



Jim Garzon
Technical Assignment 1
Construction Project Management
Apartment Complex
Anytown, USA

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Table of Contents

A. Executive Summary.....	3
B. Project Schedule Summary.....	4
C. Building Systems Summary.....	5-6
D. Project Cost Evaluation.....	7-11
E. Site Plan of Existing Conditions.....	12
F. Local Conditions.....	14
G. Client Information.....	14
H. Project Delivery System.....	15-16
I. Staffing Plan.....	17-18

A Executive Summary

In this assignment, areas such as schedule, building systems, project cost evaluation, existing conditions, delivery systems used, staff and owner of the project were analyzed. The report contains a schedule that summarizes in few activities the entire construction process. It also contains a building system summary where all the major systems of the building are described. There is also a project cost evaluation where the cost of the main systems of the building were calculated and compared to RS Means and D4 Cost Data prices. A site plan of the existing conditions as well as information of the client; Federal Realty Investment Trust, can be found in this report as well. Moreover, in the last section of this report, you will be able to find an explanation of what delivery method is being used and how is the staff of the project organized.

Clark Construction, being one of the most experienced firms in the country, was hired by Federal Realty to complete the project within budget and schedule. The delivery method used in this project was Design-Bid-Build where all the contracts with the designers and subcontractors were lump sums. Clark Construction is working under a lump sum type of contract that was negotiated with the owner. They are the ones that hold all of the contracts with the subcontractors. Therefore Clark Construction is in charge of managing the entire project from start to finish. Federal Realty and Clark Construction have built a very good relationship over the last few years. They expect to maintain their good relationship for many years. They also expect this project to be a very successful project.

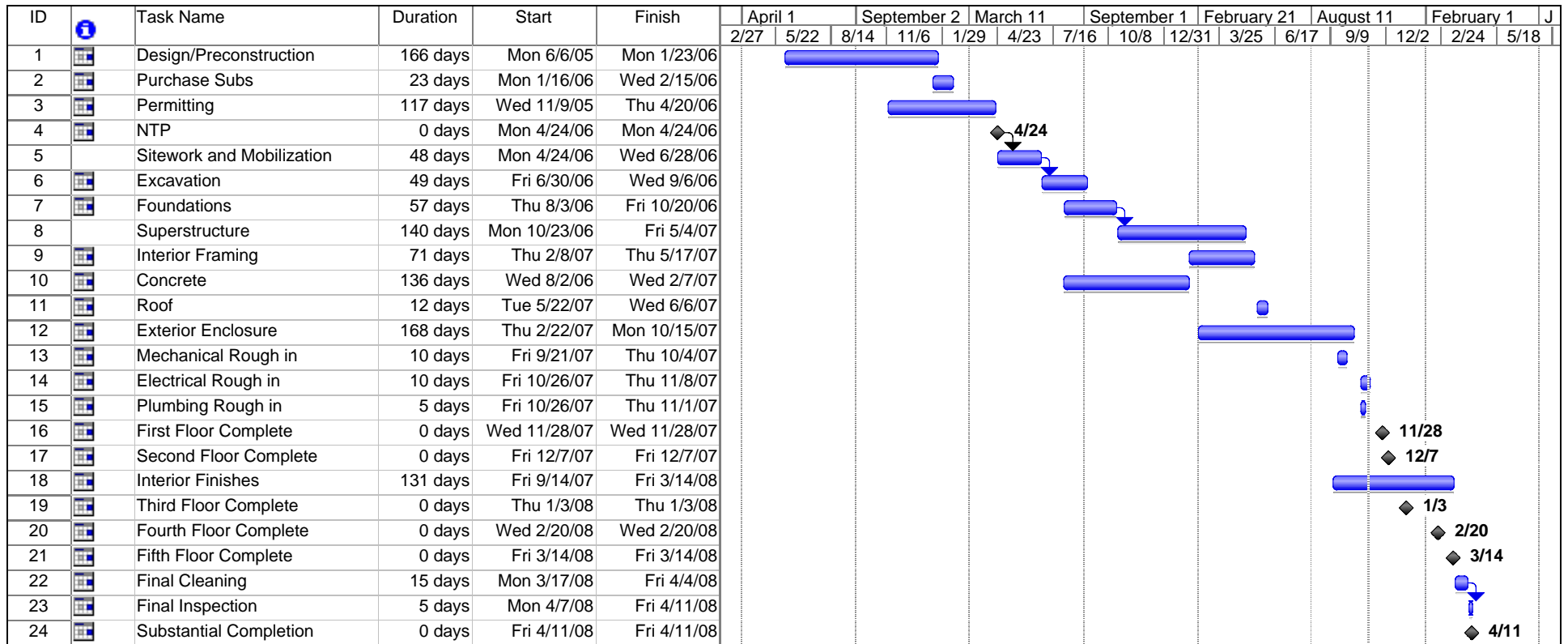
Concrete is the preferred material on most construction projects in DC due to the height restriction that is enforced in this region. However the designers of Apartment Complex designed the building mainly with wood. Wood studs will be used as the structural material and it will be used on the interior framing. Wood will also be used in the roofing system. The reason why this decision was made will be analyzed in more depth later in the semester. Other decisions made by the owner and designer regarding materials, construction methods, and contractual agreements will be also analyzed in more depth.

B. Project Schedule Summary

Foundations are the most critical activity for maintaining the project on schedule. Once the foundations are set in place, the rest of the activities should be done within schedule. That is why many CM/GC subcontract all of the activities besides foundations. They know that by self performing the foundations, they will have more control of the schedule.

Since the Apartment Complex structural system is mainly wood, the delivery of wood to the site was very important to the schedule. A delay on wood delivery would delay the entire project. Once the foundations were in place, and the wood was delivered to the project, the structure and finishes were just regular activities.

The project summary schedule for the Apartment Complex project is shown on the next page.



Project: tech 1 schedule Date: Mon 11/5/07	Task		Milestone		External Tasks	
	Split		Summary		External Milestone	
	Progress		Project Summary		Deadline	

C Building Systems Summary

Work Scope	YES	NO
Demolition		X
Structural Steel		X
Cast in Place Concrete	X	
Precast Concrete	X	
Mechanical System	X	
Electrical System	X	
Masonry	X	
Curtain Wall		X
Excavation Support	X	

Cast in Place Concrete

The Apartment Complex has a combination of structural systems. Concrete is only used up to the second floor slab. Cast in place concrete is used in this project for the foundations, perimeter wall up to the second floor, and beams and columns that extent from G2 level until the first floor slab. Sheeting panels with formwork in the form of walers were used for foundation formwork. For the concrete perimeter wall, vertically arranged upright timbers were used. Timbers were diagonally braced at both sides. Beams and columns formwork where prefabricated depending on the size of each member. Most of the concrete was placed with crane and bucket or by direct chute.

Precast Concrete

Precast concrete members were used only for decorative purposes. Those concrete parts that were hard to build with formwork were ordered as precast concrete and then installed. Two tower Cranes were used to mobilize precast members. Crane #1 was a Pecco SK 400, with radius of 220 feet and a capacity of 10,100 lbs at the tip. Tower Crane #2 was a Peiner SK 315 with radius of 180 feet and a capacity of 11,900 lbs at the tip. The location of both cranes are shown on the site plan on page 10.

Mechanical System

The mechanical system consists on three rooftop units and two air handling units located on the first floor. The mechanical system contains thirteen different types of pumps. It has two 400 ton chillers and two 1200 GPM 400 ton cooling towers. The air is distributed through galvanizes steel ducts that run all throughout the building. The building has a wet pipe sprinkler system. Smoke detectors as well as sprinklers are located all throughout the building.

Electrical System

There are two 480/277V, three phase, 2500A main breakers that control the residential area, and two 120/208V, three phase, 2000A main breakers that control the retail and restaurant service. Lighting consists of fluorescent and halide fixtures, ranging from 120-277V, which are common throughout the building. The electrical room is located on the northwest corner of garage G1.

Masonry

Both load bearing and veneer masonry was used in this project. Load bearing masonry was only used on interior space. CMU and brick was used as load bearing masonry. CMU's were installed with lintels, rebar, and stirrups. Brick was installed with steel angles. Veneer masonry was used on most of the façade of the building for aesthetic purposes. Most of the veneer masonry was 4" face brick tied with masonry ties.

Excavation Support

Since there are two underground parking garages, excavation support for a deep excavation was needed. Tiebacks and anchors were used for the support system. This support system avoids having a congested site. The absence of interior obstructions makes the excavation process much easier. This support system is mainly used in projects where space is limited and congestion need to be avoided.

D. Project Cost Evaluation

Total Project Cost

Total Cost: \$50,047,750

Square Foot Cost: \$118.19/SF

Actual Project Cost

Total Cost: \$42,584,209

Square Foot Cost: \$100.56/SF

	Total Cost of System	Square Foot Cost	% of Total Project Cost
Structural System	\$11,661,204	\$27.54	27.38%
Mechanical System	\$4,304,705	\$10.17	10.11%
Electrical System	\$3,470,420	\$8.20	8.15%
Roofing System	\$1,709,289	\$4.04	4.01%
Fire Protection	\$1,491,035	\$3.52	3.50%
Masonry	\$2,367,829	\$5.59	5.56%

RS Means Square Foot Estimate

RS Means Building Cost = \$ 37,945,643

Cost Add On's

Add	Cost	Quantity	Total Cost
Oven	\$1,122	180	\$201,960
Microwave	\$472	180	\$84,960
Refrigerator and sink	\$2,725	180	\$490,500
Garbage Disposer	\$200	180	\$36,000
Dishwasher	\$650	180	\$117,000
Elevators	130,000	4	\$520,000
Laundry Equip.	\$2,000	180	\$360,000
Smoke Detectors	\$171	220	\$37,620
Total Add Cost			\$1,848,040

Total RS Means with Add On's = \$ 39,793,683

RS Means cost guide 2007 was used to produce this square foot estimate. The information was found under Commercial/Industrial/Institutional section. The project type used was 4-7 Story Apartment and Store, Retail since this is a Mixed-used project. The initial cost per square foot that RS Means provided was reviewed as few things were added to the cost. Moreover, a location factor of 0.965 was used to adjust the price for Washington DC.

D4 Cost Data Estimate

Building Name	Description	Cost/SF	Total Building Cost
201 Turk	Apartment Complex	\$83.74	\$18,026,908
Private Residence	Private Residence	\$123.89	\$689,588
Eola South	Residential condominium	\$96.03	\$5,761,883
	Average	\$101.22	

D4 cost estimating software was used to produce a parametric estimate. The table above represents three similar projects that were selected to produce a SF estimate and compare it to the actual SF cost of the project. Location and time factors were used to adjust the price of those projects to be able to compare them to the Apartment Complex project. The breakdown for the cost of the three projects by CSI subdivisions is shown below.

201 Turk Apartment Complex

Code	Division Name	%	Sq. Cost	Projected
00	Bidding Requirements	5.42	4.54	977,007
01	General Requirements	8.44	7.06	1,520,672
03	Concrete	23.31	19.52	4,202,025
04	Masonry	3.64	3.05	655,568
05	Metals	3.03	2.54	545,798
06	Wood & Plastics	3.47	2.90	625,201
07	Thermal & Moisture Protection	16.84	14.10	3,035,013
08	Doors & Windows	4.88	4.09	880,380
09	Finishes	3.68	3.08	663,489
10	Specialties	1.11	0.93	200,046
11	Equipment	1.41	1.18	254,727
12	Furnishings	0.18	0.15	32,311
14	Conveying Systems	4.22	3.53	760,061
15	Mechanical	11.63	9.74	2,096,193
16	Electrical	8.76	7.33	1,578,417
Total Building Costs		100.00	83.74	

Eola South Residential condominium

Code	Division Name	%	Sq. Cost	Projected
00	Bidding Requirements	0.31	0.30	18,000
01	General Requirements	14.29	13.72	823,342
03	Concrete	36.01	34.58	2,074,734
04	Masonry	1.04	1.00	60,000
05	Metals	3.38	3.25	194,750
06	Wood & Plastics	3.54	3.40	204,100
07	Thermal & Moisture Protection	2.32	2.23	133,535
08	Doors & Windows	4.72	4.54	272,230
09	Finishes	15.89	15.26	915,379
10	Specialties	0.57	0.54	32,600
11	Equipment	1.28	1.23	73,600
12	Furnishings	0.33	0.32	18,995
14	Conveying Systems	0.95	0.92	55,025
15	Mechanical	8.93	8.58	514,600
16	Electrical	6.44	6.18	370,993
Total Building Costs		100.00	96.03	

Private Residence

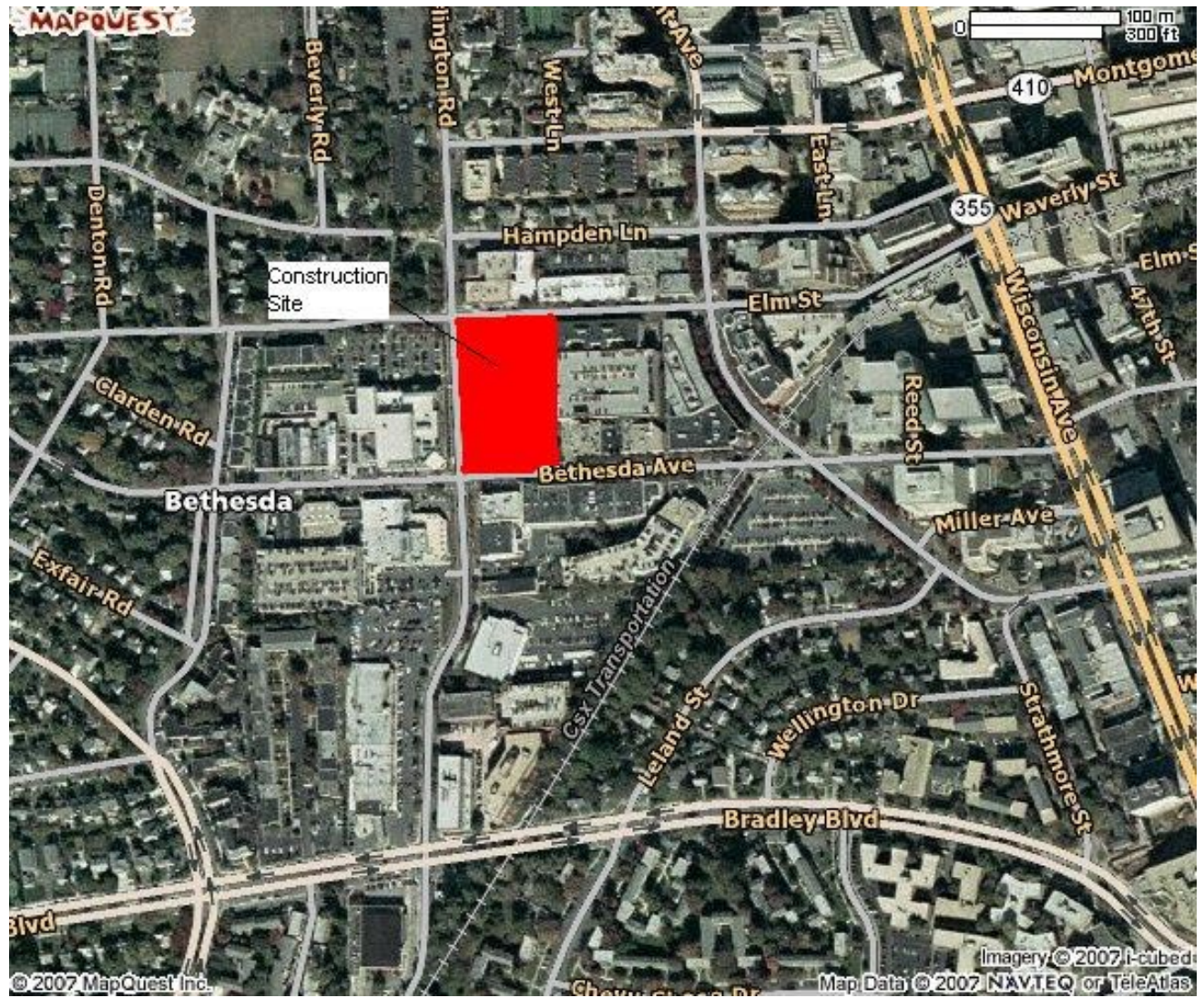
Code	Division Name	%	Sq. Cost	Projected
01	General Requirements	2.63	3.26	18,130
03	Concrete	6.33	7.84	43,628
04	Masonry	4.87	6.03	33,555
06	Wood & Plastics	20.84	25.82	143,711
07	Thermal & Moisture Protection	1.95	2.41	13,425
08	Doors & Windows	5.33	6.60	36,731
09	Finishes	28.55	35.37	196,895
10	Specialties	0.36	0.45	2,500
11	Equipment	4.78	5.92	32,973
13	Special Construction	2.47	3.05	17,000
15	Mechanical	12.90	15.98	88,966
16	Electrical	9.00	11.15	62,074
Total Building Costs		100.00	123.89	

Cost Comparison

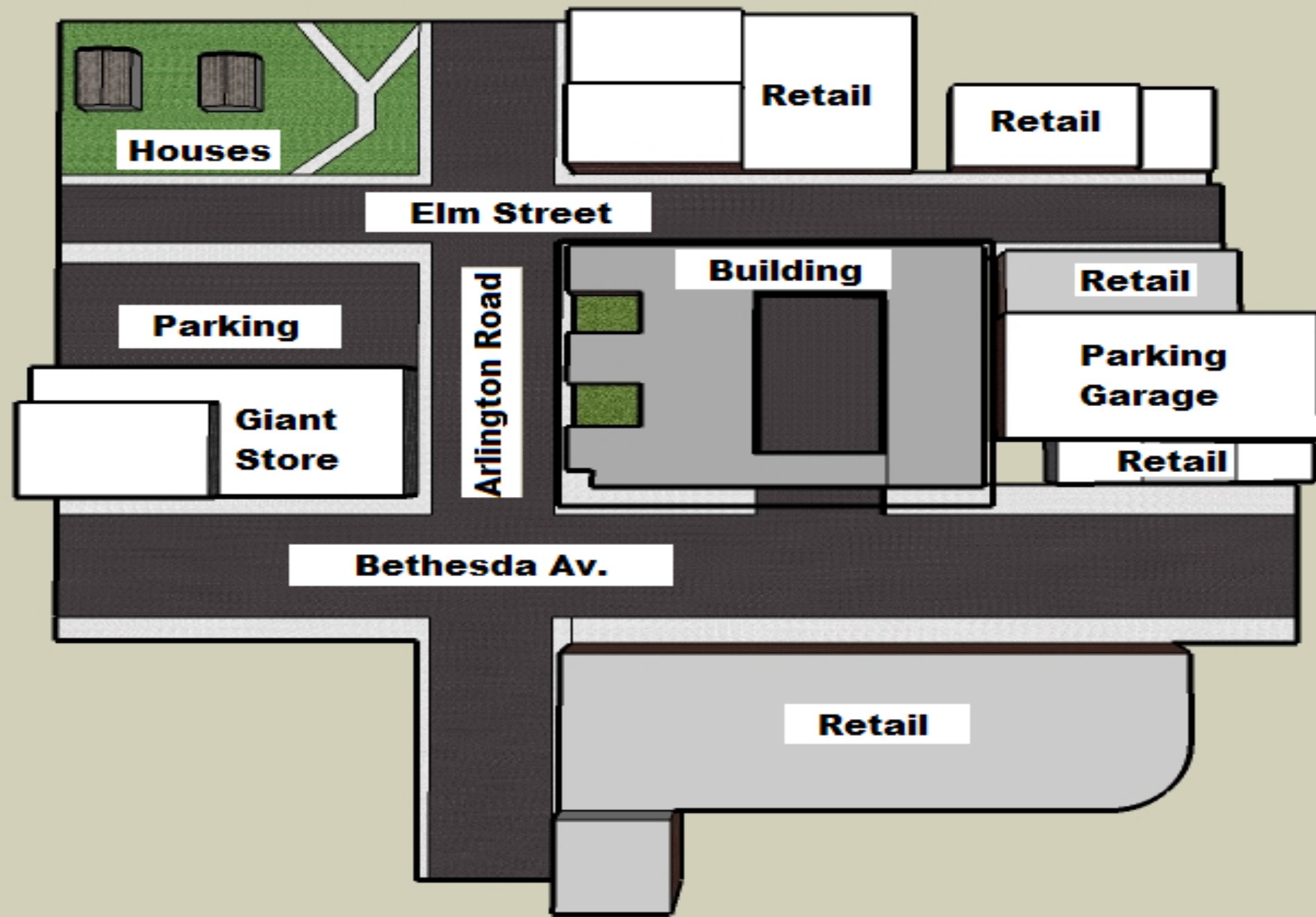
Using D4 cost estimating software, I determine a square footage cost of \$101.22, which was very similar to the actual project square footage cost, \$100.56/SF. I arrived at this number by averaging the square footage cost of three projects that were similar to Apartment Complex. One project was a residential condominium, the second one was a private residence, and the third one was an apartment complex. Due to the fact that those three projects differed on their sizes, the important information that I got from this estimate was the square footage cost of every CSI subdivision as well as the square footage cost of the entire project. The D4 square footage cost was very similar to the actual square footage cost. Even the SF costs of some CSI subdivisions were similar. For example, the average SF cost for the electrical system; \$8.22/SF, was very similar to the SF cost of the actual project, \$8.20/SF.

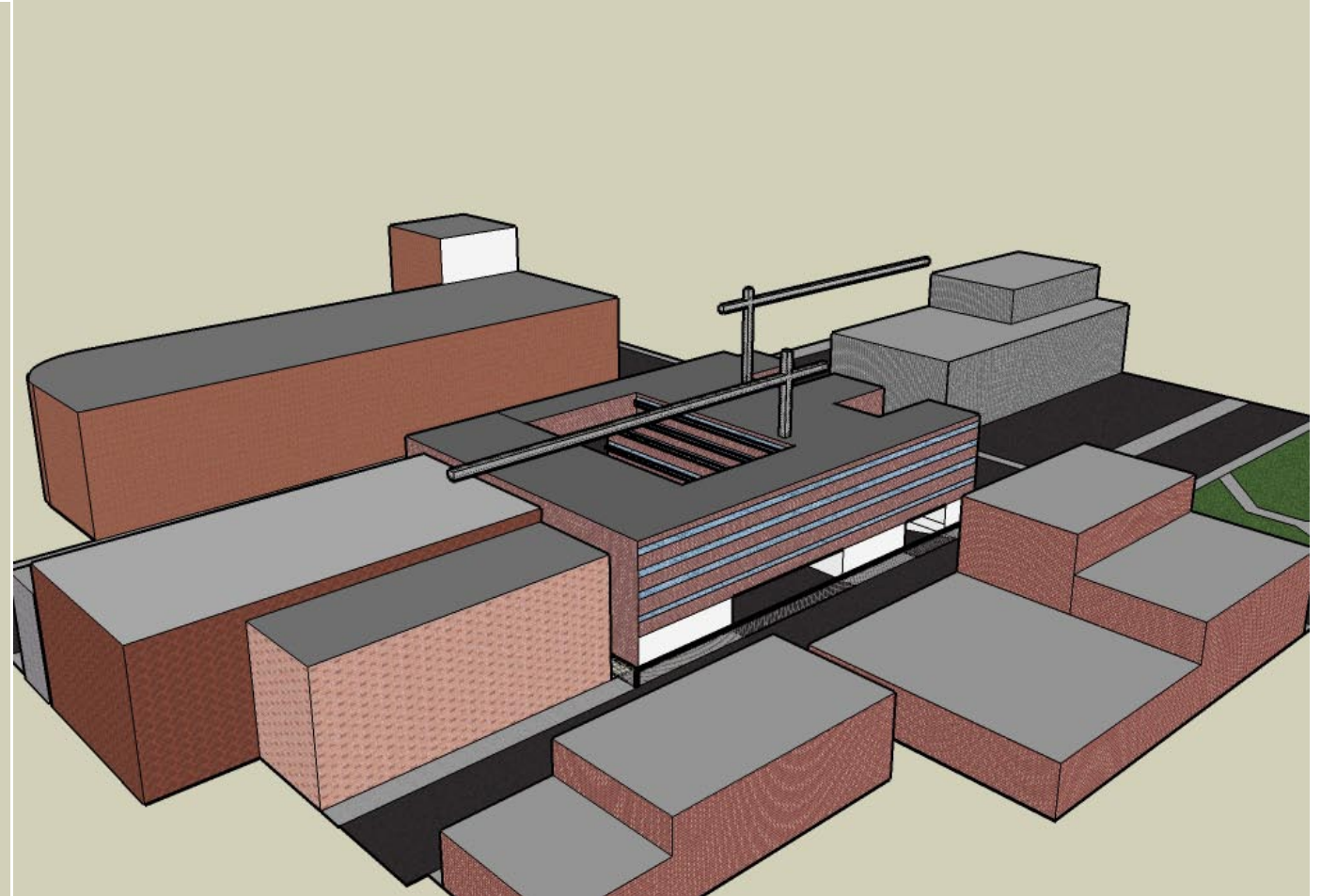
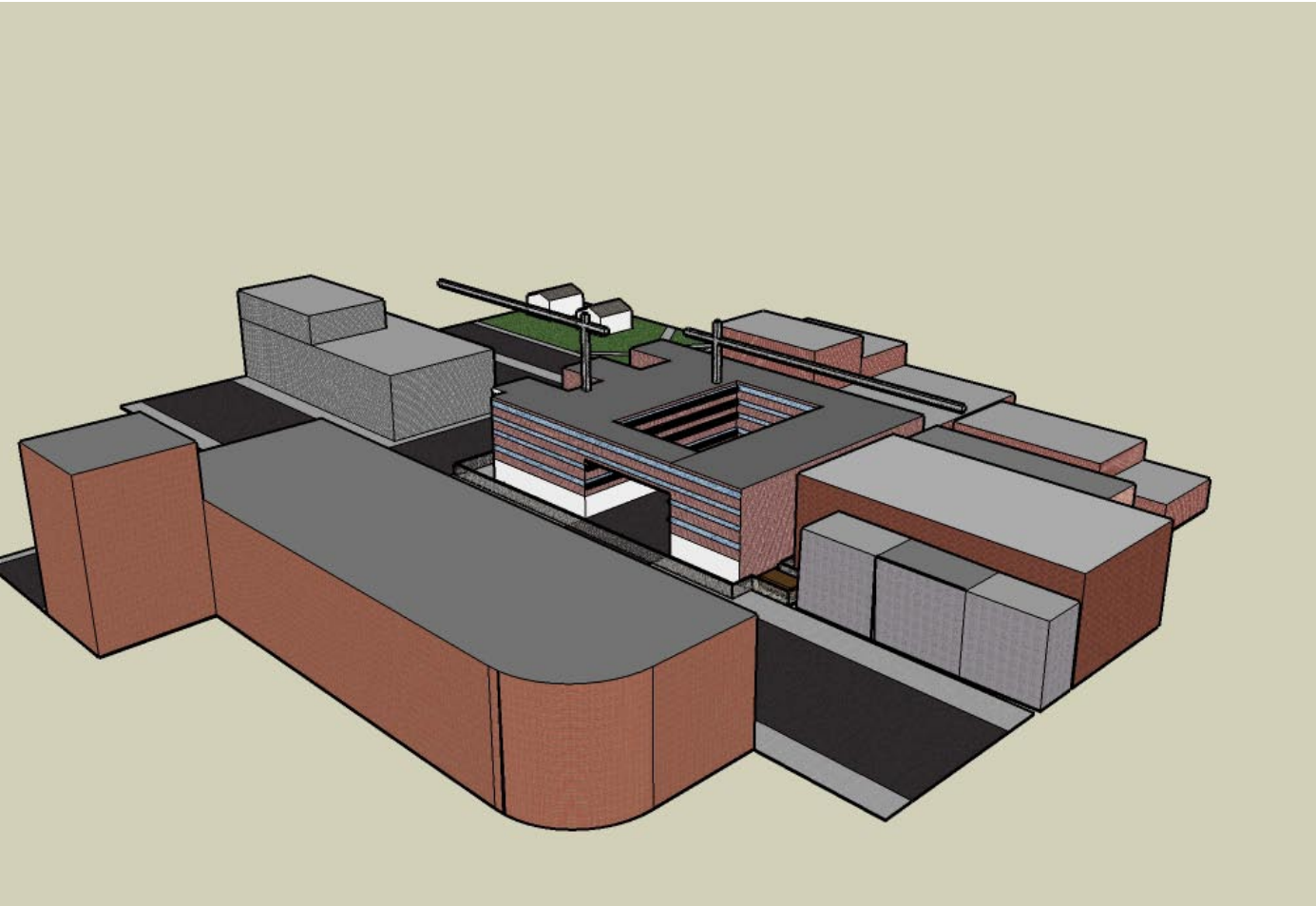
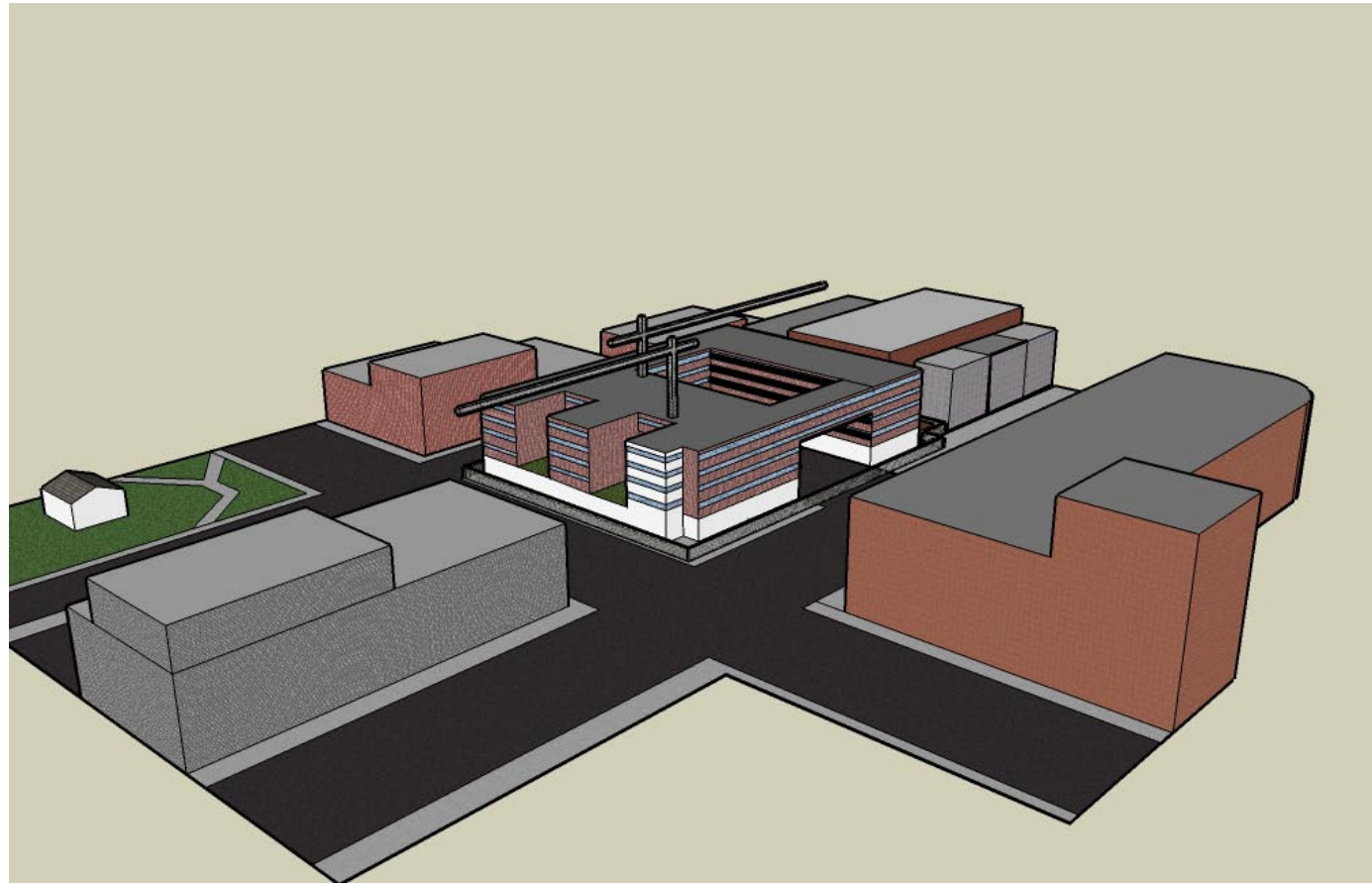
The RS Means estimate was about \$3 million less than the actual cost of the building. The problem with the RS Mean estimate is that it does not take into consideration many features of the building. Even though I added some cost for some additional features that I took in consideration, I am sure that there were many other items that were not considerate in the RS Means estimate. Moreover, RS Means does not take in account some costs such as; insurances, fees, or bonds.

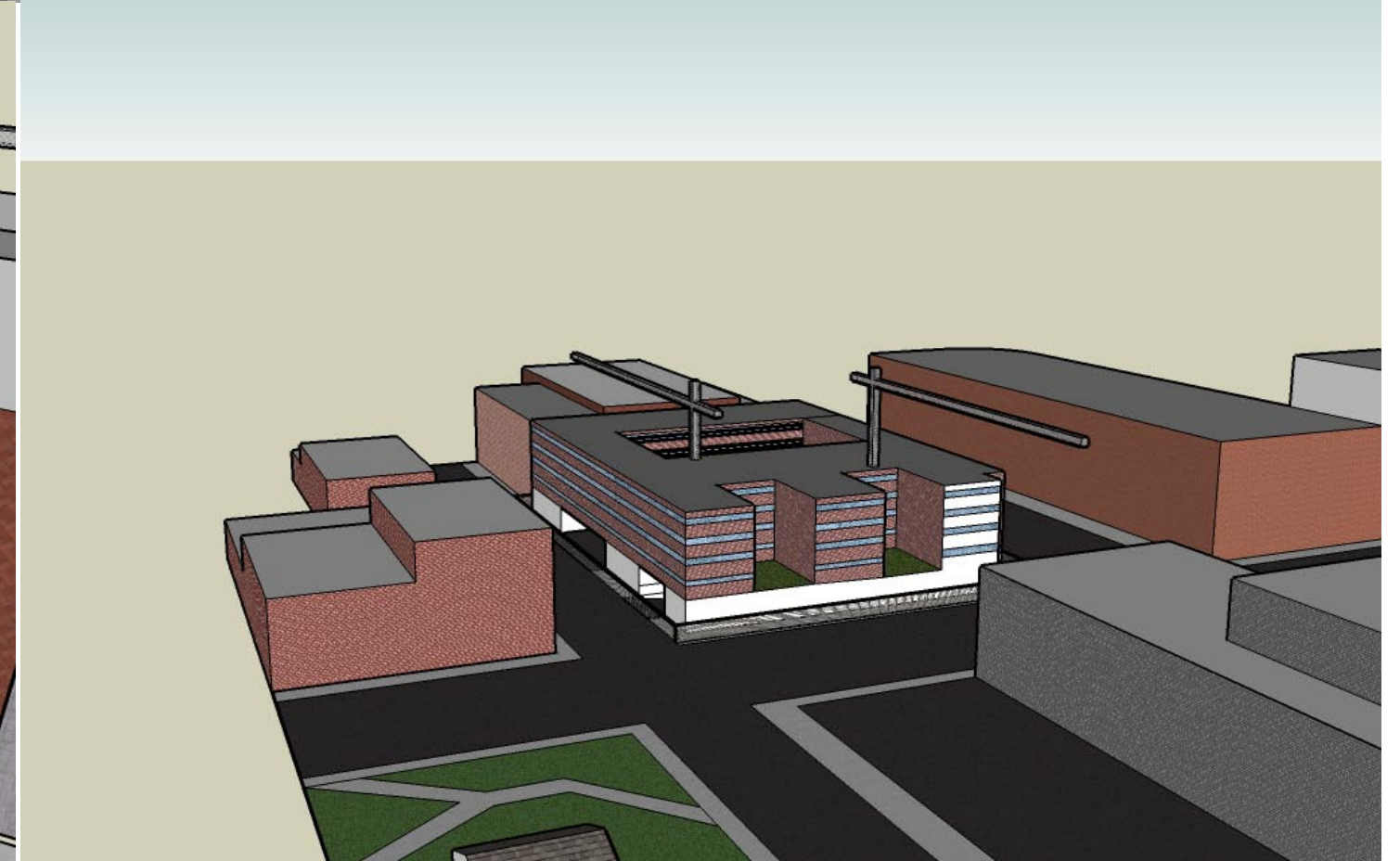
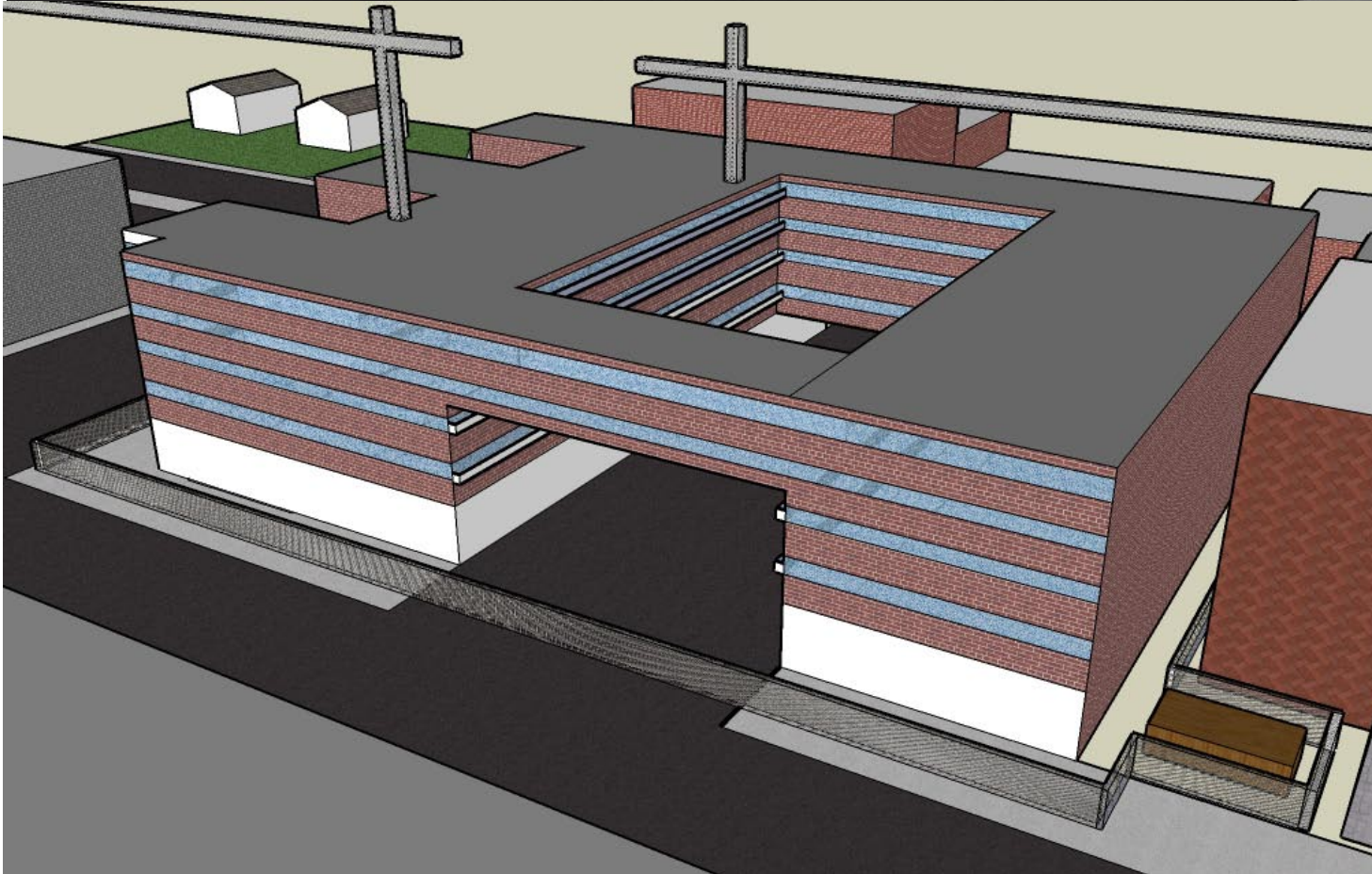
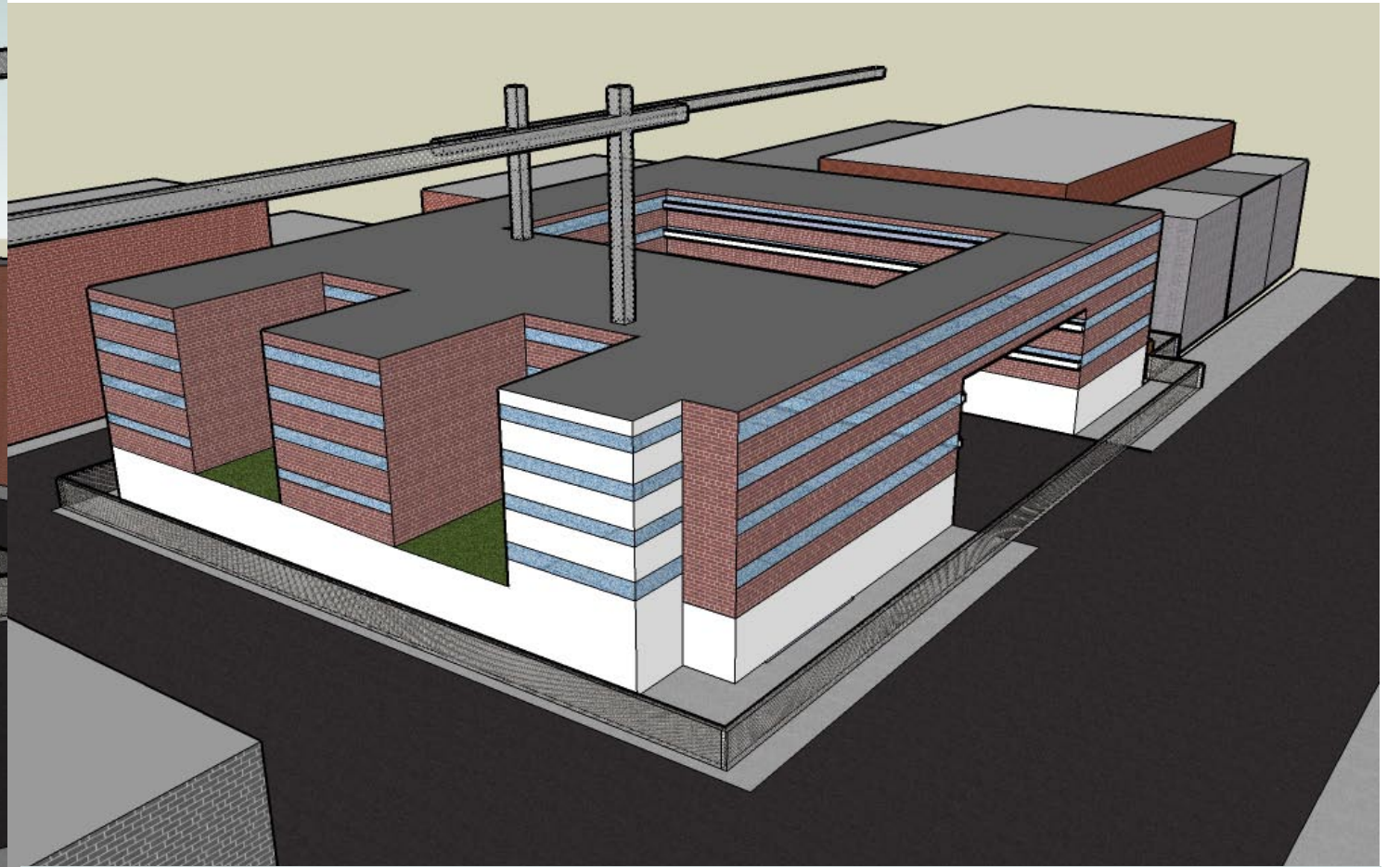
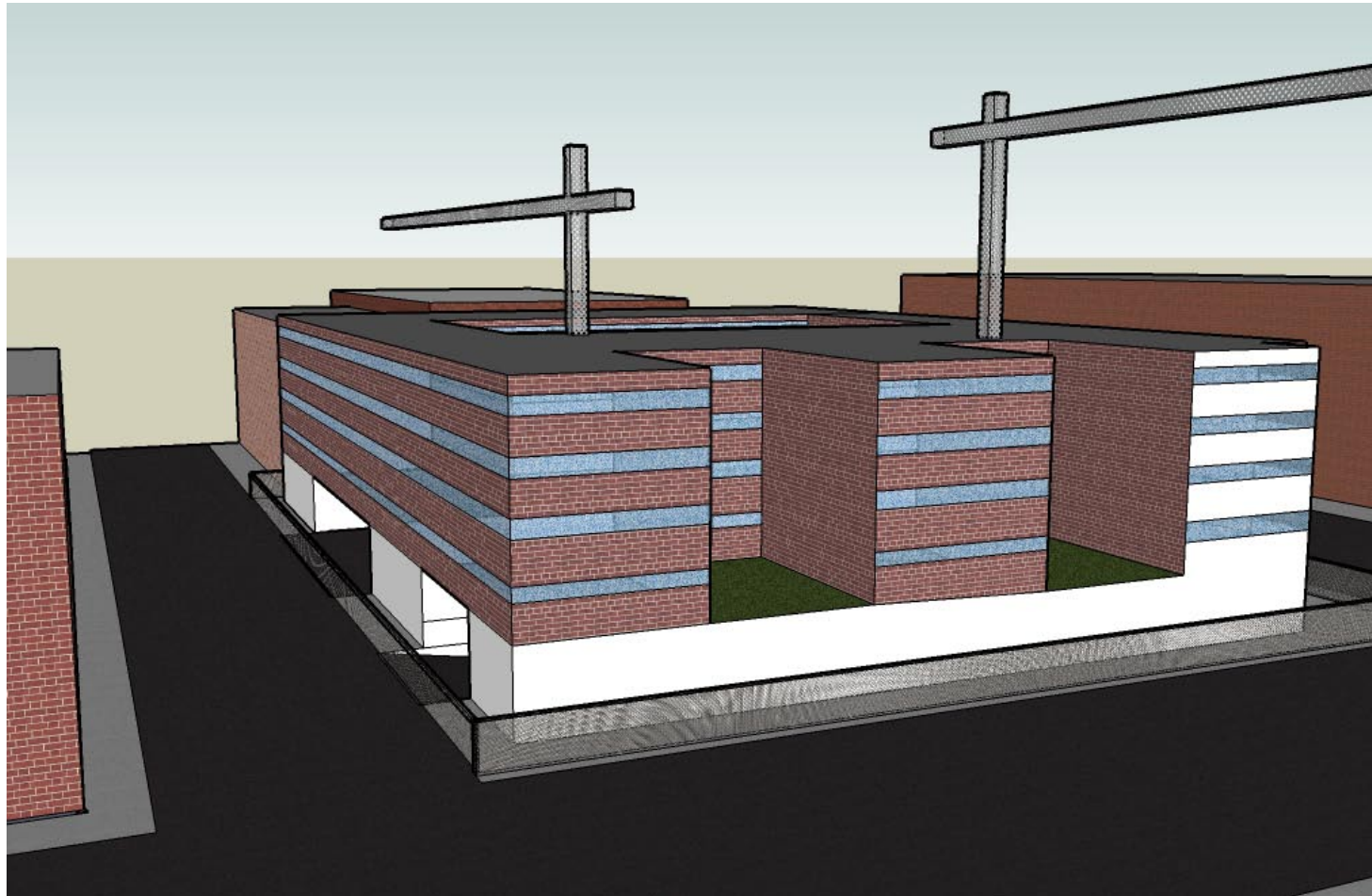
E. Site Plan of existing condition

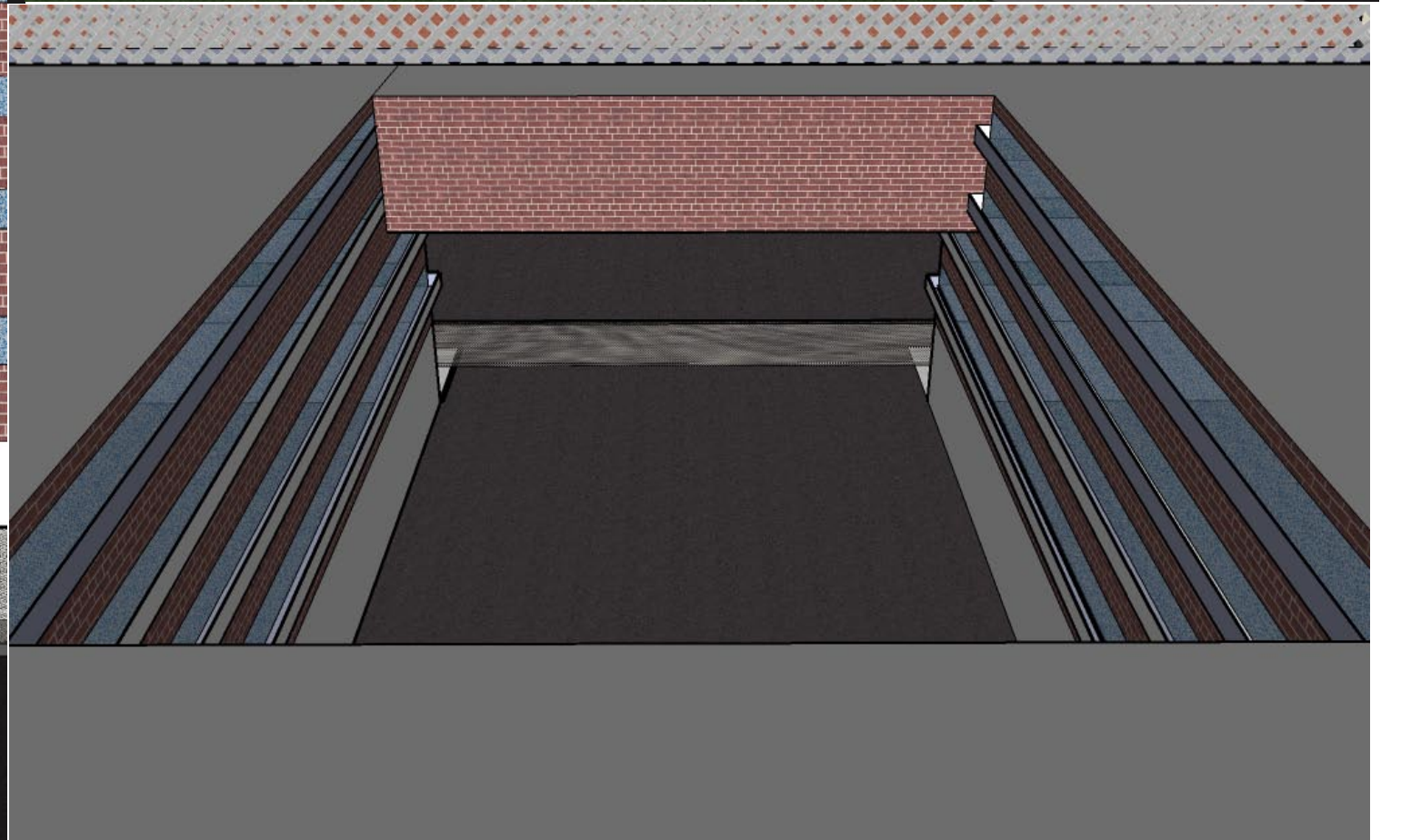
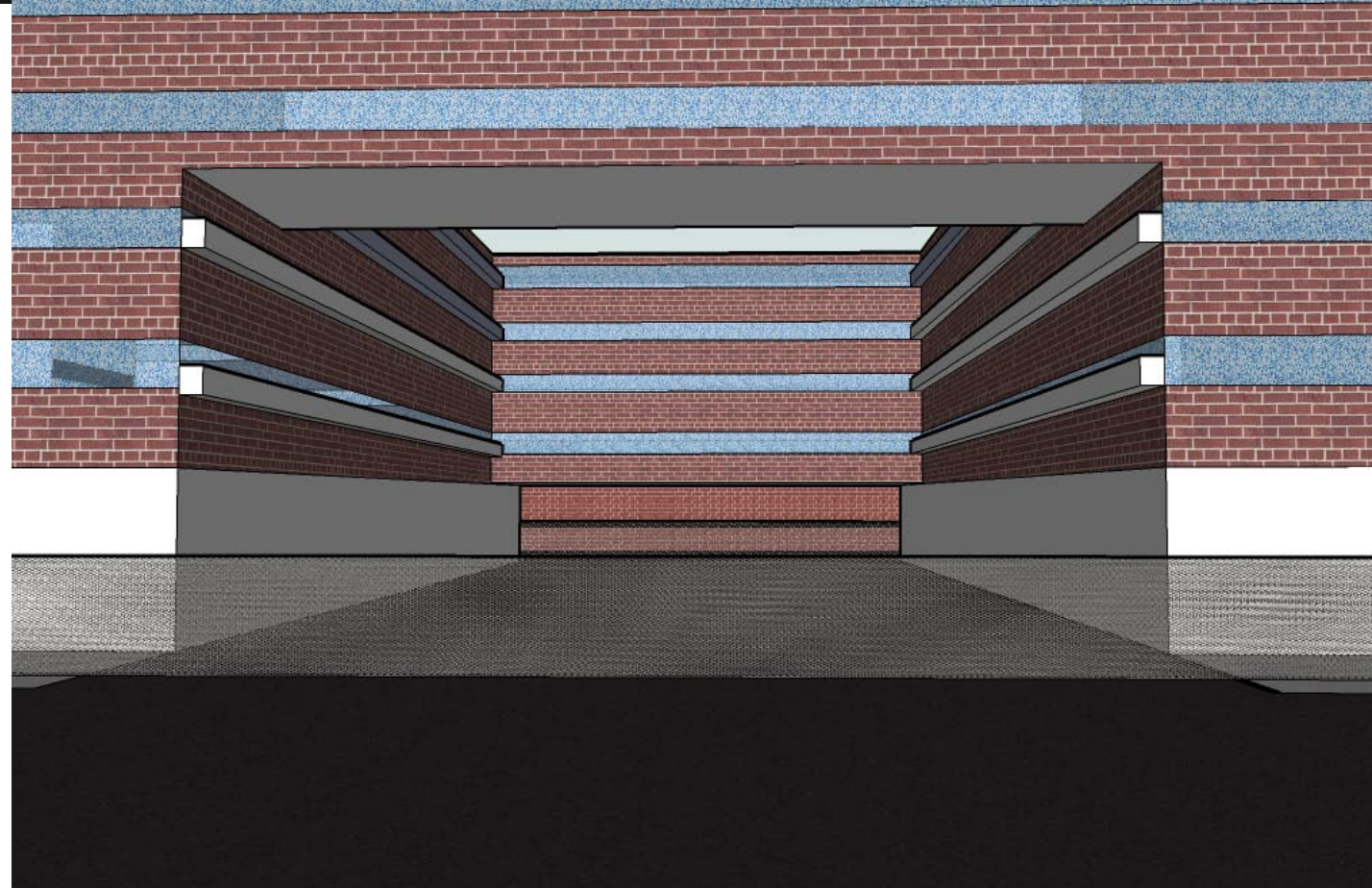
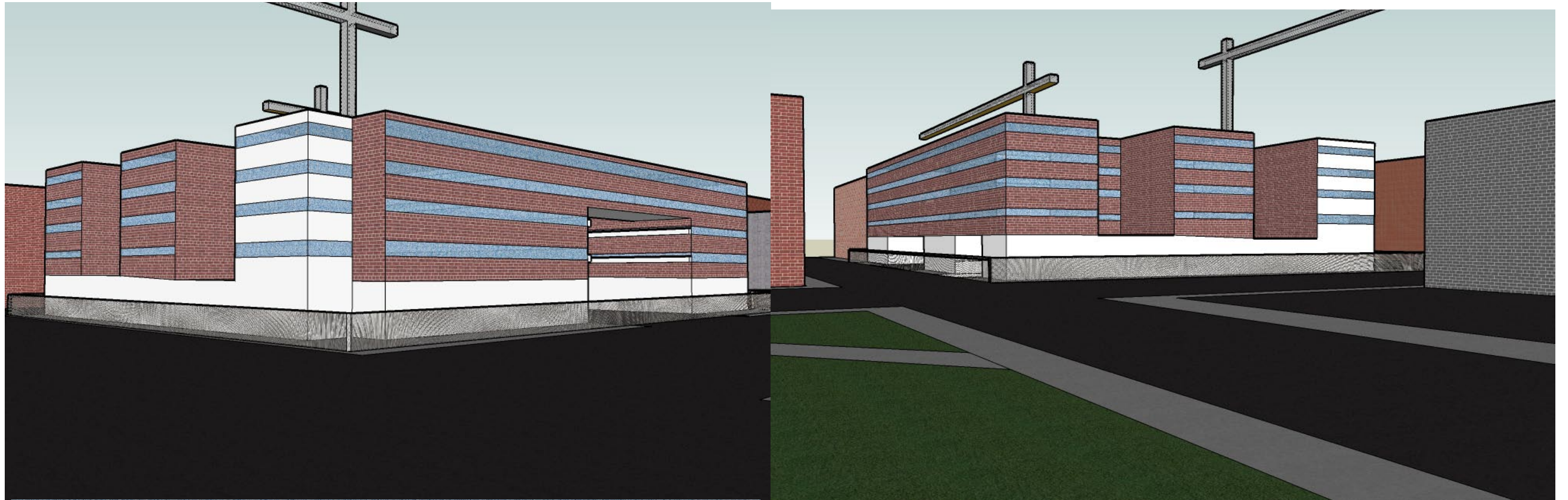


Above is an aerial picture of Bethesda, Maryland. The red portion is where the Apartment Complex project is located. The project is located close to Wisconsin Ave which is shown in yellow. On the following page, there is a site plan of the project showing all temporary facilities.









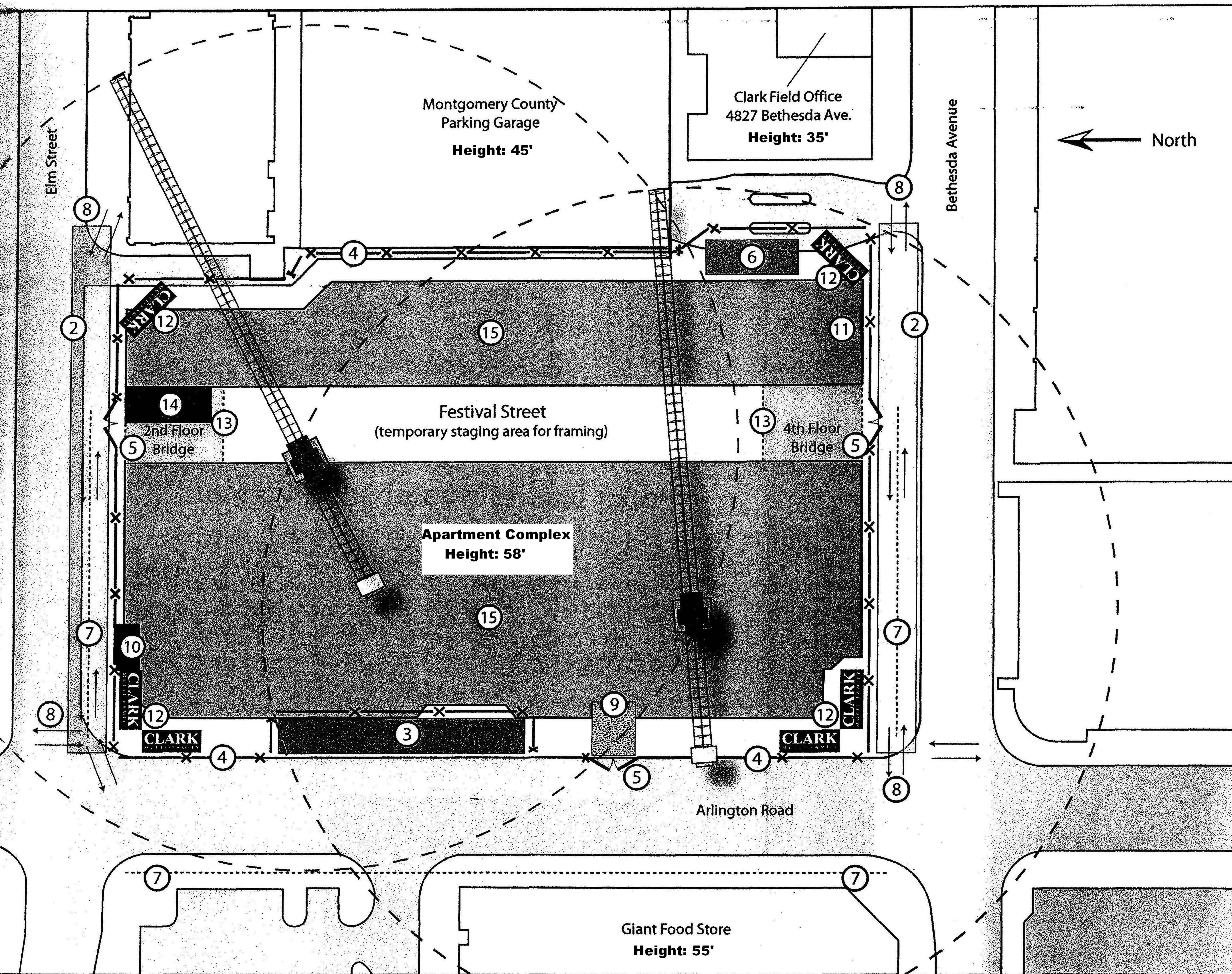
Apartment Complex

Bethesda, MD

Site Utilization Plan

Legend

- 1. Existing Building
- 2. Covered Walkway
- 3. Concrete Staging Area
- 4. Construction Fence
- 5. Construction Entrance & Gate
- 6. M & L Field Office
- 7. Overhead Power Line
- 8. Pedestrian Traffic
- 9. Proposed Construction Entrance
- 10. Temporary Power
- 11. Temporary Water
- 12. Clark Sign
- 13. Bridge
- 14. Trash Chute w/ Dumpster Below
- 15. New Building



10/05/2007

F. Local Conditions

In 1899, Congress passed a law that limited buildings to the height of the Capitol. That law is still effective today. For this reason most buildings in the area are designed as cast-in-place concrete rather than with a structural steel frame. The floor-to-floor height that can be achieved with concrete is lower than the floor-to-floor height that is achieved with steel. That is why concrete is used more in DC than in other cities. Designers can typically get one more floor out of a building when designed by concrete rather than steel. However, Apartment Complex is a hybrid. Cast-in-place concrete was definitely not the preferred method by the builder. This project combines many different materials such as; wood, steel, metal studs, as well as concrete.

The Apartment Complex is located just few blocks away from a metro and bus stop. Most of the workers take the bus or the metro to get to the jobsite. However, there are 5 public parking garages that are located within three blocks from the construction site. Those public garages are somewhat expensive and are not covered by the owner. However, some of the employees park their cars there because it is convenient.

On the jobsite, there are two thirty cubic yard open-top dumpster that are removed constantly. There is a \$135 charge per pull, in addition to a \$15 fuel surcharge and a \$60 disposal charge. Laboratory tests results of soil from 8 test borings that were taken revealed that there were mainly three types of soils; reddish brown clayey sand with gravel, reddish brown sandy lean clay, and reddish brown silty sand with gravel. Groundwater was not encountered in any of the test borings taken.

G. Client Information

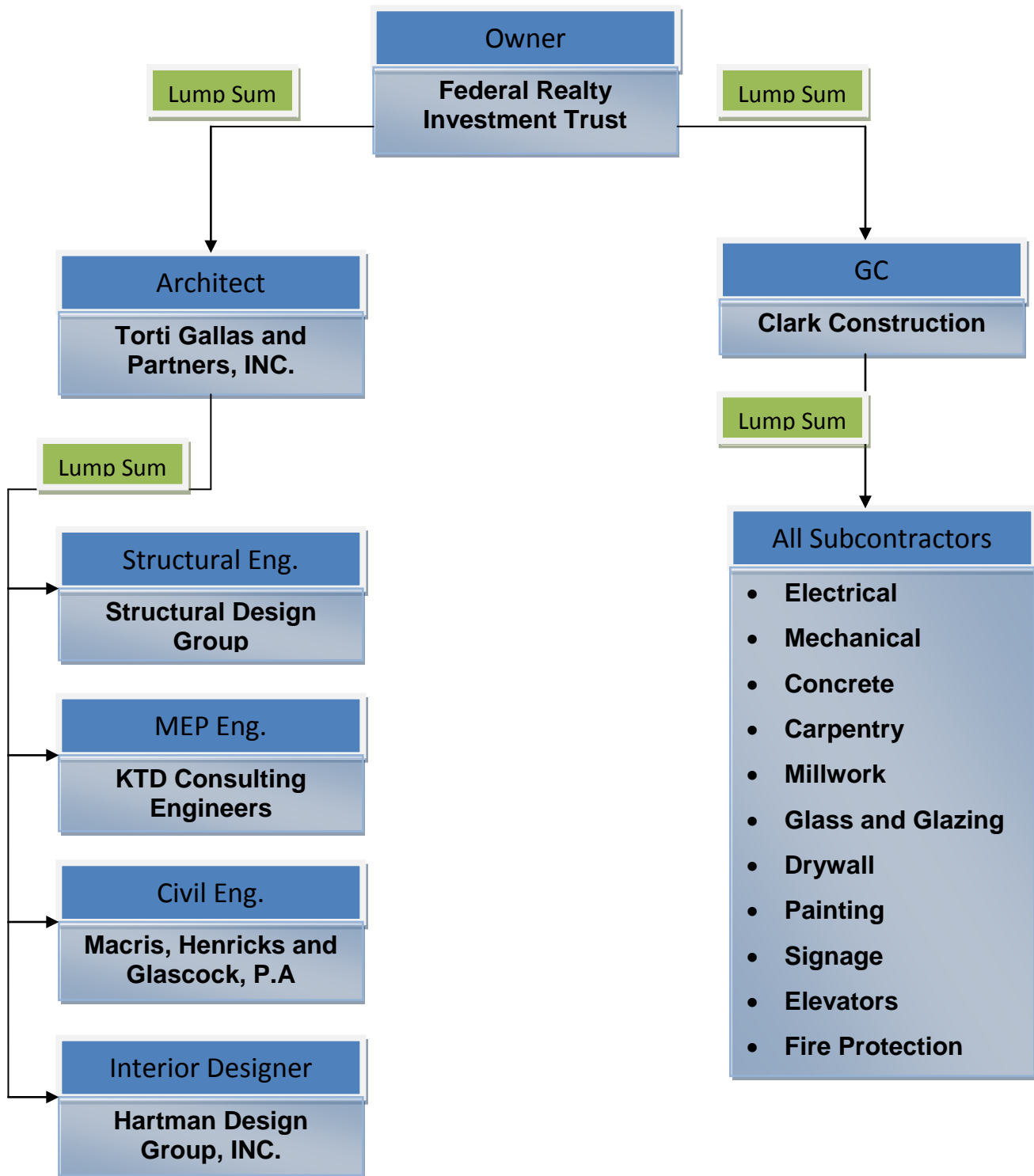
Federal Realty Investment Trust is an equity real estate investment trust specializing in the ownership, management, development, and redevelopment of high quality retail assets. Federal Realty's portfolio contains approximately 19.5 million square feet located primarily in strategic metropolitan markets in the Northeast, Mid-Atlantic, and California. Federal Realty is building the Apartment Complex project in Bethesda because is one of the growing areas in the DC area. Bethesda is actually one of the most expensive places to live in DC. Build in Bethesda is very profitable. The market is very large and the demand is increasing every day. Federal Realty is a very experienced company, and they know that a well done project in Bethesda will certainly be a very profitable project.

Since Federal Realty is a very experienced company and they know how the construction process works, they know that there will always be changes in every project. They know that change orders are part of the construction process. There is a \$450,000 contingency that they expect to take care of any unexpected changes. Federal Realty expects the project to be completed in a high quality manner, within budget and on schedule. Construction is scheduled to be 30 months in duration, with a substantial completion on April 11, 2008.

Federal Realty also expects the project to be completed in a safe way. Completing the project without any accident is one of the main goals for this project. Federal Realty as well as Clark construction, who is actually performing the job, think that a project with accidents cannot be considered a successful project. Measures have been taken to ensure the safety for everyone during and after the project is completed. OSHA guidelines are expected to be followed during construction for the safety of every worker. Fencing, traffic control, temporary lighting, access control, security monitoring, and life safety protection such as fire alarms and fire suppression systems, are some of the items that were incorporated during construction to assure the safety of every employee.

Federal Realty gave Clark the responsibility to complete the project. The sequencing of the project is up to Clark. The owner just cares about the final product. If the project is completed on time, within budget and with the expected quality, then the owner will be satisfied.

H. Project Delivery System



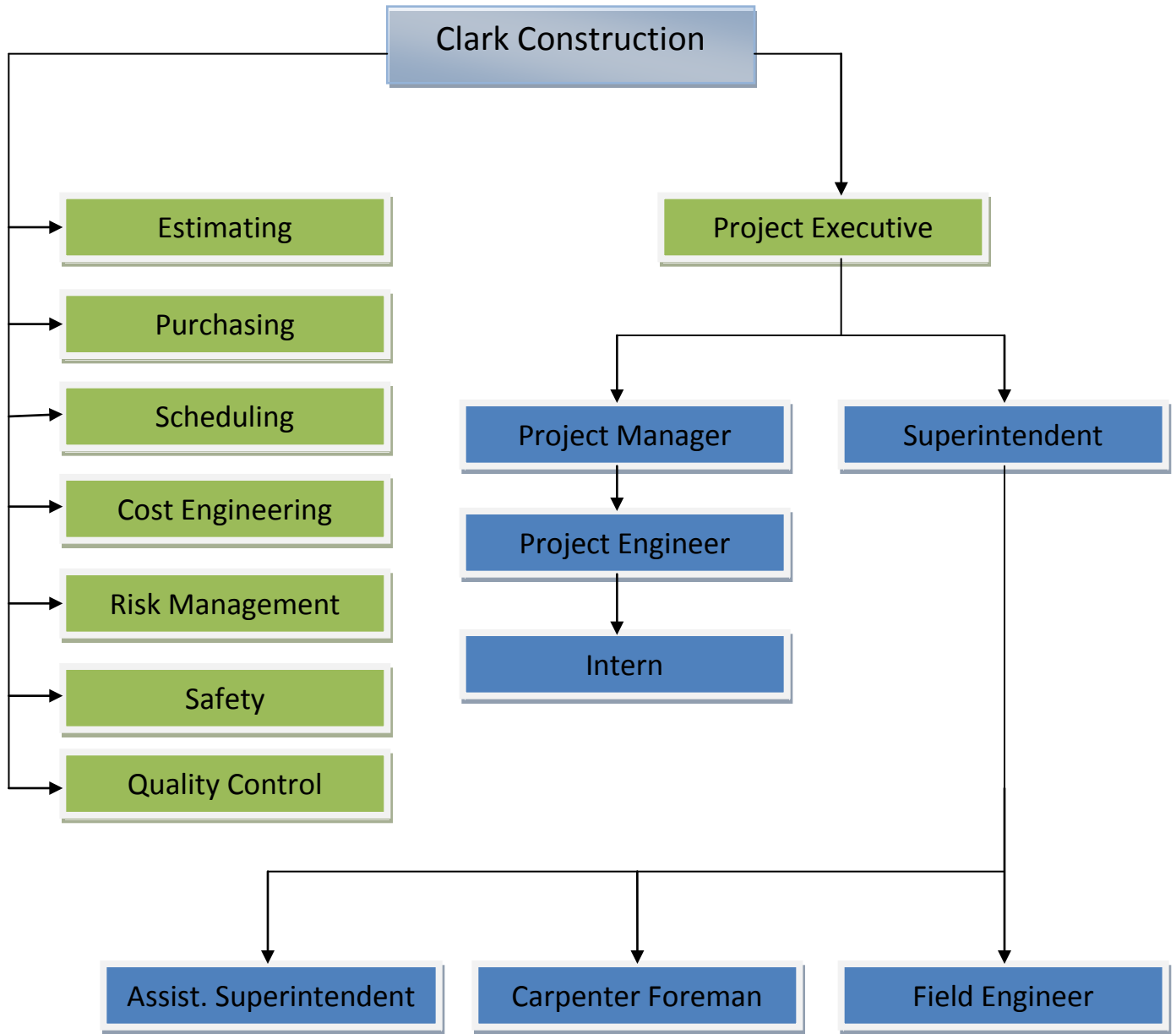
The delivery method that is being used on this project is design-bid-build. The owner hired design professionals to prepare a complete set of contract document, which includes plans and specifications, for a set price. The owner paid the designers a fixed price, called lump sum, to complete the project plans and specifications. Once the contract documents were complete and given to the owner, then the owner hired a GC. Clark Construction was hired by the owner to manage the project. The owner negotiated with Clark the contract, and they agreed on a lump sum type of contract. The owner will pay Clark \$50,047,750 to complete the entire project. However, Clark will have to manage all of the subcontractor's contracts. The owner only has a contract with Clark.

Once Clark was awarded the project, they had to hire every subcontractor for every trade. Clark bid the project, and a different contractor was selected for every trade. As in most of the projects, the lowest bidder was selected. Clark then needed to negotiate the contract with every subcontractor. The contract type used for all the subcontractors was a lump sum contract. The cost of the work for every trade was set before any work began. Moreover, every subcontractor needed insurance and bonds before starting any activity.

When an owner is not very experienced with the construction process, the best thing to do is to hire someone else to manage the entire project. Design-bid-build is a delivery method that allows the owner to allocate responsibilities and risks to others. The GC and the designers have all the responsibilities. Moreover, design-bid-build is the most common and best known delivery method. The down side of this delivery method is that the GC enters the project once the design of the building is completed. The GC has no input on design. Statistics have shown that projects tend to run smoother when the contractor has input on the design of the building.

When selecting design-bid-build, the preferred contract types for designers and subcontractors are lump sum contracts. For the GC was used a lump sum type of contract as well. The lump sum contract motivates the GC to do a better job because if they complete the project for less than the contract amount, then they get to keep the money saved.

I. Staffing Plan



Those employees that appear on the organizational chart with green background work mostly on the office. Their salaries are not necessarily charged to this project. Their salaries come from the overhead price of every project. They work in many different jobs at the same time. The people at the right side of the chart, with blue background are employees assigned only to this job. They work on the jobsite, and their salaries come directly from this project.

The project manager is responsible for developing and updated schedule, monitoring costs, managing all parties involved on the project, keeping the project on schedule and/or on budget, overseeing change orders, proposals, submittals, and RFI's. The project manager is helped by the project engineer and the project intern to accomplish all of these tasks.

The project superintendent is responsible for coordinating daily site activities and scheduling on-site construction, answering questions that subcontractors might have, managing laborers, performing general and miscellaneous construction tasks that are not assigned to any subcontractor. The project superintendent is helped by the field engineer, the assistant superintendent and the foreman to accomplish all of the tasks

The project executive is in charge of managing the entire staff of the project. The project executive deals with contracts, clients and bigger problems that people on the jobsite cannot solve. They are key players in every project even though they deal with many projects at the same time.