Louis at the 14th

Senior Thesis Proposal

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February 3, 2014

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Executive Summary

Louis at the 14th is a commercial building project located in Washington, D.C. owned by JBG Companies and currently being managed by Balfour Beatty Construction. It is a nine-story residential building with 268 luxury apartments, retail spaces on the street-level, and a below-grade parking garage. It will replace existing two-story buildings and parking lots on the property. The building is pursing a LEED Silver certification and is scheduled to be complete in early 2014.

This document proposes areas of analysis and research pertaining to the construction of this building to be credited for the senior thesis spring semester. Each proposed analysis contains unique aspects of the project that offer opportunities to adjust the project schedule, project budget, building performance, and the constructability of the design. Two additional breadths relating to the structural and mechanical designs are included, as well.

Since the original underground parking garage occupies only a portion of the building footprint, the first proposed analysis involves the extension of this underground parking area into the entirety of the building footprint, demanding a larger but willower area of excavation. To compliment this change, a structural breadth will be performed to redesign the building foundation in order to best accommodate this change.

The following analysis proposes a site-specific safety plan for the excavation phase of the previous analysis in which prevention in design research will be implemented in the plan as well as the design of the new building foundation. OSHA regulations pertaining to excavation operations will be a focus as well as public safety, since the project site is very confined and exposed to the public.

Analysis #3 involves the installation of a geothermal well system to serve the mechanical needs of the ground-level retail spaces, which will create potential schedule and budget impacts, and also a constructability study in coordination with the current AGM pile foundation. A mechanical breadth will be performed in order to efficiently size the geothermal loops and sufficiently serve the mechanical needs of the building.

The final and extra proposed analysis offers a simplification of the building's cladding system, originally designed to include primarily metal panels, steel channels, aluminum window systems, and multicolored brick veneer. This analysis will eliminate the metal paneling and replace it with continued brick veneer in an effort to simplify trade coordination efforts and accelerate the schedule. The potential amount of time that can be saved in this manner will be determined, along with any budget changes that may occur as a result.

Included in the appendix is a proposed schedule of the spring semester describing how this proposal will be approached and delivered in a timely manner. A weighting breakdown is also included in an effort to predetermine how much work each area of analysis will require and thus how each should be graded.

At the conclusion of each analysis at the end of the semester, recommendations will be made based on the findings of each analysis and whether or not each would be a necessary or favorable option.

Analysis #1

Problem: The existing design of the building includes a below-grade parking garage consisting of three levels located at the southern half of the building footprint only. The parking garage was not extended to the rest of the building footprint to the north because building codes encouraging public transportation would only allow so many parking spaces to be utilized.

Background: The excavation performed for the originally designed parking garage required a temporary dewatering system designed based on geotechnical reports, but several complications occurred as a result and caused notable delays on the project.

It was determined by geotechnical reports and cost analyses that the soil on the second level of the underground parking garage was very weak and would require a thick mat foundation if it was to be the lowest level. If the garage were designed to be one floor deeper, spread footings would be more appropriate.

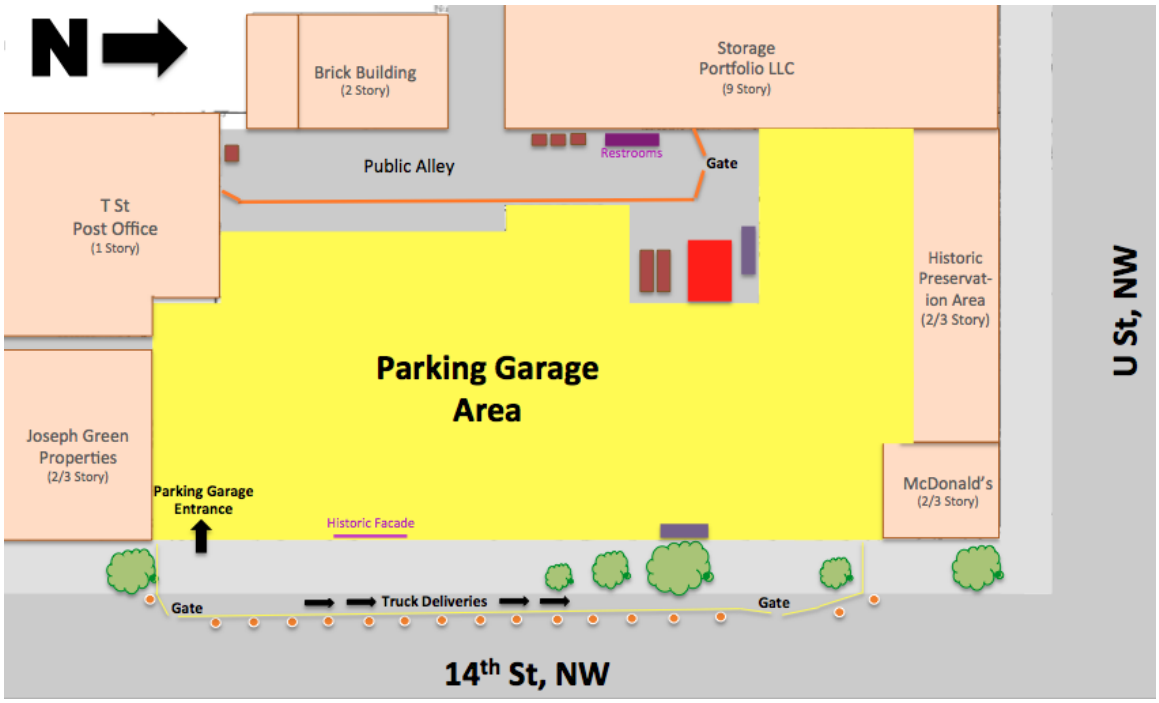
Therefore, with the additional concern of underpinning existing historic structures adjacent to the north footprint, the garage was moved to the south footprint only where the spread footings were be utilized.

Potential Solution: I propose to extend this parking garage back to the northern end of the building footprint as originally intended with the knowledge of the dewatering complications that the change introduced. This change will demand more square footage of excavation area, but will be less cubic yardage of excavated soil since it is to be significantly willower than the existing 3-level parking garage design. The shallower excavation may result in fewer dewatering issues, a more conservative project schedule, and possibly a cheaper result, as well. These geotechnical details and constraints will be further researched to determine if this is a viable solution.

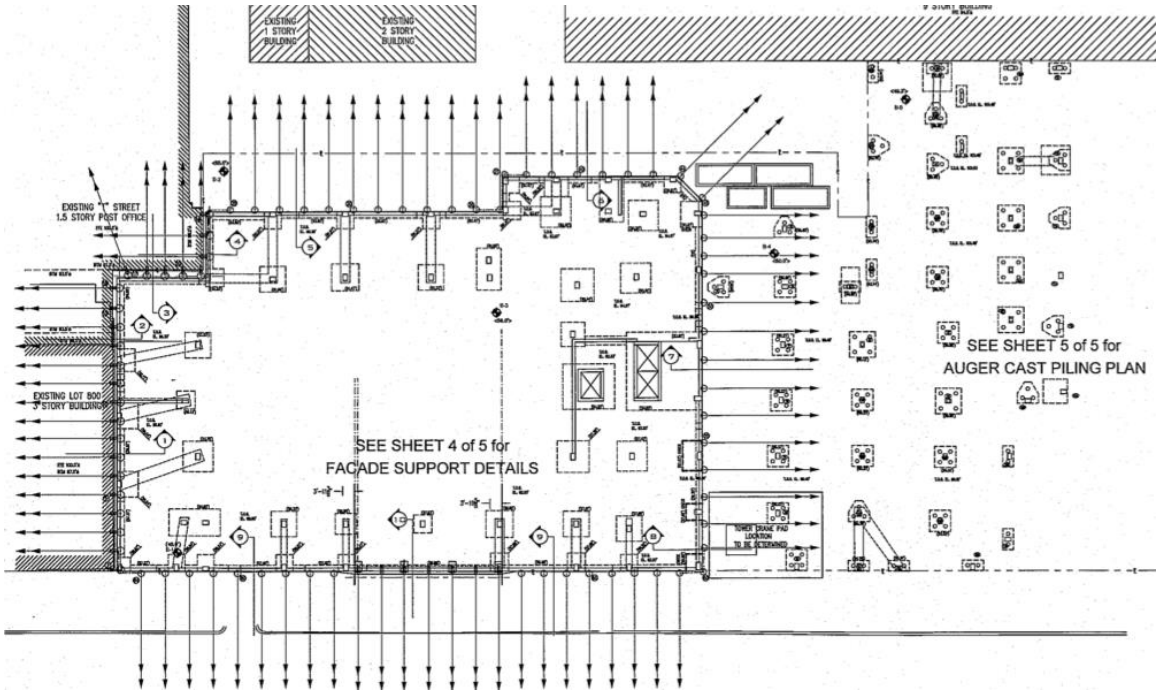
Methodology: Once the foundation system is redesigned, the additional material and labor impacts associated with the concrete parking garage extension will be implemented in the project budget, as well as its impact to the critical path schedule.

Constructability issues and constraints concerning adjacent historic buildings shown below will be considered, as well, since their foundations form the property boundary on that northern footprint.

Expected Outcome: The goal of this analysis is to determine if this different design would be more beneficial to the success of the project than the actual design used. Depending on the findings of the associated structural breadth, it is possible that the proposed change will be cheaper and faster to build given the knowledge of the problems that were encountered with the actual design.



^Pictured above is a site plan showing the area available for the proposed parking garage extension and the neighboring buildings that may cause restraints on the design.



^Pictured above is the foundation plan depicting the existing design featuring AGM Piles on the north footprint and a soldier pile & tieback system on the south footprint.

*__***Structural Breadth:***__

Problem: Since the original parking garage sits on spread footings three stories below the northern foundation micropiles, it introduces the risk of differential settlement between these two adjoining foundation types.

Background: The existing foundation design where the proposed parking garage extension is to be located consists of auger pressure grouted piles (shown below). According to geotechnical reports, the soil where the proposed extension is to be built is very weak and would require a 4-5' thick mat foundation instead of spread footings. There was also concern about the underpinning of adjacent historic structures and the risk associated with their condition.

Potential Solution: It is proposed to redesign the whole foundation as one structural unit that will allow for the extension of the parking garage and a shallower excavation, maintaining the same square footage of parking as originally intended.

The proposed foundation redesign will adjoin the northern and southern foundation in a way that mitigates the risk of differential settlement and future complication.

Methodology: The most appropriate foundation type for both parts of the footprint will be chosen based on geotechnical details and building loads. Methods of soil strengthening Basic critical dimensions and specifications of the proposed structural elements will be determined for this conceptual redesign, while keeping in mind the next analysis implementing prevention in design practices.

Expected Outcome: It is likely that a mat foundation will be used in some form as the original design previously intended; however, soil strengthening techniques may prove to be beneficial with the foundation changes.

<u>Analysis #2</u> (Critical Industry Issue)

^Pictured above is the actual excavation of the southern building foundation, compliments of Balfour Beatty Construction.

Problem: The project being delivered as design-bid-build does not allow for safety to be effectively implemented into the design of the building, specifically the excavation phase. Adjacent buildings and the public strictly confine the jobsite making the excavation phase more congested and prone to risks and hazards.

Potential Solution: The excavation changes being made in Analysis #1 allow for the opportunity to devise a site-specific safety plan with the implementation of prevention in design techniques in the redesign of the foundation system. This safety plan will be specifically designed for the excavation phase of the proposed parking garage extension with special attention to public safety concerns and constraints, as this was a challenging aspect of the actual project.

Methodology: As a critical industry issue, prevention in design safety research will be considered while redesigning the foundation as previously mentioned in the structural breadth. This research will be incorporated in the design and excavation plan of the parking garage. Since there is little opportunity to design for maintenance convenience in the below-grade foundation structure, OSHA regulations and excavation dimensions of active areas will be the primary focus of this investigation.

In addition, all hazards, risks, and appropriate precautions associated with the excavation equipment, excavation support, removal of spoils, adjacent buildings, site access, and other elements will be sufficiently identified. Public safety will be a concern throughout this analysis since the property is quite congested and exposed to the public. Therefore, specific precautions will be recommended for nearby pedestrian & traffic control.

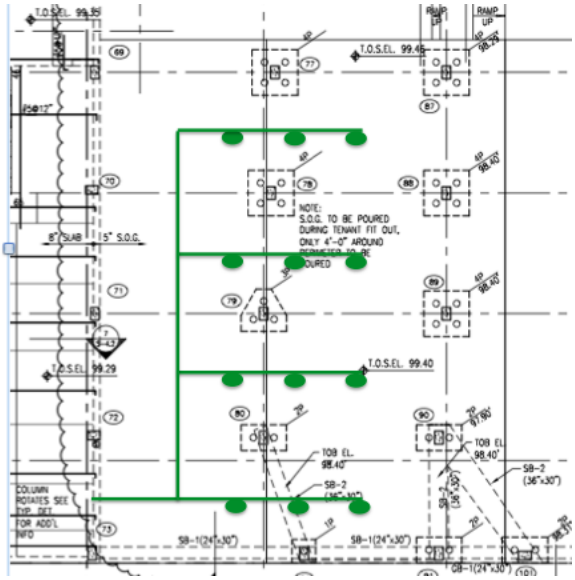
Expected Outcome: The goal of this analysis is to minimize the risks and hazards during the excavation phase as much as possible. Any additional costs or savings associated with this safety plan that may arise, along with schedule impacts and safety statistics, will be calculated to potentially provide more incentive for the owner or project team to invest in such proposed safety practices.

Analysis #3

Problem: The ground floor retail spaces are served by HVAC units separate from that of the above residential units. Also, with the parking garage being built on the south end of the building footprint, this leaves underground space unutilized at the northern footprint.

Background: The original design of the building's water-to-air mechanical system includes the traditional chiller, boiler, and cooling tower combination separately serving the ground floor retail spaces and the above luxury units.

The soil on the northern end of the building footprint is likely too weak for economical below grade foundation work, but it may be suitable for other purposes that can enhance the building design.



^Above is a depiction describing the manner in which the geothermal wells will be organized relative to the foundation structure, in this case the existing AGM piles.

Potential Solution: The installation of a geothermal loop system beneath the northern foundation that will serve the mechanical needs of only the ground level retail spaces.

Methodology: It was determined that the likelihood of having enough space available to install a sufficiently-sized geothermal loop to serve the whole building would be very low and possibly create too many constructability issues with the foundation design. Therefore this idea was refocused on the ground-level spaces only that have a completely separate mechanical system from the residential units above.

The underground loops will be installed underneath the northern section of the building footprint where the originally designed parking garage excavation would not interfere. The parking garage expansion and foundation redesign will not be used in this analysis to provide the owner with an additional option to further utilize the northern building footprint unoccupied by the parking garage.

The duration of activity required to install the geothermal wells will be determined after the system is designed in the mechanical breadth being described next. Because the drilling of the AGM piles for the northern foundation contains very similar preparation and activity as the drilling of the geothermal wells, both may be done simultaneously and thus likely cutting down on additional equipment costs.

Material and labor costs will be analyzed in detail, as well as the potential amount of energy savings and payback period that the new system will offer the owner.

Expected Outcome: The geothermal wells will eliminate the need for other HVAC equipment originally intended to serve the spaces, it will provide extra savings on energy costs for the tenants, and it will make the building more sustainable possibly gaining extra LEED points.

It is expected that the geothermal well system will take slightly longer to install and be more expensive upfront but provide a payback period to be more beneficial to the owner.

****Mechanical Breadth:***

As previously described, the geothermal well system will be sufficiently sized and designed to meet the mechanical load demands of the ground level retail spaces. The current mechanical design will be analyzed as necessary to accurately determine which other mechanical components will need to be adjusted or eliminated in order to accommodate the proposed geothermal well system.

All equipment that will be replaced by the geothermal system will be identified and their mechanical loads accounted for by the new design. The loop dimensions and technical requirements of the actual underground geothermal loop will be calculated, as well. This design will be used in the previously mentioned analysis for the constructability of the geothermal system concerning the existing foundation system.

Analysis #4

Problem: A reoccurring complication on the *Louis at the 14th* project has been the cladding system on the exterior enclosure of the building.

Background: It involves a combination of metal paneling, multiple colors of brick veneer, and steel channels along with the aluminum window systems as pictured to the right. According to project manager Will Siegel, this array of materials has slowed down production and has demanded extra coordination efforts to be made in their proper installation.

^Above is a rendering of the existing building façade design, compliments of JBG Companies.

Potential Solution: Analysis #4 proposes to eliminate the metal panels and replace them with more repeatable brick veneer in order to simplify these complications and potentially accelerate the schedule.

Methodology: This primary scheduling advantage will be analyzed in detail to determine exactly how much activity durations will change and ultimately how much faster the building enclosure may be installed.

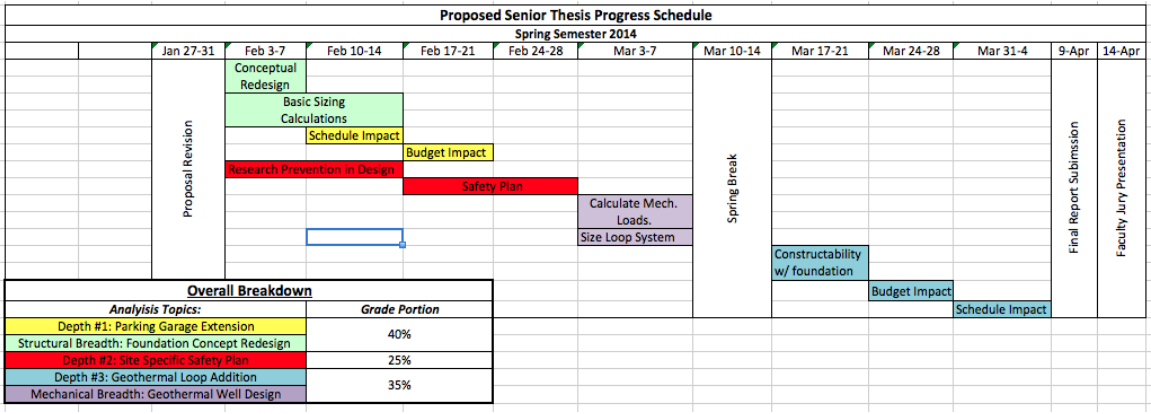
In order to compliment the scheduling advantage of this change, any budget changes that may occur as a result will be investigated, which will likely be a result of different material costs. If this schedule acceleration technique yields any significant budget changes, it could serve as another incentive for the owner to initiate such plans.

Structural elements supporting the façade will not be analyzed in detail for this change, but may be briefly discussed.

Since this analysis potentially benefits the time and cost aspects of the project, that leaves quality to be a remaining question. Therefore, it should be noted that an opportunity to perform an architectural breadth for this aesthetic change has been considered to supplement this analysis but is not being formally proposed. In which case, these findings would be compared against the new look of the building and whether or not it would suit the aesthetics of the building.

Expected Outcome: It is expected that these changes will provide a substantial schedule acceleration opportunity with minimal budget changes, but possibly slightly different architectural elements on the exterior of the building.

Appendix



Overall Breakdown	
Analyisis Topics:	***Grade Portion***
Depth #1: Parking Garage Extension	40%
Structural Breadth: Foundation Concept Redesign	
Depth #2: Site Specific Safety Plan	25%
Depth #3: Geothermal Loop Addition	35%
Mechanical Breadth: Geothermal Well Design	