Walker Jones

100 L Street NW
Washington, DC 20005

Technical Assignment 3: Alternative Methods Analysis
Dr. Messner
11/21/08

Maria Piergallini | Construction Management

Walker Jones Educational and Community Center

Washington, DC

Project Team

Owner:	Office of the Deputy Mayor for Planning and Economic Development
Architect:	Hord Coplan & Macht
Construction Manager:	Forrester Construction & Columbia Enterprises (joint venture)
Structural Engineer:	Simpson Gumpertz & Heger
MEP Engineer:	Burdette Koehler Murphy & Associates

Mechanical

•8 roof top air handling units ranging in size from 3,150 CFM to 20,200 CFM with energy recovery wheels

•AHU's work in conjunction with 2 boilers to serve the 2 pipe VAV system that ventilates the building

•Commissioning for all MEP systems

•Pre-occupancy building flush-out to increase indoor air quality

Building Statistics

Size:	125,000 SF
Function:	Pre-K – 8 school, public library, and community center
Building Cost:	$36 Million
Construction Dates:	March 2008-August 2009
Delivery Method:	Design-Bid-Build with GMP

Structural

•Concrete foundation walls sit on spread footing system supported by soil reinforced with impact piers and helical anchors ranging in length from 19' to 42'

•Steel superstructure with concrete composite slabs on metal deck supported by wide flange beams

•W shaped beams and columns with HSS in multi story spaces

Architecture

•Organized by grade based on floor level with shared spaces at circulation nodes

• "C" shape footprint designed to provide a safe area in the middle of the "C" for kids to play

•Seeking LEED certification upon completion

•29,000 SF of green roof with access for students

Electrical

•Building distribution is 480V, 3 phase, 4 wire from Pepco supply

•3000A main switchboard with 1000A, 400 A and 225A distribution panelboards

•275kW 480/277V emergency generator with 500 gallon fuel tank for 23 hours of operation at full load

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Construction Management

Executive Summary

Technical Assignment Three takes a look at areas of the Walker Jones project that are good candidates for research, alternative methods of construction, value engineering, and schedule compression. Ideas gathered in this report will be imperative to a final thesis proposal.

First, constructability challenges are reviewed. The top three constructability issues on this project are bracing for concrete foundation walls, the lack of coordination in the design of deep impact piers, and the masonry façade. Next, schedule acceleration ideas are discussed. The critical path of the project is described and several areas of concern are outlined. Ideas for schedule acceleration are listed. Finally, value engineering topics are analyzed. This section includes ideas that were used on the Walker Jones project as well as ideas that were not accepted to be used.

Based on constructability challenges, schedule acceleration scenarios, and value engineering ideas, the most problematic features of the building are identified and discussed. Four of these areas are then discussed in further detail as analysis activities for a thesis project. These four ideas involve an analysis of the mechanical system, the brick façade, the roofing system and LEED for schools.

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Constructability Challenges

Overview

The Walker Jones project poses many unique challenges and opportunities for innovation. Being a $36 million project completed in 15 months, there is little room for difficulties or delays. With such an aggressive schedule, several packages such as demolition, excavation, sheeting and shoring, geopiers, and structural steel had to be released early. This was a decision made by the project team to allow the beginning stages of construction to progress quickly, getting the project off to a smooth start. Unfortunately, early releasing these packages resulted in a high number of change orders since subcontractors were bought before design was complete. Another challenging aspect of the project has been LEED certification. Many members of the project team are not familiar with LEED and the tracking process, so it has required a lot of time and attention. Finally, the project team is faced everyday with challenges concerning constructability. The top three concerns involve bracing for a retaining wall in Area A and Area B, deep impact pier design, and the masonry facade.

Bracing in Area A and Area B

With the fast paced schedule and minimal time for design, it is understandable that the design team overlooked certain constructability issues. One of the most problematic issues occurred in Area A and Area B. There is an elevation change of 15 feet from Area B to Area A, and ground level steps back down into Area C to receive utilities. Because of this, the concrete foundation walls around the outside perimeter of the building act as retaining walls. These walls must be anchored on the bottom in Area B and Area C and on the top in Area A. Each wall is only capable of supporting itself after the slab on grade is poured; however, the slab can not be poured until after the wall is backfilled. No details were provided in design for backfilling the wall.

Luckily, a member of the project team noticed this issue several weeks before it became a problem. Initially, the structural engineer designed a system to solve the problem, but the other members of the project team deemed it too conservative and argued that it would add unnecessary cost and delay the project. The contractor worked with the sheeting and shoring subcontractor, who is a licensed P.E. in the District of Columbia to design a temporary bracing system while the walls were being backfilled. Initially, this design caused some concern; however, it was eventually agreed upon and construction continued without delays to the schedule.

Please see *Appendix A* for details of the temporary bracing design.

Deep Impact Pier Design

The design of the deep impact piers and the retaining walls was not coordinated, which led to additional problems getting out of the ground. The design of the retaining walls did not take into account that the impact pier drill rig would be in close proximity to the walls, applying additional pressure from the weight of the rig and the vibrations caused by drilling.

This complication required a change in design from impact piers to steel piles in the area of concern. These piles require pile caps which transfer loads from the caps down through the piles. The steel piles were designed by the structural engineer, who provided loads, and the geo-technical engineer who decided what to install. The piles were then installed by the sheeting and shoring contractor. The steel piles were a viable alternative because they apply less pressure to the concrete wall than the deep impact piers.

Please see *Appendix B* for the revised pile design.

Masonry
Although masonry façade is a common system, the exterior walls have eight steps to complete, making the masonry a logistical headache. To close in the building, the subcontractors must install studs, followed by flashing and dens glass, then tape the joints, install rigid installation board, install the brick ties, install the brick, and finally the windows must go into place. This requires three different subcontractors to trade off using the same scaffold.

Please see *Appendix C* for a typical wall detail.

Curtain Wall Complication
The initial curtain wall design was not structurally sound. The structural loads due to wind were too much for the system as it was initially designed. The contractor worked with the glass and glazing subcontractor and the design team to decide on a system that was structurally sound and cohesive with the overall feel of the building.

Site Utilities
The site utilities were poorly designed and were not coordinated with the building plumbing drawings. This resulted in fifteen RFI's and two addendums being issued to ensure that the sewage was not flowing up hill, as it was initially designed. The team had to work with the designers to change the elevations of inverts, rework hundreds of feet of pipe, and resize the pipe.

MEP Coordination
MEP coordination was a challenge from the beginning. This is partially due to weak design documents which led to an abundance of RFI's which contradicted each other. Also, the MEP subcontractor was not especially aggressive in their coordination efforts. This caused the team to fall slightly behind in terms of putting duct and pipe in place.

Schedule Acceleration

Overview

With a 15 month $36 million project, there is little room in the schedule for delays and few opportunities to make up for lost time. It is imperative that the schedule is carefully monitored and subcontractors consistently deliver quality work on time. The main technique for making up lost time is simply putting subcontractors on notice when they get behind. Working more men more hours is the primary method used to combat schedule delays. Listed below are several areas that are critical to the schedule as well as a few schedule acceleration ideas.

Critical Path

The critical path of the schedule is the most imperative sequence of events to ensure that the project is delivered on time. The critical path began with excavation and sheeting and shoring. These activities began March 10, 2008 and were completed July 30, 2008. Next on the critical path is impact piers followed by foundation concrete. Soil reinforcement and below grade concrete had from June 9, 2008 through August 25, 2008. Once these activities were complete, focus shifted to steel, the skin of the building, and finally temporary heat and interior fit out. Concerns over steel began in April 2008 when the steel fabrication began. Because it is such a long lead time item, it was an important package to early release. Getting a subcontractor on board early allowed for procurement of materials on time. Purchasing of the storefront, glass and glazing subcontractor was not so timely and is discussed below.

Procurement

The subcontractors were not all bought out together at the beginning of the project. This was anticipated, and a purchasing schedule was compiled to keep the project on schedule. Unfortunately, this schedule was not followed and several packages were purchased late. Specifically, the storefront, glass and glazing subcontractor was purchased several weeks late which did not delay the schedule, but did eliminate the possibility of enclosing the building ahead of schedule and starting work on interior trades early. Purchasing all of the subcontractor packages early provides the opportunity to accelerate the schedule; without a subcontractor on board, nothing is going to get done. If the storefront, glass and glazing subcontractor was bought out on time, enclosing the building ahead of schedule, which was a possibility, would have accelerated the schedule.

Utilities

The project team had the opportunity to accelerate the schedule, but without utilities, this can not be done. The utilities are the owner's responsibility and have been slow for the duration of the project. The power comes from Pepco, the natural gas from Washington Gas, and the public space permit for domestic and sprinkler water from DC WASA. These utilities all require coordination with the general contractor and with various subcontractors. Getting them installed on time is imperative to the schedule.

Contingency
Because the project is a GMP agreement, there was a contingency established to allow for overtime. The money was used to pay subcontractors who were asked to work more men more hours to help speed up the schedule. This contingency was anticipated to be used to accelerate finish trades. The project team decided to use a good portion of the money to accelerate trades up front so the project was ahead of schedule from the beginning.

Masonry
Acceleration of the masonry subcontractor was a major consideration for schedule acceleration; however, the masonry subcontractor performed as well as it possibly could have. One alternative which could be considered to help with schedule and cost concerns is pre-cast brick panels instead of hand-laid brick.

Value Engineering

Overview

Because of design liability, the project team did not do any value engineering, but instead made cost saving suggestions. These suggestions primarily concerned site construction, thermal and moisture protection, equipment and mechanical aspects of the project. All of the accepted suggestions were changes that will not affect the educational value of the school. District of Columbian Public Schools wanted to ensure that the school provides a safe, healthy learning environment for the students. With this being the top priority, budget was a close second. All of the cost saving suggestions maintained the quality of the school while decreasing the overall project cost. Listed below are several accepted cost saving suggestions as well as a few that were not applied to the project.

Stair Railings

Estimated Cost Savings: **$52,000**

As designed, the railings in the stairwells were mesh. Changing the railings to a picket style is a faster, easier, and cheaper alternative.

Vents

Estimated Cost Savings: **$51,300**

There are 4 window types that have operable vents. The type A window is a large square window found in the third and fourth floor classrooms and offices. Types B, C, and D are located at the second floor in the classrooms and offices. The type A window has an operable vent of approximately 10 square feet. The Type C window has a comparably sized vent. Deleting the vents from the type B and type D windows results in a cost savings and there is still the same amount of operable windows per room. There are only 2 rooms at the second floor that do not have a type C window. These are the Workroom/ Mail Room 206 and Pre-K classroom 230. The vents in one of the existing type D windows at these 2 locations were kept.

Flexible Duct Length

Estimated Cost Savings: **$15,000**

The specified flex duct length is 3'. Although the project team proposed to extend that length to 10 feet, the mechanical engineer only approved a 6 foot length for flexible ducts. Beyond 6 feet, it is difficult to install and can lead to kinks or duct work that is not properly supported.

Variable Frequency Drive Bypass

Estimated Cost Savings: **$30,000**

The VFD option on the rooftop AHU's is seldom used on VAV units, and can lead to control issues. Many of the rooftop units have dual fans and VFD's already, so there is no need for the bypass option.

Underground Piping
Estimated Cost Savings: **$12,000**
The project team used DWV PVC piping and fittings for the underground sanitary and storm water systems rather than the service weight cast iron. The team had to be especially careful not to damage the PVC during construction. Because it was installed with great care, the mechanical engineer agreed to this change.

Above Ground Piping
Estimated Cost Savings: **$60,000**
The project team also substituted DWV PVC piping and fittings for the above ground waste and venting systems and well as the above ground storm water systems. The ceiling is not used as a return plenum, and the mechanical engineer agreed cautiously. There was concern about piping behind fixtures; with water hammer and movement, connections could become loose. The team was careful to install the piping properly and it should not be an issue. Another concern is that the sound of water moving through the PVC is more noticeable and it could be distracting.

Roofing – Not Accepted
Estimated Cost Savings: **$50,000**
The majority of the roof on Walker Jones is a green roof; however, Area C and Area D have an EPDM roofing system. Rather than use the dark EPDM system, a light colored reflective system was suggested to be used instead. It was noted that many alternative systems are cheaper up front, but the systems may not be as durable as EPDM.

Lighting – Not Accepted
Estimated Cost Savings: **$25,000**
The team suggested replacing the T5 lamps, which are equipped with dimming capabilities, with standard parabolic T-8 lamp lighting. By changing to parabolics, there would be a dark band of light around the entire room (from the ceiling to a point 2-3 feet or more down the wall). The parabolic light cuts-off the light at a 45 degree angle from the ceiling. This dark band, or "cave effect," will be significant. This dark band would impact the teaching wall and likely be dark across the top of the marker board.

Also, the maintenance/life cycle cost for owning all of the additional lamps (3 T8's vs. 2 T5's) and ballasts (2 vs. 1) will be higher for the parabolic type fixture. The cost for the parabolic system should be approximately half the cost of the direct/indirect fixture. Finally, District of Columbia Public Schools design standards explicitly state that parabolic light fixtures are not to be used.

Reheat Coil – Not Accepted
Estimated Cost Savings: **$9,000**
The project team suggested deleting the reheat coils as an attempt to save money. The VAV boxes have a temperature sensor down stream of each VAV coil. This is good for trouble shooting later as part of the energy management system. Without it, it creates a larger maintenance issue for diagnosing problems in the system.

Gym Duct – Not Accepted
Estimated Cost Savings: **$9,000**
Single wall duct was suggested to be used in the gym rather than the specified double wall duct. The specified double wall duct has a duct liner that prevents condensation. By changing to a single wall duct, the liner is lost and there is no insulating quality, resulting in condensation.

Duct Liner – Not Accepted
Estimated Cost Savings: **$6,000**
It was proposed that the perforated metal duct liner be deleted 25 feet from the rooftop air handling units. The mechanical engineer advised against this as the liner is required to maintain the integrity of the line.

Problem Identification

Overview

During the Project Manager interview and through the analysis of constructability challenges, schedule acceleration scenarios and value engineering topics, several areas emerged as problem areas on the Walker Jones project. One of the most problematic areas, in terms of coordination, is the mechanical system. Another key factor in the construction process is the building envelope. The building is primarily brick façade, so this will be the focus of the envelope study. Next, the roof will be analyzed to find a system more efficient and sustainable than EPDM. Finally, a key topic on this project is LEED. The project is a contender for LEED certification once it is complete, and the value of LEED certification on school projects will be analyzed.

Mechanical System

The mechanical system is designed to have eight rooftop air handling units. Each of the eight air handling units is responsible for an individual zone. Zones 1-8 are broken into east, west, north and south classroom blocks, cafeteria, library, gymnasium, and kitchen, respectively. The mechanical rooms are located in Area C in a partial basement and on the third floor above the kitchen. The cafeteria, gymnasium and kitchen have constant air volume systems while the rest of the building has a variable air volume (VAV) system. Heating water will be generated from three (3) gas fired boilers located in the northeast mechanical room above the kitchen. Two (2) heating water pumps (primary and standby) will circulate heating water to the air handling units.

This system requires heavy equipment on the roof which takes away from the aesthetics of the green roof. It also requires a lot of ductwork which has caused many coordination issues. An alternative to the VAV system currently in place would be a chilled beam system. This would make for an interesting construction management analysis as far as how the system affects the cost, schedule and logistics of the project, as well as a mechanical breadth.

Brick Façade

As mentioned above, the brick façade requires eight steps to enclose the building. These steps take time and coordination and even with a stellar masonry subcontractor, the brick façade has caused headaches for the project team. Alternative solutions to a typical brick façade include pre-cast brick panels or thin bricks which are cast into concrete. Such systems could eliminate the need for scaffolding, save time and money.

Roofing

Although most of the roof is a green roof, the roof is designed as an EPDM system. During the value engineering process, a light colored TPO roof was suggested instead but was not approved due to quality and long term durability issues. The roofing system provides an excellent opportunity to minimize the heat island effect of the building and to greatly reduce construction cost.

LEED

Because the building is a LEED project and it is a critical industry issue, it would be an interesting topic of research. For most members of the project team, this was their first LEED project and they were quite unfamiliar with the process. In addition, the owner seemed weary of earning credits that appeared to cost more upfront. Looking into the positives, negatives, and long-term benefits of LEED for schools could be an interesting endeavor.

Technical Analysis Methods

Overview

The Technical Analysis methods section of this report outlines four construction management analysis activities which were listed above. A plan for completing the analysis on the building systems is outlined below.

Mechanical System

Although chilled beam systems have been popular in Europe for years, this system has only begun making its way to the United States recently. The innovative HVAC technology provides a draft-free and energy-saving approach to heating and cooling.

Benefits:

A chilled beam system reduces energy needed to run fans. It also requires minimal space, which leads to more shallow ceiling plenums. Additionally, such a system increases indoor air quality by eliminating the mixing of air and increases occupant comfort because it is a quieter system than VAV. Finally, chilled beam systems do not require large mechanical rooms or ductwork and is easier to maintain than a VAV system.

Drawbacks:

Unfortunately, chilled beam systems can have a higher up front cost compared to traditional VAV systems. Another difficulty associated with a chilled beam system is that many MEP engineers are not familiar with this technology, especially in the United States. With a chilled beam system, conditions must be kept within a certain range or condensation will occur.

Analysis:

The analysis will include a basic redesign of the mechanical system. The design will by no means be complete, but will give a general idea of the size and types of equipment necessary. Through this analysis, an upfront cost analysis will be performed as well as a long term estimate to determine a payback period on the system. Indoor air quality, consistency with LEED credits, durability and long term maintenance will also be taken into account.

A few good contacts have been identified already. The first contact is Bill Moyer of Davis Construction, who discussed chilled beam systems at the PACE Roundtable. Davis is currently working on Constitution Center in Washington, DC, which employs a chilled beam system. The project team on Constitution Center would be the first point of contact and a valuable source. Additionally, the mechanical engineer on Walker Jones has agreed to be of any help he can and will be a valuable contact.

To complete this analysis, a better understanding of chilled beam systems will be required. This can be done by using online databases such as ProQuest to obtain as much background information as possible about chilled beams. Once this basic knowledge has been gathered, it will be possible to speak intelligently with project teams who have worked on projects such as Constitution Center, as well as mechanical engineering firms who are familiar with the system.

This analysis will be interesting from the construction management perspective as it deals with cost, schedule and coordination concerns. It will also encompass a mechanical breadth. There is a possibility that this analysis could include a lighting breadth if an integrated/multi service beam system can be implemented. These beam systems include lighting, speakers, sprinkler openings and cable pathways. Structural concerns may also be addressed. With the designed eight rooftop units, the superstructure of the building needed to be beefed up to hold all the extra weight on the roof. A chilled beam system could eliminate much of that weight, allowing for a reduction in structural members.

Brick Façade

Although the current hand-laid brick is a common façade finish, it has caused a lot of coordination and site logistics issues on Walker Jones. The brick façade was also a primary focus of schedule acceleration planning, if it was necessary. Because exterior enclosure is required to begin interior fit-out, accelerating the façade would help the project.

Benefits:

A hand laid brick system requires the use of a large amount of scaffolding, which can cause site congestion and coordination issues between trades. Precast systems also eliminate the need for a mortar station and constant stockpile of bricks. Installing standard bricks requires more people which increases safety and coordination headaches. Additionally, a precast system will cut back on cost because labor forces can be reduced. Hand-laid brick takes more time to install than a precast system. Most of the work for a precast system can be done ahead of time off site in a controlled environment, eliminating many logistical, coordination, and weather concerns. It is even possible to obtain precast panels that act as a complete wall system. This one panel could take the place of brick, vapor barrier, metal studs, insulation, and conduit.

Drawbacks:

With precast systems, there is often less design flexibility than a hand-laid system. Luckily, the design for Walker Jones does not require unusual colors or complicated patterns. Precast systems also have joints, so the design team must pay more attention to where the joints are located.

Analysis:

The main focus of the study will be on schedule acceleration and cost impacts. For a system to be considered acceptable, the quality must remain the same or better than a hand-laid system. This analysis will include durability, aesthetics and constructability. Additionally, the structural and architectural differences will be addressed.

Research will begin with learning about different prefabricated wall systems. Industry professionals will be consulted for their opinions and knowledge of precast systems. The best systems will be selected and used for the analysis. Analysis will include cost, schedule, constructability and availability.

Roof

The current EPDM system may use recycled materials, but it is not an incredibly green product. There are cheaper roofing alternatives that are more sustainable and result in long-term cost savings. These systems include a variety of “cool” roof and white roof systems.

Benefits:

Innovative light colored roofs can reduce the indoor air temperature as well as the urban heat island effect, reducing energy costs and slowing the pace of global warming by increasing reflectivity. Many new roof coatings reflect a broad spectrum of UV light and emit nearly 90% of any absorbed heat, both of which contribute to deterioration of conventional roofing materials.

Many elastic coatings also protect against expansion and contraction cracks in the roof which lead to roof deterioration and leaks. This is possible because the elastic can bridge cracks that form as temperatures fluctuate. Coated Roofs can also reduce landfill waste and provide savings in maintenance and repair costs.

Drawbacks:

Many alternative systems are newer and therefore do not have the longevity assurance that typical roofing systems have. Also, some “green” roofing materials are not green in their production. This must be considered when selecting an alternative roofing system.

Analysis:

The roof analysis will begin by learning about the many alternatives to a built up EPDM system. Once the best system is identified, it will be analyzed and compared to the EPDM system. This comparison will take into account cost, schedule, and environmental impact. Depending on the chosen system, this analysis could involve a structural analysis or mechanical analysis if the system drastically reduces the mechanical loads of the building.

LEED

The United State's Green Building Council's Leadership in Energy and Environmental Design (LEED) has become the primary accreditation system for the design and construction of green buildings. Since the conception of the USGBC in 1993, the LEED rating system has continuously evolved based on feedback from industry members. While the new LEED rating system is due out in early 2009, the current version, LEED 2.2 is widely known and highly respected.

It has been commonly accepted that the benefits of LEED are lower long term costs, improved indoor air quality and higher occupant comfort. The certification system also aims to reduce pollution, waste water and ecological impact.

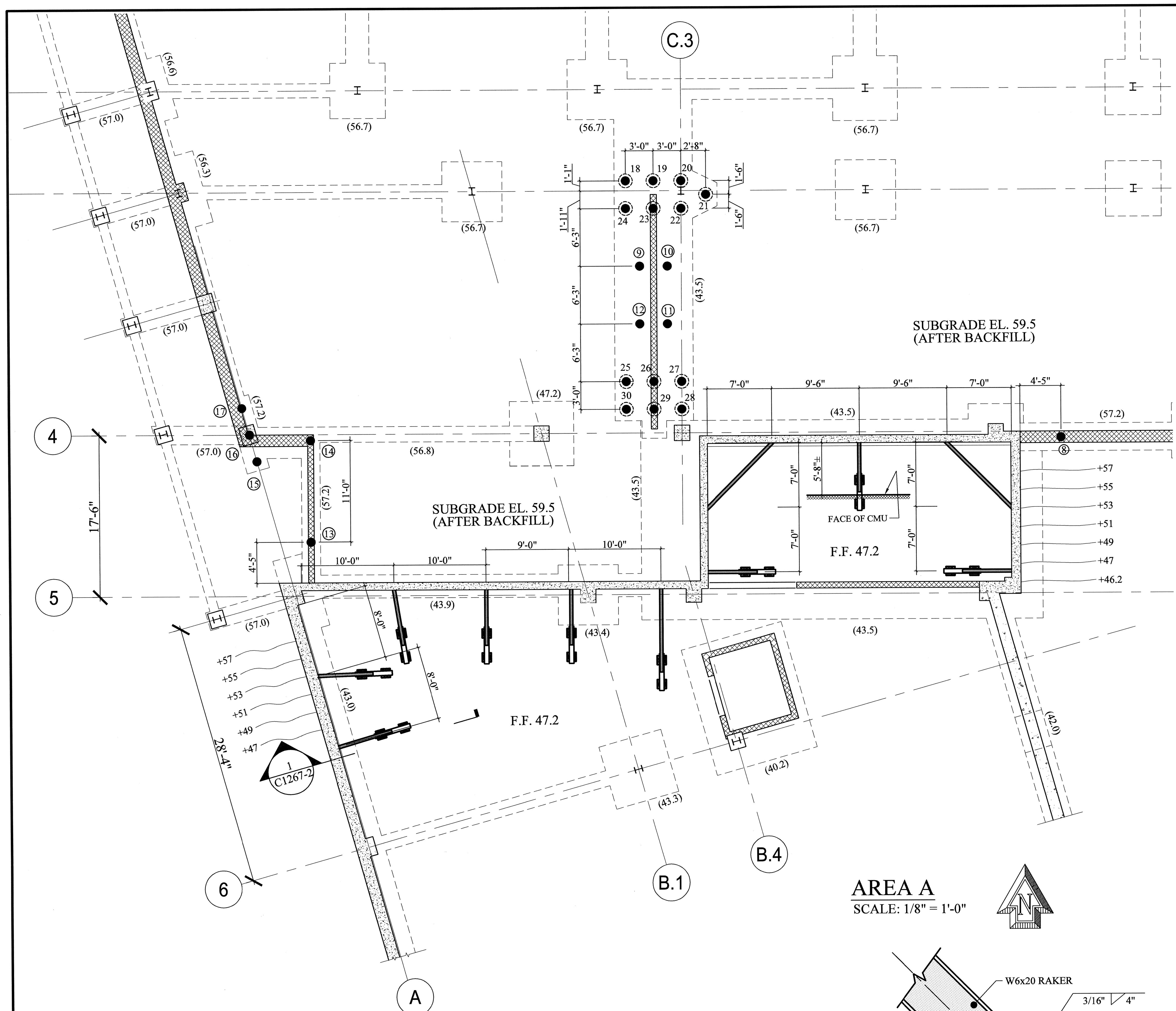
Although the LEED system is commonly known and respected by most, many people seem to be hesitant to jump on the bandwagon. This area of research would focus on the benefits of LEED certified schools.

Analysis:

A general idea of how people involved in green schools feel about the LEED system will be obtained by performing an in depth survey. Separate surveys will be developed for school board members, teachers, and parents. Topics of the survey will include perceived benefits of LEED, willingness to consider upfront versus long term cost, and the positives and negatives of the end result.

Parties involved in both LEED certified and traditional school projects will be surveyed to determine varying opinions. Questions will range from impact on sick days and student attention span to the overall appeal of the school. This analysis could be a useful tool for school districts considering a "green" resolution, which will require new construction and major renovations to be LEED certified.

Appendix A: Temporary Bracing Design



AREA A
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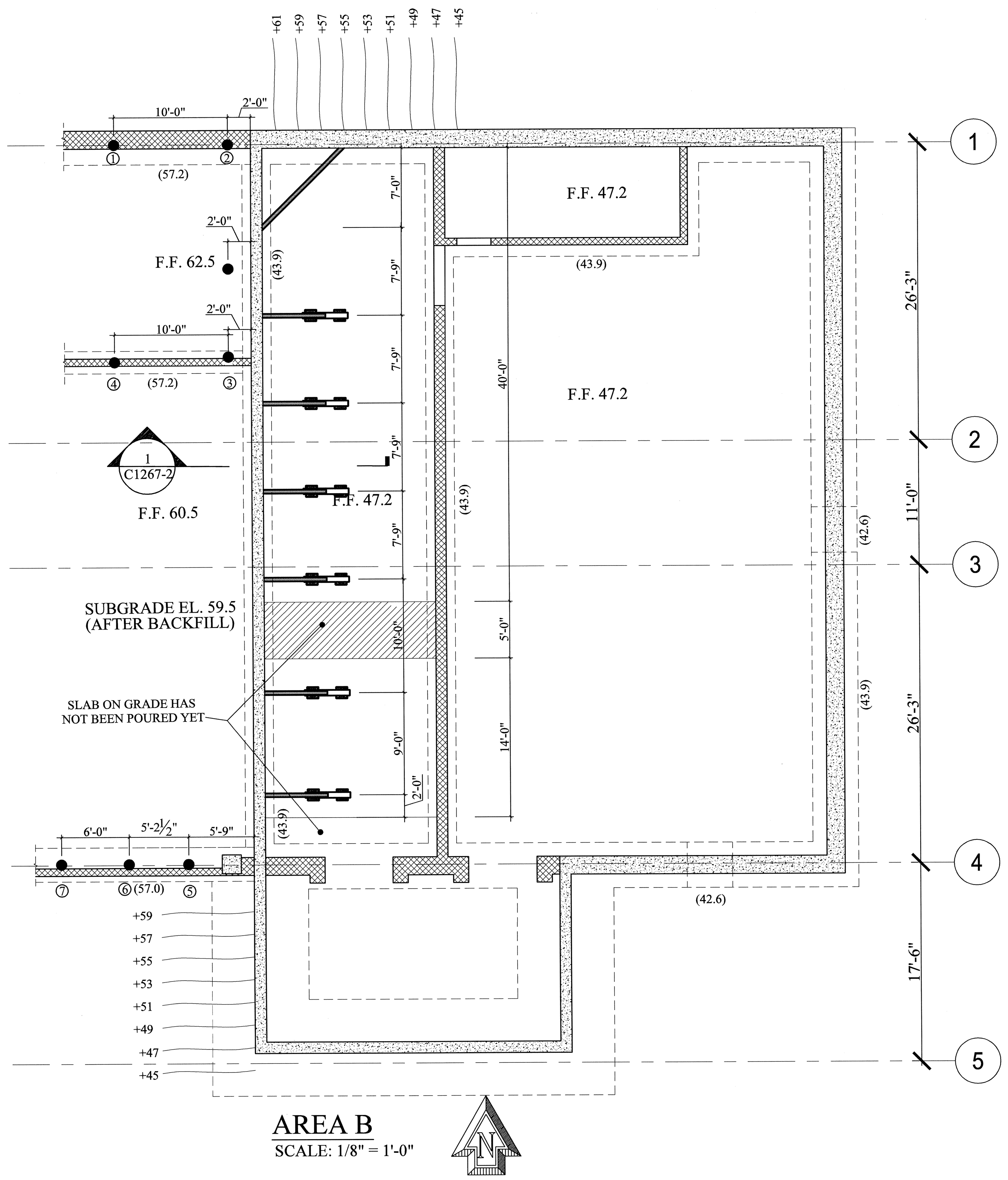

AREA B
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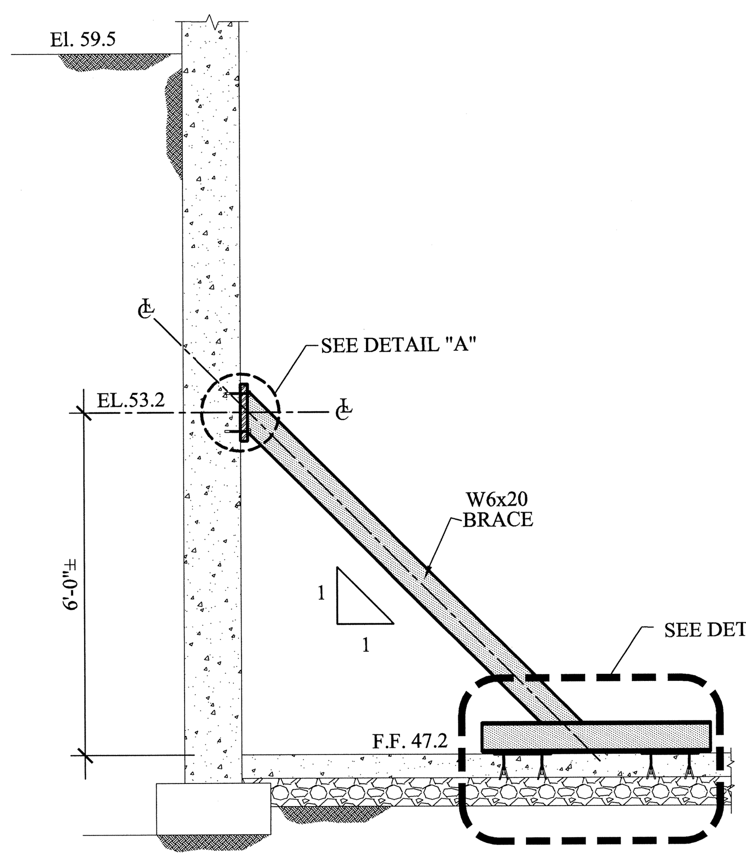

SECTION "1"
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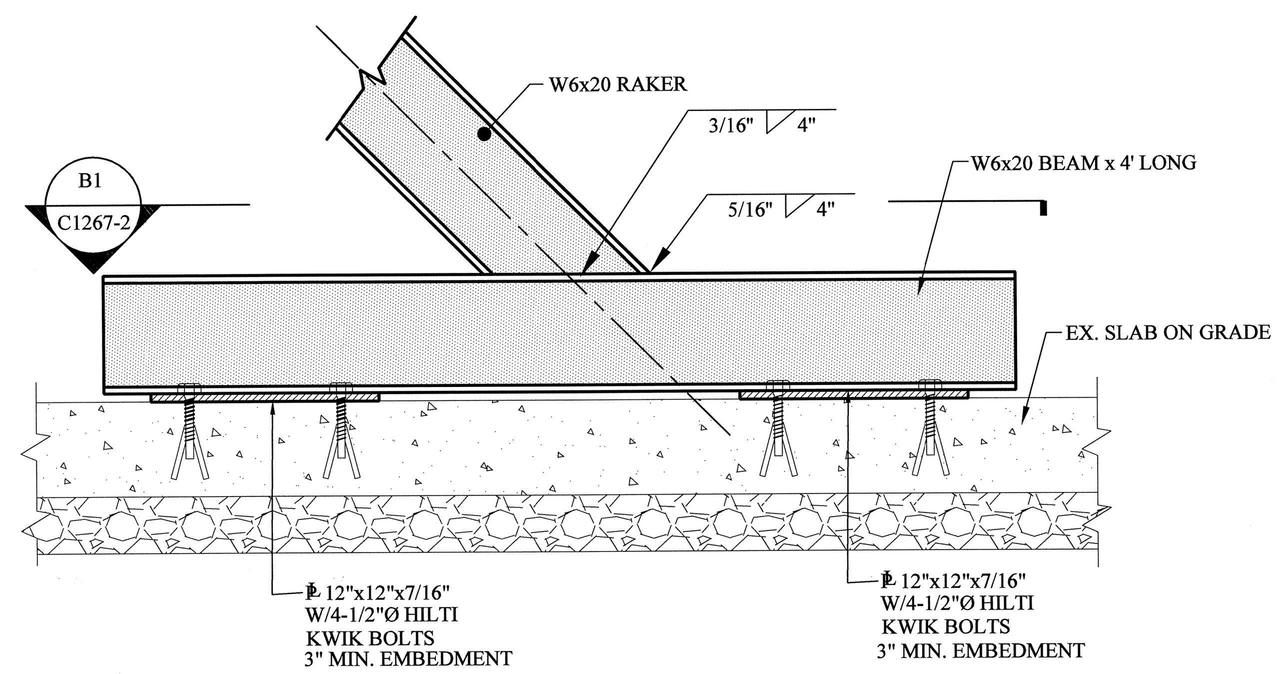

DETAIL "B"
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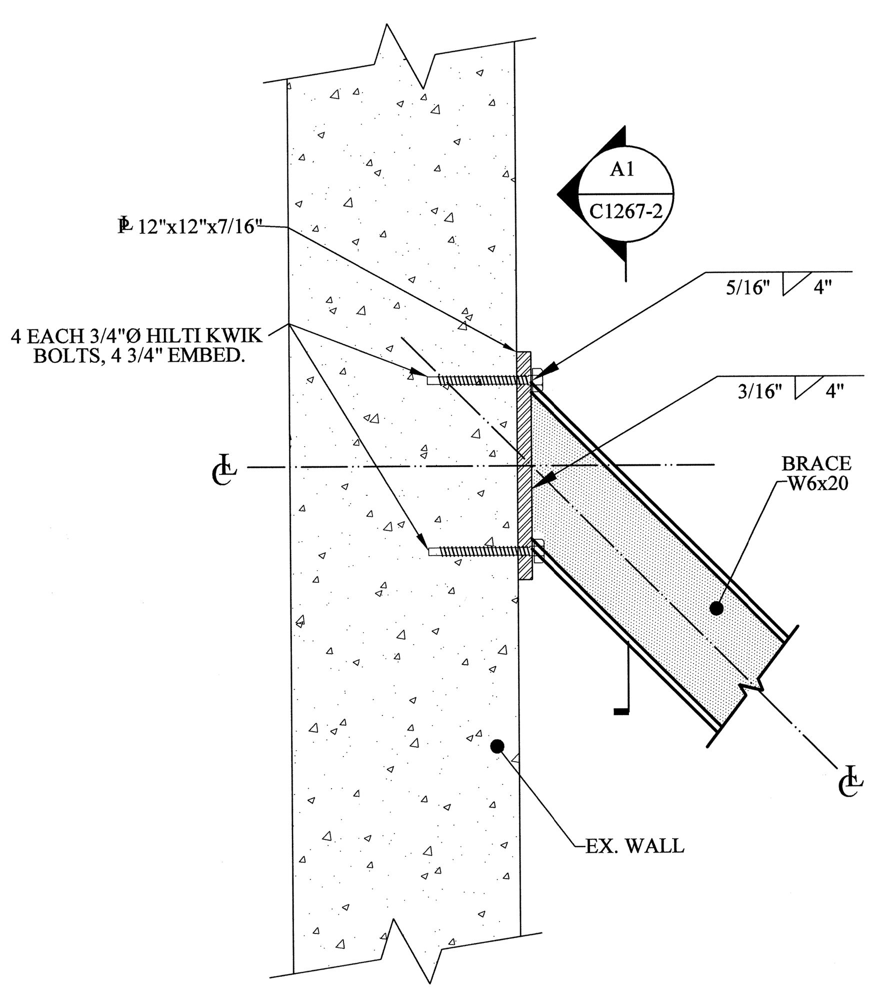

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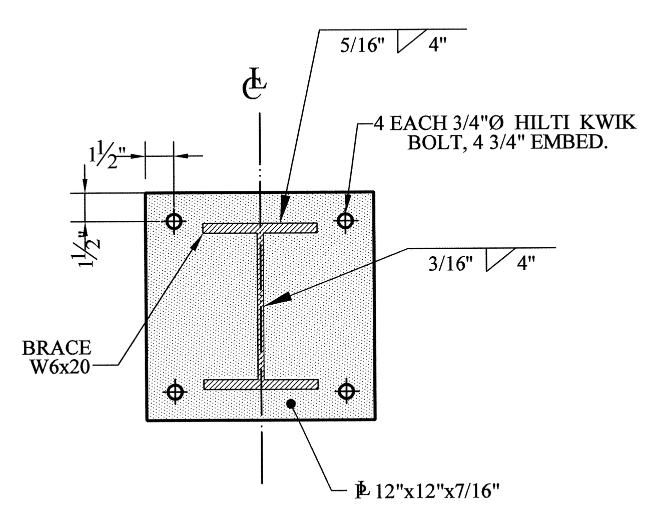

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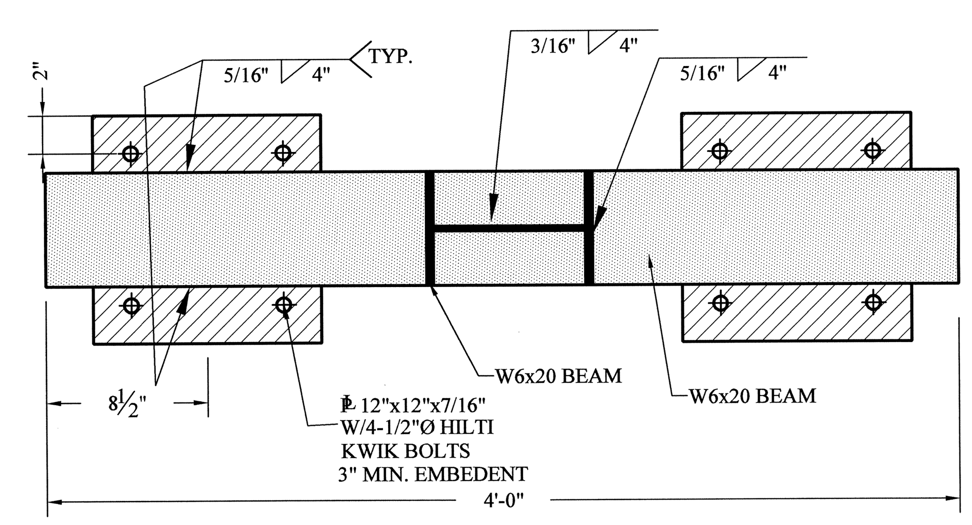

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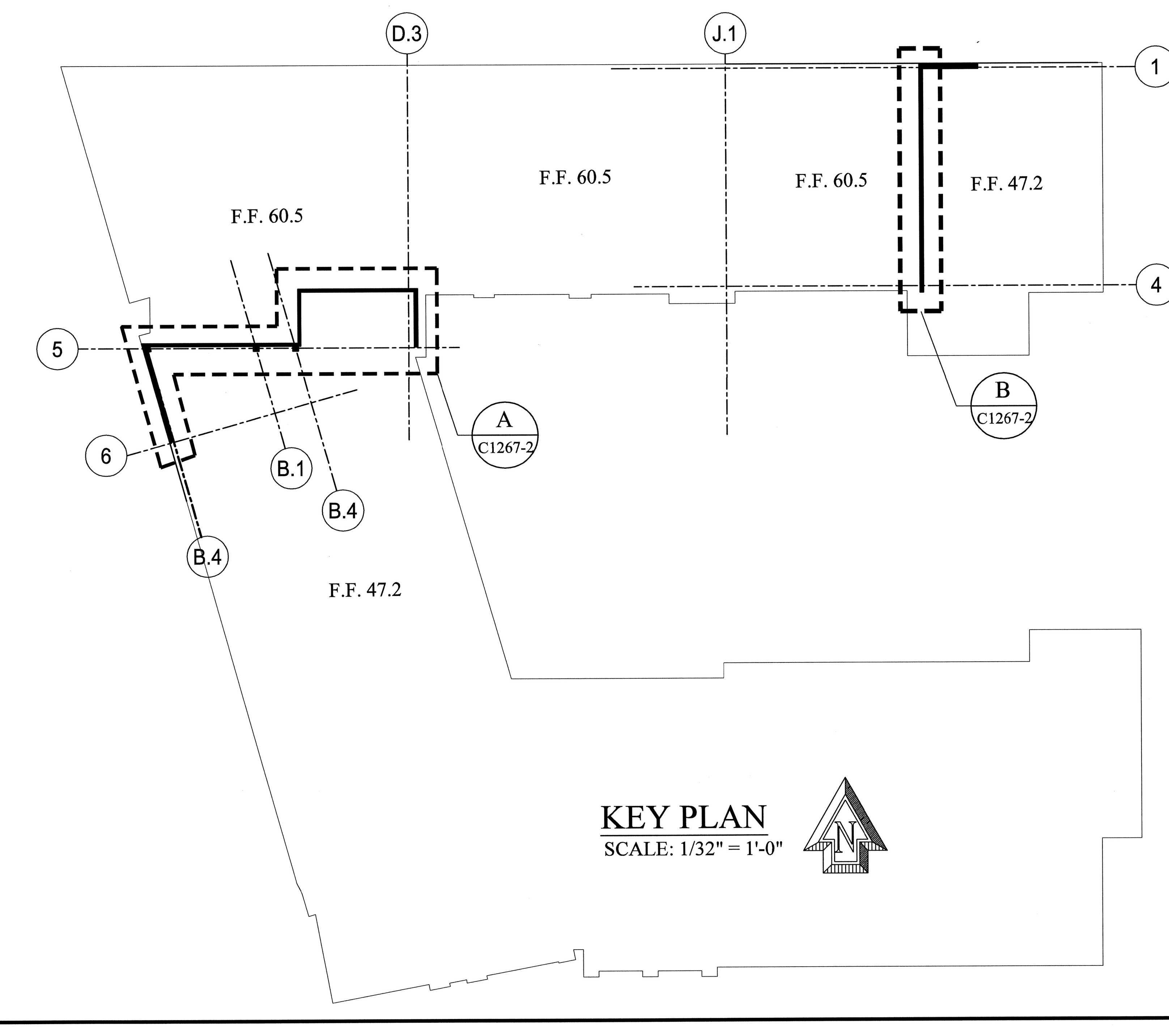


KEY PLAN
SCALE: 1/32" = 1'-0"

TEMPORARY BRACING
WALKER JONES K-8 SCHOOL
WASHINGTON, D.C.

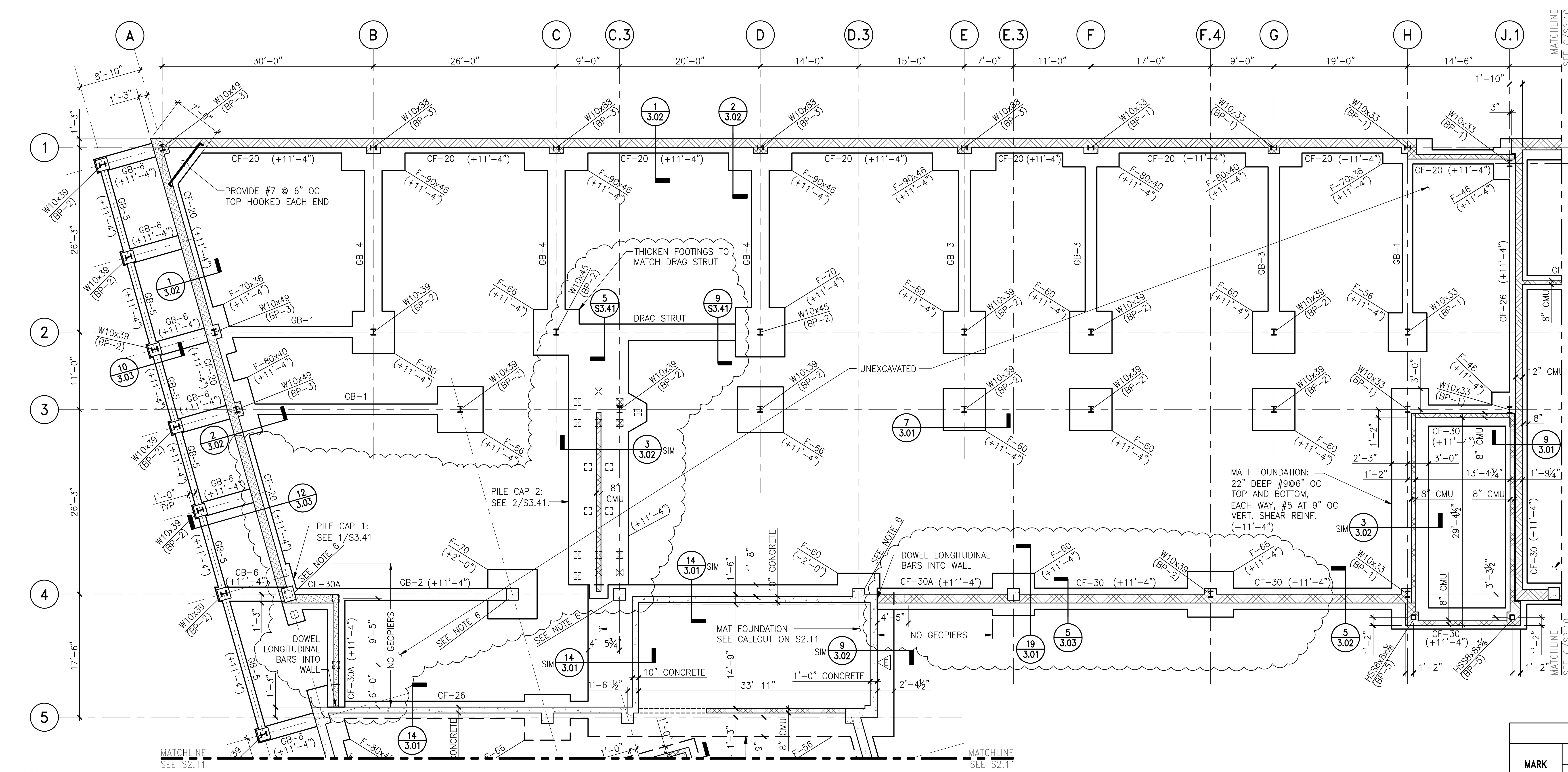
HOLD COPLAN MACHT - ARCHITECT
SIMPSON GUMPERTZ - STRUCTURAL ENGINEER
FORRESTER CONSTRUCTION- GENERAL CONTRACTOR

APPROVED FOR WORK TO BE PERFORMED BY STEELE FOUNDATION, L.L.C.
BY:

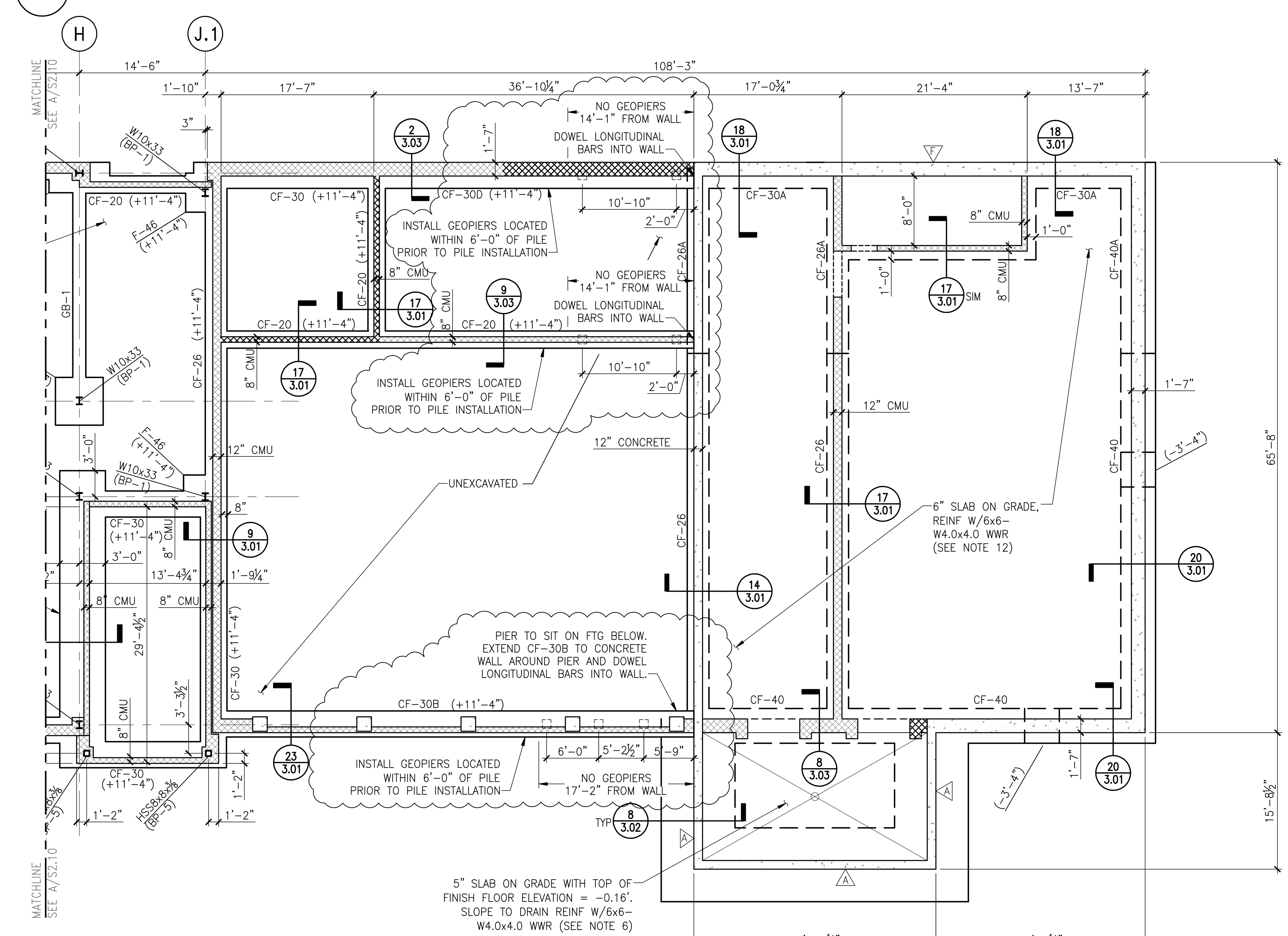
ENGINEERED FOUNDATION CONSTRUCTION
STEELE FOUNDATION, L.L.C.
3299 K STREET, N.W., WASHINGTON, D.C.
(202) 342-1194

DRAWN BY: JORGE
DATE: 07-17-2008
SCALE: AS SHOWN
DRAWING NO. C1267-2

Appendix B: Revised Pile Design



A FIRST FLOOR/FOUNDATION PARTIAL PLAN – NORTH CLASSROOM BLOCK



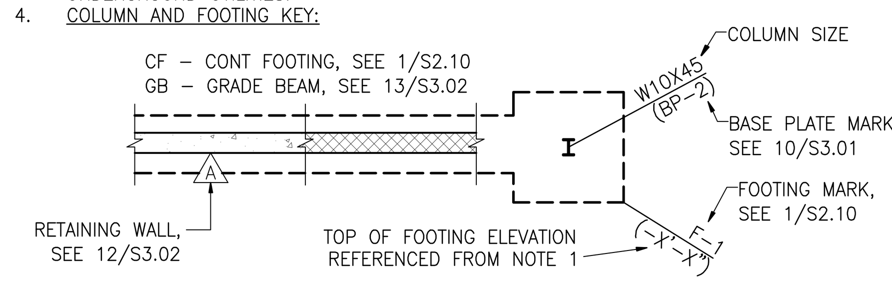
C FIRST FLOOR/FOUNDATION PARTIAL PLAN – CAFETERIA

A FOUNDATION PLAN – NORTH CLASSROOM BLOCK

1/8"=1'-0"

PLAN NOTES:

1. TOP OF FINISH FLOOR DATUM ELEVATION = 0.00' = ACTUAL ELEVATION 47.16' UNLESS NOTED OTHERWISE ON PLAN.
2. TOP OF FOOTING ELEVATION = –2'–0" UNLESS NOTED (+/–X'=X") ON PLAN REFERENCED FROM ELEVATION IN NOTE #1. BEARING ELEVATION OF ALL FOOTINGS SHALL BE AT OR BELOW PROJECTED FROST DEPTH MEASURED FROM SURROUNDING FINAL GRADES.
3. TOP OF STRIP FOOTING SHALL MATCH TOP OF ADJACENT SPREAD FOOTING ELEVATIONS. ALL LONGITUDINAL STRIP FOOTING BARS SHALL RUN CONTINUOUS THROUGH SPREAD FOOTINGS. STEP STRIP FOOTINGS AS REQUIRED TO MATCH ADJOINING SPREAD FOOTING ELEVATIONS PER DETAIL 1/S3.01. MAINTAIN FROST DEPTH AND COORDINATE WITH UNDERGROUND UTILITIES.
4. COLUMN AND FOOTING KEY:



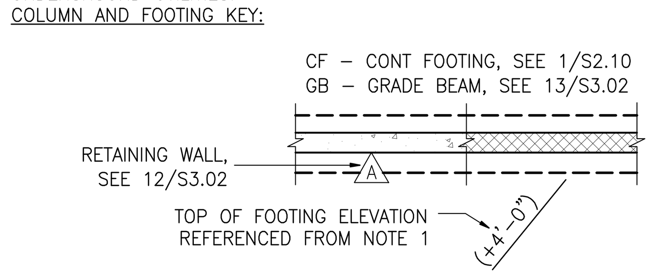
5. ALL FOOTINGS, PIERS AND COLUMNS SHALL BE CENTERED ON COLUMN LINES UNLESS DIMENSIONED ON PLAN OR DETAILED OTHERWISE.
6. SEE DETAIL 23/S3.01 FOR CONCRETE PIER REQUIREMENTS AT COLUMN LOCATIONS INDICATED ON PLAN.
7. FOR GENERAL NOTES, SEE DRAWING S0.01 & S0.02.
8. FOR DETAILS, SEE DRAWING S3.01 THRU S3.32.
9. PROVIDE VERTICAL CONTROL JOINTS IN ALL CMU AND CONCRETE WALLS PER 6/S3.11 AND 2/S3.01 RESPECTIVELY.
10. THICKEN SLAB ON GRADE UNDER BOTTOM OF STEEL STAIR AND CMU PARTITION WALLS PER 7/S0.02. (NOT SHOWN–SEE ARCH)
11. WALL TYPES ARE INDICATED:
    - REINFORCED CMU WALLS. FILL ALL REINFORCED CELLS AND BELOW GRADE CELLS SOLID WITH GROUT. SEE DETAILS AND SCHEDULES FOR REINF.
    - REINFORCED CONCRETE WALLS. SEE DETAILS FOR REINF.
12. PILE TYPES ARE INDICATED:
    - COMPRESSION PILE. SEE 4/S3.41.
    - TENSION PILE. SEE 3/S3.41.

C FIRST FLOOR/ FOUNDATION PLAN–CAFETERIA

1/8"=1'-0"

PLAN NOTES:

1. TOP OF FINISH FLOOR DATUM ELEVATION = 0.00' = ACTUAL ELEVATION 47.16' UNLESS NOTED OTHERWISE ON PLAN.
2. TOP OF FOOTING ELEVATION = –2'–0" UNLESS NOTED (+/–X'=X") ON PLAN REFERENCED FROM ELEVATION IN NOTE #1. BEARING ELEVATION OF ALL FOOTINGS SHALL BE AT OR BELOW PROJECTED FROST DEPTH MEASURED FROM SURROUNDING FINAL GRADES.
3. TOP OF STRIP FOOTING SHALL MATCH TOP OF ADJACENT SPREAD FOOTING ELEVATIONS. ALL LONGITUDINAL STRIP FOOTING BARS SHALL RUN CONTINUOUS THROUGH SPREAD FOOTINGS. STEP STRIP FOOTINGS AS REQUIRED TO MATCH ADJOINING SPREAD FOOTING ELEVATIONS PER DETAIL 1/S3.01. MAINTAIN FROST DEPTH AND COORDINATE WITH UNDERGROUND UTILITIES.
4. COLUMN AND FOOTING KEY:



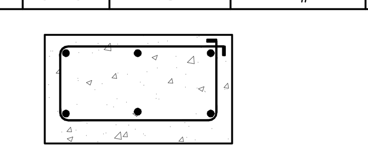
5. ALL FOOTINGS, PIERS AND COLUMNS SHALL BE CENTERED ON COLUMN LINES UNLESS DIMENSIONED ON PLAN OR DETAILED OTHERWISE.
6. TOP OF SLAB ON GRADE MAY VARY. SLOPE SLAB ON GRADE TO CONFORM TO THE DRAINAGE PATTERN AND DRAIN LOCATIONS SHOWN ON THE ARCHITECTURAL AND MECHANICAL DRAWINGS WHILE MAINTAINING THE SLAB THICKNESS NOTED ON PLAN.
7. FOR GENERAL NOTES, SEE DRAWING S0.01 & S0.02.
8. FOR DETAILS, SEE DRAWING S3.01 THRU S3.32.
9. PROVIDE VERTICAL CONTROL JOINTS IN ALL CMU AND CONCRETE WALLS PER 6/S3.11 AND 2/S3.01 RESPECTIVELY.
10. THICKEN SLAB ON GRADE UNDER BOTTOM OF STEEL STAIR AND CMU PARTITION WALLS PER 7/S0.02. (NOT SHOWN–SEE ARCH)
11. WALL TYPES ARE INDICATED:
    - REINFORCED CMU WALLS. FILL ALL REINFORCED CELLS AND BELOW GRADE CELLS SOLID WITH GROUT. SEE DETAILS AND SCHEDULES FOR REINF.
    - REINFORCED CONCRETE WALLS. SEE DETAILS FOR REINF.
12. PILE TYPES ARE INDICATED:
    - COMPRESSION PILE. SEE 4/S3.41.
    - TENSION PILE. SEE 3/S3.41.

SOIL REINFORCING/REMEDIATION

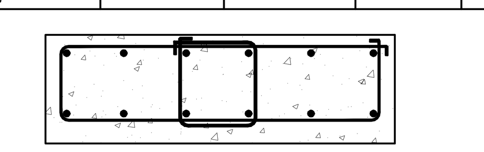
PER THE DIRECTION OF THE GEOTECHNICAL ENGINEER, ECS MID–ATLANTIC, LLC., THE FOUNDATION HAS BEEN STRUCTURALLY DESIGNED AS A SPREAD FOOTING SYSTEM ON SOIL REINFORCED WITH IMPACT PIERS OR SIMILAR METHOD APPROVED BY THE GEOTECHNICAL ENGINEER. THE CONTRACTOR'S GEOTECHNICAL ENGINEER HAS SPECIFIED AN ALLOWABLE BEARING PRESSURE OF 6000 PSF ONCE THE SOIL IS REINFORCED. THE ALLOWABLE BEARING PRESSURE OF 6000 PSF OF THE SOIL, ONCE REINFORCED, SHALL BE VERIFIED IN THE FIELD BY A REGISTERED GEOTECHNICAL ENGINEER IN THE DISTRICT OF COLUMBIA PRIOR TO INSTALLING FOUNDATIONS.

FOOTING SCHEDULE

MARK	DIMENSIONS			BOTTOM REINFORCEMENT		TOP REINFORCEMENT		STIRRUPS	REMARKS
	LONG	SHORT	THICKNESS	LONG BARS	SHORT BARS	LONG BARS	SHORT BARS	SIZE	
F–46	4'–6"	4'–6"	15"	8–#4	8–#4	–	–	–	–
F–50	5'–0"	5'–0"	16"	6–#5	6–#5	–	–	–	–
F–56	5'–6"	5'–6"	18"	11–#4	11–#4	–	–	–	–
F–60	6'–0"	6'–0"	20"	6–#6	6–#6	–	–	–	–
F–66	6'–6"	6'–6"	21"	8–#6	8–#6	–	–	–	–
F–70	7'–0"	7'–0"	23"	9–#6	9–#6	–	–	–	–
F–76	7'–6"	7'–6"	25"	7–#7	7–#7	–	–	–	–
F–80	8'–0"	8'–0"	26"	8–#7	8–#7	–	–	–	–
F–70x36	7'–0"	3'–6"	23"	5–#6	9–#6	–	–	–	–
F–80x40	8'–0"	4'–0"	26"	4–#7	8–#7	–	–	–	–
F–90x46	9'–0"	4'–6"	29"	4–#8	8–#8	–	–	–	–
CF–20	–	2'–0"	15"	3–#5	#6@12"	–	–	–	–
CF–20A	–	2'–0"	20"	5–#11	–	5–#11	–	#5@6"	TYPE A
CF–26	–	2'–6"	15"	3–#5	#6@12"	–	–	–	–
CF–26A	–	2'–6"	15"	3–#6	–	3–#6	–	#4@6"	TYPE A
CF–30	–	3'–0"	15"	4–#5	#6@12"	–	–	–	–
CF–30A	–	3'–0"	15"	3–#6	–	3–#6	–	#5@6"	TYPE A
CF–30B	–	3'–0"	18"	3–#6	–	3–#6	–	#4@6"	TYPE A
CF–30C	–	3'–0"	26"	14–#11 (2 LAYERS)	–	14–#11 (2 LAYERS)	–	#5@6"	TYPE B
CF–30D	–	3'–0"	18"	6–#6	–	6–#6	–	#5@6"	TYPE A
CF–36	–	3'–6"	15"	4–#5	#6@12"	–	–	–	–
CF–40	–	4'–0"	15"	5–#5	#6@12"	–	–	–	–
CF–40A	–	4'–0"	15"	3–#6	–	3–#6	–	#5@6"	TYPE A
CF–60	–	5'–0"	20"	5–#5	#9@12"	5–#9	#9@12"	–	–
CF–90	–	9'–0"	18"	8–#6	#6@12"	–	–	–	–



TYPE "A" STIRRUPS
NTS

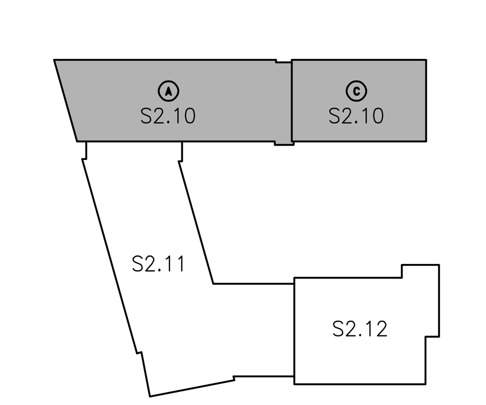


TYPE "B" STIRRUPS
NTS

NOTES:
1. FOOTINGS DESIGNED BASED ON SOIL BEARING PRESSURE OF 6000 PSF.
2. REFERENCE SOIL REPORT BY ECS MID–ATLANTIC, LLC. AND GEOSTRUCTURES, INC. FOR ADDITIONAL REQUIREMENTS AND SPECIFICATIONS.

1 FOOTING SCHEDULE TABLE
N.T.S.

KEY PLAN



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410-377-2543

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Park Plaza I
2101 Gaither Road, Suite 250
Rockville, MD 20850
301-417-0900
301-417-9625

Data & IT
Wright Engineering, LLC
3 Leonard Court
Perry Hall, MD 21128
410.877.6297
866.636.6374 Fax

SEAL

ASI #7	8.13.08
ASI #6	7.17.08

REVISIONS

SHEET TITLE
First Floor / Foundation Partial Plan

SCALE	DATE	PROJ#
1/8" = 1'-0"	4.14.08	27142.1

PROJECT PHASE
Bid Set

DRAWING #
S2.10

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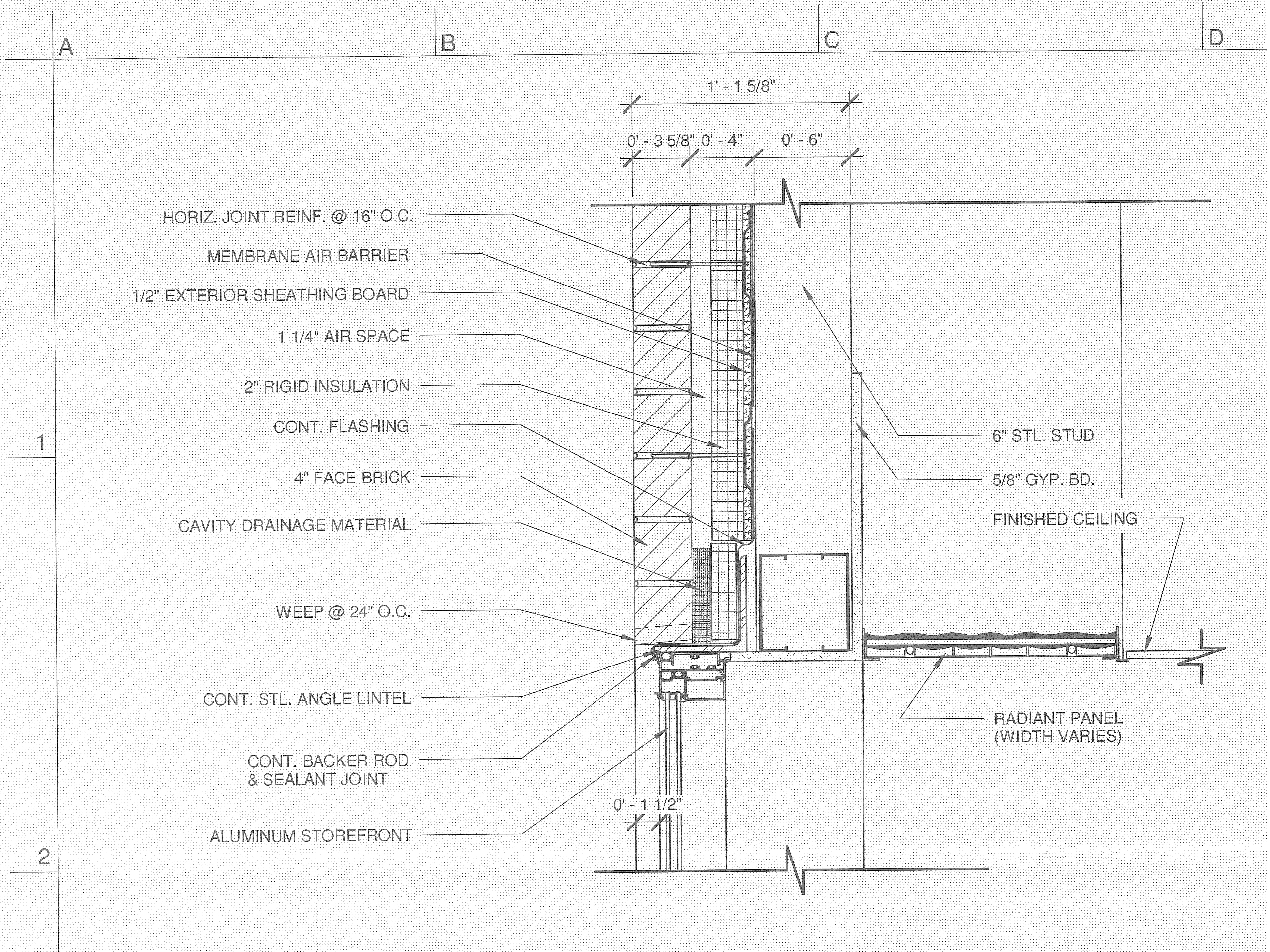
Appendix C: Typical Wall Detail



3A
A5.24

Typical Head Detail - XM6 Walls

1 1/2" = 1'-0"