahead, innovate our strategies wherever available, tailor our personnel to the job, and demand that our systems perform to the highest standards.

Weight Matrix

Description	Research	Value Engr.	Constr. Review	Sched. Redu.	TOTAL
<i>Surveying</i>	30%	30%	20%	20%	20%
<i>Basement Exp.</i>	30%	10%	30%	30%	30%
<i>Team EQ</i>	30%	30%	10%	30%	40%
<i>Energy Savings</i>	20%	20%	30%	30%	10%
TOTAL	20%	40%	20%	20%	100%

Time Table

Week of	Activity
Winter Break	Read G. Brent Darnell's "The People-Profit Connection"
January 12 th	Contact WH Gordan & Research Surveying Case Studies (Smithsonian/Constitution Center)
January 19 th	Request Estimate for 3D Laser Mapping Following Selective Demolition (WH Gordan)
January 26 th	Comparing Various Methods, Perform and Compare Cost Benefit Analyses
February 2 nd	Perform Basic Calcs of Building's Support Systems
February 9 th	Research & Compare Various Systems by Load Bearing Capability and Constructability
February 16 th	Perform Projected Revenue Calc Based On Additional Rentable Square Footage
February 23 rd	Survey Important Qualities of Effective Leaders On Historical Renovation Projects
March 2 nd	Research & Compare Raised Flooring Forced-Air Heating vs Traditional Overhead Duct Systems
March 9 th	<i>SPRING BREAK</i>
March 16 th	Determine the Level to which Occupants of Raised Flooring Heating Can Control Their Comfort
March 23 rd	Analyze Impact on the MEP Coordination to Determine if Schedule Compression is Possible
March 30 th	Evaluate Researched Material & Follow-Up With Industry Contacts for Final Time
April 6 th	Compile Final Summary Report
April 13 th	Finalize and Present Final Report

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Appendix – Breadth Studies

Structural - Basement Redesign, Excavation and Expansion

In order to create additional rentable space, the owner and architect agreed to take advantage of the void space beneath the sidewalk that once housed the utility infrastructure in the days of the building's original construction. The design scheme was to lift the entire building off of its foundation, excavate beneath the sidewalk, pour the new basement and raise the structure four to six feet to create additional rentable square-footage.

While the need for this design change is questionable, for the purpose of this assignment and specifically to study the impacts of a structural change to a construction project, this scenario represents the structural breadth that I will study in the coming semester.

Considering the design decision wouldn't change, the best solution is to research alternative structural support systems and excavation techniques to minimize disruption to the existing building and bearing soil. It is imperative that more research is done to understand how the loads are transferred from the building to the earth while the excavation and foundation work is being performed. Then by combining our knowledge of both structures and construction engineering, we will design a structural support system that would have prevented the schedule delays and challenges this project has encountered.

The first phase of our research methods will be to understand the process with which the building was raised, supported, and excavated while it remained standing. This research will demand a lot of time and many conversations with the onsite superintendants, PMs, and APMs because little to no information regarding this plan was ever indicated in the drawings. Initially, it will be vital to determine the structure of the bracing that held the building off of its foundation and the exact process they went through.

To effectively articulate and demonstrate our structural knowledge in terms of a structural breadth, it is imperative that we clearly calculate the building loads, understand their load paths, and examine how an entire temporary structure could the building whole excavation was occurring underneath. Extensive research will go into what excavation support systems were used on the building itself and with the soils beneath it. After various load calculations of the structural system in use, I plan to scientifically determine if any alternative support systems would have been lucrative.

It is likely that through this research, analysis, and redesign of the structural support system, opportunities for savings will be discovered through the use of alternative systems and inventive strategies. There have to be ways that through more extensive planning and the use of innovative structural supports this construction process could have been expedited with considerably safer circumstances resulting in significant time and cost savings.

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Appendix – Breadth Studies

Mechanical - Mechanical Implications of a Structural Change for Constructional Reasons

The historical renovation of the Berry & Whitmore, Corcoran, and Nordlinger Buildings encompassed the redesign of their structural support system by surgically adding steel members to support the flooring levels. This structural change was made for constructional reasons, seeing as the beams were simpler to place than casting concrete or inserting pre-cast. This solution to a structural challenge immediately made the design of the HVAC system very difficult. The insertion of these steel members drastically effects the architectural of the building by lowering the plenum height due to the need for ductwork to run uninhibited below the beams.

My solution to this coordination challenge is to incorporate a raised floor forced-air system in the renovation of those buildings. The under floor distribution system will keep the designed architecture unaltered and the structural system unaffected, no longer requiring the need for a ceiling grid.

The first portion of the process will require considerable research of raised floor systems and their output levels to ensure they meet the requirements of the mechanical demand loads. Then, using simulations, data collection will begin to learn how energy consumption is impacted by the move to this alternative system. Secondly, the aspect of personal comfort and degree to which a space can be human-controlled will be studied to ensure that the ultimate occupants feel comfortable with the implications of the design change. For example, it doesn't matter how capable the raised floor system is when compared to an overhead system if the tenant's perception is in conflict with it. In the end, customer satisfaction and approval is the owner, Douglas' main concern for the entire project.