Stanton Elementary School, ***Washington, D.C.***

Technical Assignment 1:
Construction Project Management

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Executive Summary

The Stanton Elementary School construction project located in Washington, D.C. is a two phase renovation and building addition project. Phase one of this project included the renovation of the existing three story brick building located on the site. Phase two of this project includes a three story addition at the building's west (parking lot) entrance and one-story addition (that is attached to the existing building as well) that extends along the parking lot. This phase of construction also includes demolition of the annex, which is a brick one story building that was located perpendicular to the main building. During phase two, the site surrounding the school will be demolished and revamped to improve the school's surrounding landscape and parking lot. The phase two building addition is a 16 million dollar project and will cover 29,500 square feet.

Phase two of the Stanton Elementary School project is the main focus of the following technical report. This phase is currently under construction and on pace to be completed in April of 2016. Strict scheduling requirements act as a driver for this project. A project summary schedule is provided later in the report to identify major areas of the schedule and approximate deadlines for major project tasks. Building systems information is also provided, including some of the unique design aspects of each system. A brief cost analysis is also performed by breaking down actual building system costs and a square foot estimate is provided. Additionally, information on the client (Department of General Services), the project delivery method, and a staffing plan description are provided at the conclusion of the report.

Phase 2 Project Schedule Summary

The building renovation is projected to be completed on December 28, 2015. Site work and landscaping is projected to be completed by April 15, 2016. Additionally, a notable amount of demolition will need to occur in the existing building prior to construction of phase two. At this point in construction, very little attention must be paid to the site, for it will be demolished and readdressed by the end of the project. While the annex building will be demolished, the project schedule calls for this building to remain standing until substantial completion of the building addition. Therefore, construction begins with excavation for the building foundation. Piles can be drilled, pile caps should then be formed and placed, and continuous footings can be excavated, formed and placed. Backfill and compaction can occur where it is appropriate.

Once the building has taken shape the construction of the superstructure can begin. Connections to the concrete supports must be secured, steel erection can begin, and connections between steel columns, girders, and beams can occur. This building utilizes composite decking. Concrete placement for the slab on grade and for the composite decking can occur once the steel superstructure has been erected and is considered stable. Once construction of the superstructure has completed, the building enclosure can be put into place. The building design features a metal panel façade on both sections of the additions. Additionally, there is a massive curtain wall façade that is located at the building's west entrance. The building's interior is comprised of CMU walls.

Following the building enclosure, the major building systems, such as the building mechanical, electrical, security, plumbing, and fire protection systems can be installed. Finishing can begin once the MEP rough-in has completed. At this point in construction, different tasks that occur during finishing can be performed concurrently with the fit out of the MEP and other systems. Once the finishing stage has seen completion, the building can be furnished and welcome occupancy. Once substantial completion has occurred, the annex building can be demolished. At this stage in construction, landscaping can begin as well. Utilities, sidewalks, and the parking lot pavement must be demolished. Utility work on site will then need to be performed, along with the placement of sidewalks, the placement of the parking lot, and the planting trees or other types of vegetation on the site or on the building's green roof. A summary schedule is located in the *Appendix A* to provide additional clarification.

Building Systems Summary

Architectural System

The Stanton Elementary School addition utilizes a very different façade than the existing building. Architecturally, the building enclosure features an insulated metal panel façade system. The panels run horizontally for the building addition directly attached to the existing building. The metal panels run vertically for the metal panels enclosing the single-story addition. In addition to the panel façade, a large glass curtain wall is featured at the west entrance of the building. This large curtain wall paired with the large windows featured in the building design allow for a lot of natural daylight to enter the interior space. This helps with building sustainability.

Sustainable Systems

The green roof that is present on the roof of both the single-story addition and the two-story addition is the major sustainable system throughout the building. Waterproofing and drainage protection layers as well as a roof barrier are used in between the structural roof slab and the green roof vegetation. The green roof vegetation are sedum plantings on 4 inches of extensive planting media. Additional points of emphasis in sustainable systems includes thermal comfort systems that utilize low-emitting materials and feature easy controllability. Systems for water efficient landscaping and the recycling of materials help the project attain the LEED Gold certification for which the Stanton Elementary School is on track (the original goal was LEED Silver certification).

Structural System

The building utilizes a steel superstructure with mostly bolted connections. The floor system is a composite deck that is composed of four inches of lightweight concrete on top of a two inch 20 gage deck. In the pre-kindergarten wing, beam sizes range from W8x15 to 21x50. Typical girders are W24x68. In the remainder of the building, beam sizes range from W8x15 to W16x26. Typical girders throughout the remainder of the building are between W24x62 and W27x94. Column sizes range from W10x33 toW10x77 throughout the structure.

The building superstructure is supported by a building foundation that features a pile and pile cap system and a continuous footing system. The pile and pile caps system uses a total of 262 helical piles that are capped by a variety of eleven different sized pile caps. Helical piles range from depths of 5 to 30 feet from the base of its respective pile cap. Variability in soil bearing capacity throughout the site calls for the large differences in drilling depths. The continuous footings run along the perimeter of the building. The foundation wall is concrete masonry unit wall.

Electrical System

The electrical system power is provided to the main switchboard MDPH. Switchboard MDPH supplies power to distribution panels MPDL and GEN. Switchboard MDPH also supports mechanical roof top units, condensing units, kitchen loads, standby loads, and lighting in the building addition. This switchboard operates as a 265 V/460 V system. Distribution Panel MDPL supports the power risers, building addition power, basement power, the HVAC riser, mechanical room loads, and stage lighting. This switchboard operates as a 120 V/208 V system. Distribution Panel GEN supports he fire pump, life safety lighting, the building addition elevator, and standby power. This switchboard operates as a 277 V/408 V system.

Lighting System

The building lighting is defined by seven major, unique zones: classrooms; corridors, lobbies, and vestibules; cafeteria; multipurpose room; private offices and open offices; conference rooms; and stairwells. Classroom lighting uses dimmable ballasts and is broken into three different zones that separate the front of the room, the middle of the room and the back of the room. Lighting for the building's corridors, lobbies, and vestibules are controlled by a time clock in a centralized lighting control system. A low voltage override switch is used to turn on the lights in these areas during after-operation hours. The cafeteria uses a simple low voltage two-button switch at each entrance.

The multipurpose room has the most involved lighting system, for it includes lighting for the stage within this space. At the room's entrances, the lighting system is operated by a low voltage two-button switch. A five-button switch is located behind the stage and used for stage lighting specific to scene control. All light fixtures are equipped with dimmable drivers/ballasts between 10% and 100% light outputs. Each row of fixtures moving back on the stage is under a separate zone.

Office spaces utilize a low voltage two button system. Both the office spaces and conference room spaces use dimmable ballasts. The building stairwells use dimmable ballasts as well. The building stairwell lighting is unique based on the fact that it is tied into the life safety power panel. The classrooms, cafeteria space, offices, conference rooms, and stairwells all utilize occupancy sensors that trigger the lighting within those spaces to emit light to 100 percent output as an individual enters that space.

Mechanical System

The mechanical system was designed based on a 91^{o}F summer dry bulb temperature and an 11^{o}F winter dry bulb temperature. The mechanical system used in the school is a variable refrigerant flow system using variable air volume terminals for distribution. The air temperature and output is controlled by a building automation system computer. This automation system is interconnected between the rooftop mechanical equipment, variable refrigerant flow condenser units, and variable air volume output terminals to regulate desirable building temperatures. This system is supported mostly by switchboard MPDH. Mechanical rooftop and condensing units receive power from the main switchboard MDPH. The mechanical riser and smaller mechanical equipment spread throughout the building receive power from distribution panel MDPL.

Fire Protection System

Fire protection within the building occurs with a quick response sprinkler system with a 155^{o} rating. Sprinkler heads are semi-recessed in the ceiling except for in the main lobby where sprinkler heads are recessed with a cover plate. All sprinklers within the building cover an area of 1500 square feet. Most sprinklers within the building release at a water pressure of 0.15 gallons per minute per square foot area. Fire protection main piping is 2.5 inches and larger. Branch piping is 2 inches and smaller. The building standpipe in stair A is a 6-inch pipe. Stair T uses a 4-inch standpipe.

The fire alarm system includes fire alarm strobe lights in each room, whether the room is a classroom, office, or corridor. Classrooms feature extra protection, as they each have fire alarms in addition to the strobe lights, and a fire alarm manual station. Bathrooms also have a fire alarm and strobe light combination. Smoke detectors are located on each floor in the elevator lobby. The fire alarm system is tied in with various building systems to limit the spread of smoke during a fire. The system is able to shut down mechanical units, activate the alarm indicator system, recall the elevator to the primary floor, and close dampers in the mechanical units.

Phase 2 Project Cost Evaluation

As previously stated, the total project cost for the phase 2 addition is $16 million. The actual cost of the building only is $13.2 million. Additional building cost information is represented in *Table 1*.

Table 1: Building Cost Breakdown

Project Cost	Total Cost	Cost per square foot
Total Project	$16 million	$654 per ft^2
Total Building Addition	$13.2 million	$540 per ft^2
Electrical System	$1.8 million	$74 per ft^2
Structural Steel	$1.3 million	$53 per ft^2
Concrete & Masonry	$1.4 million	$57 per ft^2

At this stage in cost analysis, a square foot estimate, accurate to a projected +/-15% has been produced. This building was modelled as two to three story educational building with a steel frame and a brick façade. These assumptions gave the most accurate representation of the building compared to the other options provided, as this model was based off of RS Means data. With the building addition coming in at approximately 29,520 square feet, the base building cost was determined to be $195.60 per square foot. After accounting for a perimeter and height adjustment, the total cost per square foot arrived at $165.81 per square foot, leading to a base cost of $4,894,711. After accounting for the addition of a green roof, clock system for each classroom, moveable desks and chairs for each classroom, and the location factor for a Washington, D.C. commercial construction project, an estimate of $4,747,897 was developed. Including additives such as general conditions, fee, contingency and bond, the final square foot cost estimate arrived at $6,599,539 +/- 15%. There is an incredible gap between the actual project cost and the cost projected by the square foot cost estimate. Potential sources of error could have occurred by the assumptions made on building type when selecting a building from RS Means; lack of consideration to building systems; and the fact that this project is a building addition rather than the construction of an entirely new building. Demolition costs were also not included in this cost estimate. A further breakdown of the projected costs for each system is provided in *Appendix B*.

Phase 2 Site Logistics Plans & Existing Conditions

Construction space is limited to the grounds currently owned by the school. The site is constricted by Naylor Road east of the school, an apartment complex and two restaurants north of the building, 25th Street west of the building, and the school's turf athletic fields south of the building. Additionally, there is already an existing fence laid around the sight. The best location for the contractor to gain access to the site is by entering the sight from 25th Street west of the site. Material and equipment deliveries should be made at the 25th Street entrance to the site. Students shall be dropped off and picked up at the 25th street entrance as they always have. A better depiction of the site logistics can be seen in the appendix with the site logistics plan. This graphic also shows utilities and fire hydrant locations as well as the location of the annex that is to be demolished and the building addition that is a part of phase two of construction. It is also important to note that the Annex building will not be demolished until after the building addition has been completed and students have moved into that space. The site logistics plan in *Appendix C* demonstrates how this affects the boundaries of the site.

Client Information

The project owner is the Department of General Service (DGS). During phase one of the building renovation and addition, the owner's intent was to bring the building up to code, enhance the classroom spaces to make them more space efficient and remodel the classrooms to meet current educational specifications. Phase two of the project was determined to be necessary to keep up with the increased enrollment that Stanton Elementary School has been seeing. The design of both the phase one renovation and the phase two addition are meant to enhance the experience and the quality of learning that students are receiving by attending Stanton Elementary School. To maintain that construction is performed up to the standards outlined in the construction documents and project specifications, the owner has brought on a third party inspector to assure a quality project is delivered.

The owner's expectations for this project were fairly simple: deliver the project on-time and on-budget. In regard to project sequencing, the owner expected that all work for phase one would be completed during the academic 2014 summer. Owner's expectations for phase two are that phase two will be completed by the end of 2015 to permit students to move from the annex to the new building. Because one of the main goals of the project was to provide students with more space due to the increasing numbers in student enrollment, the owner has requested that the Annex demolition does not occur until after students have relocated into the new building addition. This would mean the Annex cannot be demolished until 2016. The owner expects that the Annex will be completely demolished with finished site work no later than April 15, 2016. As far as safety standards go, the contractor's safety standards exceed the standards put in place by OSHA requirements in several cases. The owner should not expect to have issues with safety due to the contractor's attention to safety. The owner also expects to receive a LEED Silver certification for this project. The project is on track to receive a LEED Gold rating, and could even improve upon that rating if a few of the LEED sustainability measures that are currently uncertain are eventually sought out later in the project.

Project Delivery System

The contractor has indicated that this is design build project with a guaranteed maximum price (GMP) agreement. After further analyzing the contractual agreement between the construction manager and the owner, this project truly does appear to be a design-build GMP agreement. References are made multiple times regarding the contractors responsibility as a design-builder throughout each phase of construction. Contractual relationships between the contractor and any subcontractors are unknown to this point.

Staffing Plan

On the job currently, the contractor has a project manager that oversees the work of three superintendents. There is a daytime project superintendent, an interiors superintendent, and a night project superintendent. All three superintendents must communicate accomplished work with each other so that everyone is up to speed with the current status of construction. Each super must fill in the project manager and receive direction from the project manager. This project also recognizes an MEP engineer, and FF&E engineer and an engineer's assistant. The engineers shall be consulted when an issue arises with a system, whether the issue is with constructability, clashes with other system, or concerns with the efficiency of the system. The project manager and engineering staff must communicate with one another to ensure systems are being installed correctly and are working up to the standards to which they are expected. Reference the attached staffing plan organizational chart in *Appendix D* to gain a better understanding of the staffing relationships.

Appendix

The following elements are a part of the appendix and may have been referenced throughout the course of the technical report:

I. Appendix A: Project Summary Schedule

II. Appendix B: Square Foot Cost Estimate

III. Appendix C: Site Logistics Plan

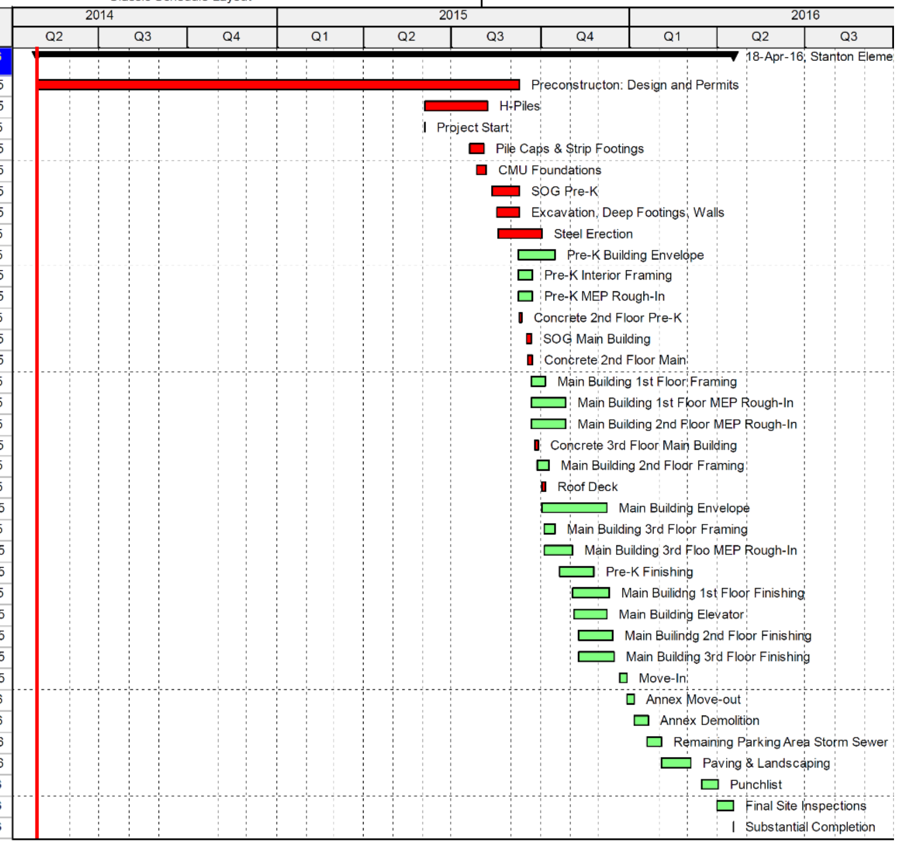
IV. Appendix D: Contractor Staffing Plan

Appendix A: Project Summary Schedule

Summary Schedule

Classic Schedule Layout

Activity ID	Activity Name	Original Duration	Remaining Duration	Start	Finish
Stanton Elementary Summary Sch		516	516	28-Apr-14	18-Apr-16
A1000	Preconstructon: Design and Permits	358	358	28-Apr-14	09-Sep-15
A1030	H-Piles	48	48	03-Jun-15	07-Aug-15
A1370	Project Start	0	0	03-Jun-15	03-Jun-15
A1040	Pile Caps & Strip Footings	11	11	20-Jul-15	03-Aug-15
A1050	CMU Foundations	9	9	27-Jul-15	06-Aug-15
A1070	SOG Pre-K	21	21	12-Aug-15	09-Sep-15
A1060	Excavation, Deep Footings, Walls	18	18	17-Aug-15	09-Sep-15
A1090	Steel Erection	34	34	18-Aug-15	02-Oct-15
A1140	Pre-K Building Envelope	28	28	08-Sep-15	15-Oct-15
A1160	Pre-K Interior Framing	11	11	08-Sep-15	22-Sep-15
A1170	Pre-K MEP Rough-In	11	11	08-Sep-15	22-Sep-15
A1100	Concrete 2nd Floor Pre-K	3	3	09-Sep-15	11-Sep-15
A1080	SOG Main Building	3	3	17-Sep-15	21-Sep-15
A1110	Concrete 2nd Floor Main	3	3	18-Sep-15	22-Sep-15
A1200	Main Building 1st Floor Framing	11	11	22-Sep-15	06-Oct-15
A1210	Main Building 1st Floor MEP Rough-	26	26	22-Sep-15	27-Oct-15
A1240	Main Building 2nd Floor MEP Rough	26	26	22-Sep-15	27-Oct-15
A1120	Concrete 3rd Floor Main Building	3	3	25-Sep-15	29-Sep-15
A1230	Main Building 2nd Floor Framing	10	10	28-Sep-15	09-Oct-15
A1130	Roof Deck	3	3	02-Oct-15	06-Oct-15
A1150	Main Building Envelope	49	49	02-Oct-15	09-Dec-15
A1260	Main Building 3rd Floor Framing	10	10	05-Oct-15	16-Oct-15
A1270	Main Building 3rd Floo MEP Rough-I	22	22	05-Oct-15	03-Nov-15
A1180	Pre-K Finishing	26	26	21-Oct-15	25-Nov-15
A1220	Main Builidng 1st Floor Finishing	29	29	03-Nov-15	11-Dec-15
A1190	Main Building Elevator	26	26	04-Nov-15	09-Dec-15
A1250	Main Builindg 2nd Floor Finishing	27	27	09-Nov-15	15-Dec-15
A1280	Main Building 3rd Floor Finishing	28	28	09-Nov-15	16-Dec-15
A1290	Move-In	6	6	22-Dec-15	29-Dec-15
A1300	Annex Move-out	6	6	29-Dec-15	05-Jan-16
A1310	Annex Demolition	11	11	06-Jan-16	20-Jan-16
A1320	Remaining Parking Area Storm Sew	11	11	20-Jan-16	03-Feb-16
A1330	Paving & Landscaping	23	23	03-Feb-16	04-Mar-16
A1340	Punchlist	13	13	16-Mar-16	01-Apr-16
A1350	Final Site Inspections	12	12	01-Apr-16	18-Apr-16
A1360	Substantial Completion	0	0	18-Apr-16	18-Apr-16



Actual Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | summary

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TASK filter: All Activities

Figure 2: Stanton Elementary School Summary Schedule

Appendix B: Square Foot Cost Estimate

Square Footage Estimate						
Category		**Quantity**	**Units**	**Assumptions**		
Base Cost/SF:	$	195.60	/SF	Assume face brick with Concrete from RS Means		
Perimeter Adjustment:		-27.99	/SF			
New Base Cost:	$	167.61	/SF	Adjusted for Perimeter		
Story Height Adjustment:		-1.80	/SF	15 feet tall average story heights		
New Base Cost:	$	165.81	/SF	Adjusted for Perimeter and Floor to Floor Height		
Final Base Cost:	**$**	**165.81**	/SF			
Building Area:		**29,520**	SF			
Building Cost:	**$**	**4,894,711.20**		Final Base Cost x Building Area		
Green Roof Additive	**$**	**112,129.00**				
Classroom Clock System Additive	**$**	**46,800.00**				
Moveable Desks/Chairs	**$**	**65,646.00**				
Location Factor:		0.97		Washington, D.C. Location Factor		
Building Sub-Total	**$**	**4,747,869.86**				
Direct Cost				**% of Total**	**Cost**	
Substructure				**4.10%**	**$**	**194,662.66**
Superstructure				**13.90%**	**$**	**659,953.91**
Exterior Enclosure				**16.30%**	**$**	**773,902.79**
Roofing				**5.20%**	**$**	**246,889.23**
Interiors				**19.90%**	**$**	**944,826.10**
Converying				**0.50%**	**$**	**23,739.35**
Plumbing				**4.80%**	**$**	**227,897.75**
HVAC				**15.90%**	**$**	**754,911.31**
Fire Protection				**2.10%**	**$**	**99,705.27**
Electrical				**15.10%**	**$**	**716,928.35**
Equipment and Furnishings				**2.20%**	**$**	**104,453.14**
Fees						
Building Sub-Total:	**$**	**4,747,869.86**		With Additives and Location Factor		
General Conditions				**10.00%**	**$**	**474,786.99**
Temporary Facilities				8.00%	$	37,982.96
Supplies				2.00%	$	9,495.74
Temporary Utilities				5.00%	$	23,739.35
Safety				2.00%	$	9,495.74
Logistics				3.00%	$	14,243.61
Staffing				60.00%	$	284,872.19
EBE				20.00%	$	94,957.40
Contractor Fee				3%	$	142,436.10
Contractor O&P				10%	$	474,786.99
Contingency				8%	$	379,829.59
Bond				1%	$	47,478.70
Insurance				1%	$	47,478.70
Tax				6%	$	284,872.19
Total Building Cost:	**$**	**6,599,539.11**		**Including Additives and Fees**		

Figure 1: Square foot cost estimate

Appendix C: Site Logistics Plan

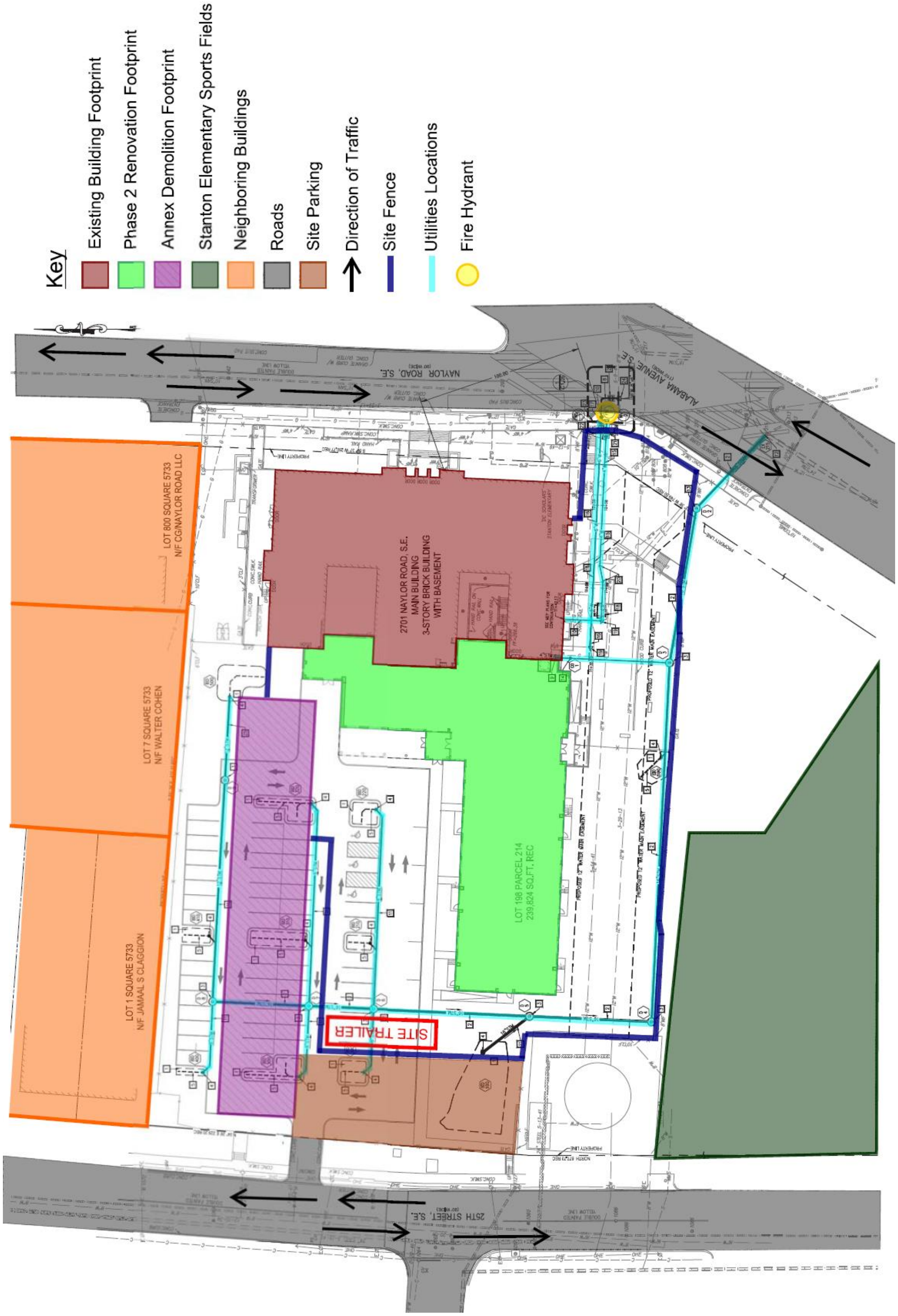

Figure 2: Construction Manager Staffing Plan

Appendix D: Contractor Staffing Plan

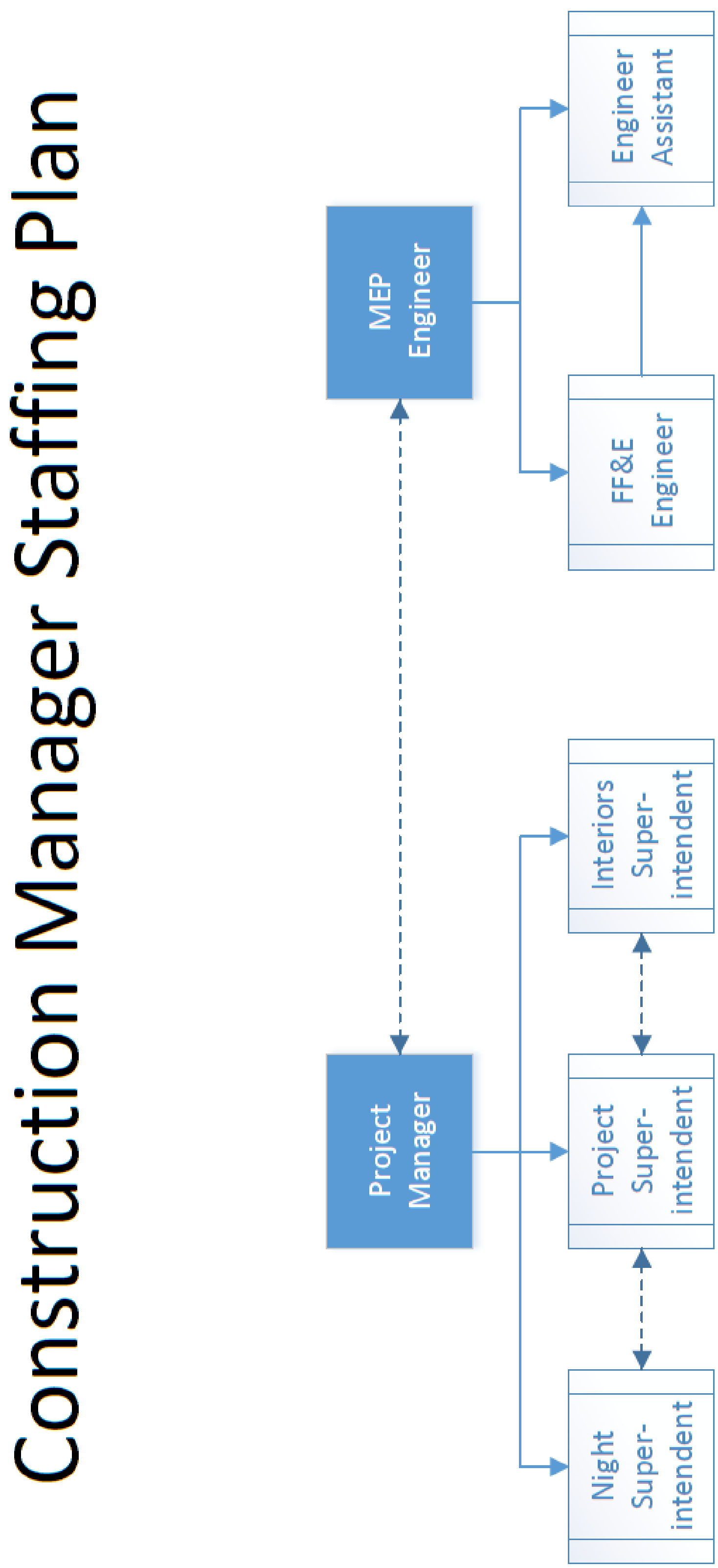

Figure 2: Construction Manager Staffing Plan