

# **Louis at the 14th**

## ***Senior Thesis Proposal***

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## Executive Summary

*Louis at the 14<sup>th</sup>* 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 shall replace existing two-story buildings and parking lots on the property. The building is pursuing 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 shallower area of excavation. To compliment this change, a structural breadth shall 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 shall 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 shall 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 shall 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 shall be made based on the findings of each analysis and whether or not each would be a necessary or favorable option.

### **Analysis #1**

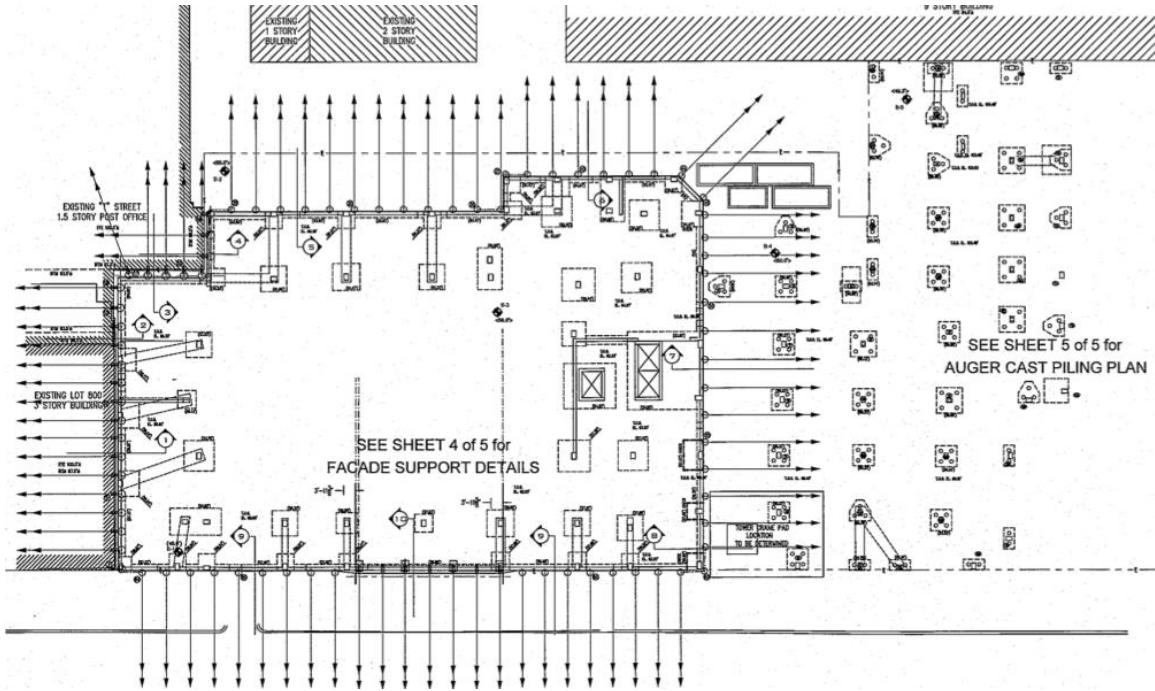
The existing design of the building includes a below-grade parking garage consisting of three levels located at the southern half of the building footprint only. The parking garage was not extended to the rest of the building footprint to the north because building codes encouraging public transportation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

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.

I propose to extend this parking garage to the northern end of the building footprint while maintaining the same number of parking spaces as originally intended. This design change will demand more square footage of excavation area, but will be less cubic yardage of excavated soil since it is to be significantly shallower than the existing 3-level parking garage design. The shallower excavation may result in fewer dewatering issues and a more conservative project schedule as a result. These geotechnical details and constraints will be further researched to determine if this is a viable solution.

The additional material and labor costs associated with the concrete parking garage extension will be implemented in the project budget, as well as the duration of the additional work in order to determine if such changes would be advantageous to the building owner and occupants in these aspects.

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



<sup>^</sup>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:**

The existing foundation design where the proposed parking garage extension is to be located consists of auger pressure grouted piles (shown below). I propose to redesign the whole foundation of this side of the building in order to sufficiently accommodate the parking garage extension.

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

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

## **Analysis #2 (Critical Industry Issue)**



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

The aforementioned analysis allows 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 shall 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.

As a critical industry issue, prevention in design safety research shall be considered while redesigning the foundation as previously described 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 shall be a main concern throughout this analysis since the property is quite congested and exposed to the public. Therefore, specific precautions shall be recommended for nearby pedestrian & traffic control.

Any additional costs or savings associated with this safety plan, 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.

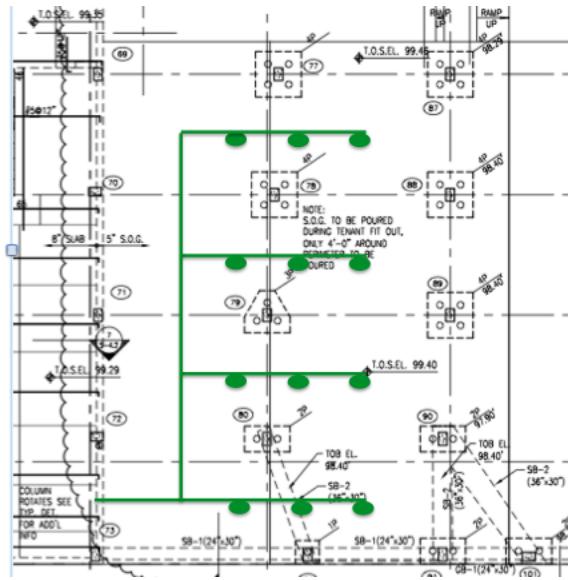
### **Analysis #3**

The original design of the building's water-to-air mechanical system includes the traditional chiller, boiler, and cooling tower combination. Analysis #3 proposes the installation of a geothermal loop system that will serve the mechanical needs of only the ground level retail spaces and eliminate the need for other HVAC equipment originally intended to serve it, save on energy costs, and possibly gain extra LEED points.

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 would likely be placed 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 shall 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 shall 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.



*^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.*

**\**Mechanical Breadth:***

The geothermal well system shall 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 shall be used in the previously mentioned analysis for the constructability of the geothermal system concerning the existing foundation system.

#### **Analysis #4**

A reoccurring complication on the *Louis at the 14<sup>th</sup>* project has been the cladding system on the exterior enclosure of the building. 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.

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. 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.



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

## Appendix

