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Tech Report 1
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CityCenterDC | Parcel 1

Washington, D.C.

Executive Summary

CityCenterDC is a 2 million square foot real estate development located in the heart of Washington, D.C. It consists of two office buildings, two condominiums, and two rental buildings, all sitting on top of a shared four story parking garage. The focus of this technical assignment is a comprehensive report of the existing conditions of the north office building of the project, also known as Parcel 1 or Office Building 1.

Nearly a decade ago the District launched an initiative to develop the site of the old convention center. Hines-Archstone, the chosen developer, implemented a design-bid-build delivery method. Foster+Partners began designing the development in 2004. In 2008, Clark/Smoot was awarded the project under a Guaranteed Maximum Price contract. Construction did not begin until 2011 due to various financial issues. The parking garage, serving as the foundation for all six buildings, was erected first, followed by the remaining buildings. The construction of Parcel 1 began towards the end of February 2012, and its substantial completion is expected in mid-2013.

Parcel 1 is a 257,500 sq. ft. core and shell office building. It is a cast-in-place concrete structure comprising of post-tensioned slabs and shear walls. A curtain wall system, fastened to embed plates in the slabs, encloses the entire building. The mechanical penthouse on the roof houses three cooling towers, outside air handler units, and rainwater retention systems. The core of every floor contains an electrical and mechanical closet, bathroom, elevator shaft, kitchen, and storage closets. The main electrical distribution room in the garage provides 480/277V, 3P, 4W power to the building, along with a 750kW back-up generator. A chilled water system, along with fan powered terminal units, VAV boxes, and electric heating coils, is used to condition the spaces. The multiple green roofs contribute to the minimum LEED Silver accreditation CityCenterDC is seeking.

The actual cost of construction [redacted] of Parcel 1, as well as a cost breakdown of the systems, was compared to square foot and assemblies estimates. It was found that both estimates came in lower than the actual cost due to factors such as, but not limited to, materials, lack of detail in RSMeans, and untraditional project phasing. Investigation into the organizational and staffing charts was performed to gain a broader understanding of the responsible parties for the project. Existing conditions of the site were analyzed and three site layout planning maps were created for different phases of the project. The findings in this report will serve as a precursor to the remaining thesis assignments.

Table of Contents

Project Schedule Summary

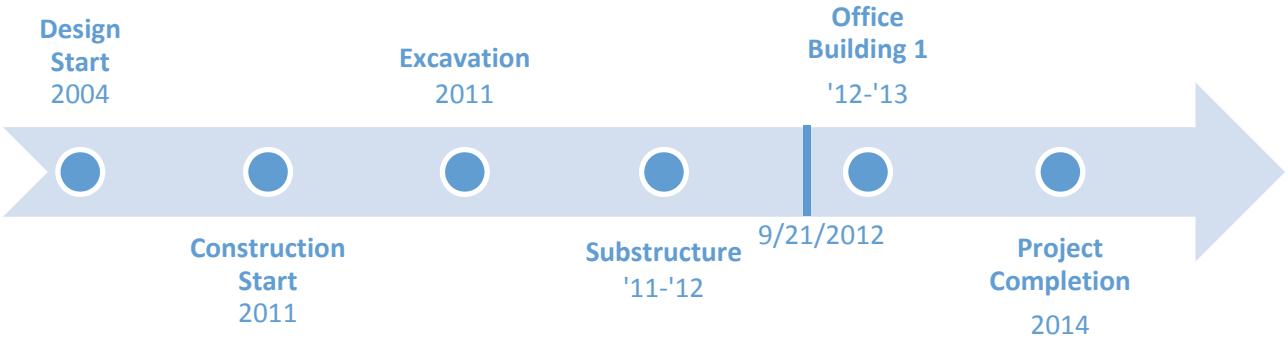
The idea for City Center started over a decade ago when Mayor Anthony Williams decided to redevelop the site of the old convention center. In 2002, after two years of research and studies, he announced the space would be best served as a development consisting of apartments/condominiums, along with parking and office space. An RFP was issued, and by 2004 Hines-Archstone was chosen as the developer for the project. Hines-Archstone appointed Foster + Partners, a UK based, world-renown architecture firm, to design the development.

For the next couple of years, the District and developers struggled to come to terms on the details of the project. Approvals and financing from both sides dragged this process along until finally in 2008, with a finalized master plan, Hines issued an RFP for a general contractor. A joint venture between Clark Construction and Smoot Construction was awarded the project. Once again, due to an ailing financial market and the financing difficulties associated with it, the construction start date dragged to the fall of 2011.

City Center was broken down into four separate packages: parking garage, office, rentals, and condominiums. As soon as the massive excavation was complete, crane foundations were set and the seven cranes were erected, as they would be embedded in buildings throughout construction. The parking garage would be erected first, as it spans the entire length and width of the site, and acts as the foundation for the remaining buildings.

The remaining buildings could not begin construction until the parking garage was complete. Only upon the successful and substantial completion of the parking garage could the remaining buildings begin construction. As a result, the garage's timely completion ultimately determined the end date for the entire project.

Once the garage was completed, a seamless transition into the construction of the offices, rentals, and condos began. The north office and condo were the first two buildings to begin construction. Their southern counterparts followed behind by one floor. A month later, the rental units in middle of the site rose above grade, approximately four floors behind the office. Office building 1 in the meantime rose by about one floor per week.



Foundation Sequence

As mentioned above, all of the buildings, including the office building, share the same foundation structure. The first step in the foundation sequence was to create a concrete pad for the crane. Shortly thereafter, the structure of the crane was set up to where it was in fully operational mode. With all of the cranes set up, they assisted in transporting concrete and materials down into the excavation. The cast-in-place structure included four levels of thick concrete walls and columns. The office foundations were the first to develop, followed by the condo foundations, and finally the rentals. Throughout the project, this sequence of working towards the middle from the outside was followed.

Structural Sequence

The structural sequence for the office building follows the traditional rules for a cast-in-place concrete structure. Formwork and temporary shoring are erected, starting from the west to the east side of the building. Post-tensioned cables are arranged along with rebar and the slab is poured. Once the concrete has reached sufficient strength, the same process is repeated for the floor above, all the way to the 12th floor. Shoring usually remains for two to three floors below the most current slab. Cables are post-tensioned when the slab has completely cured.

In this whole process, there were two major details that required special attention. The first was the post-tensioned cable. It's proper placement and layout was crucial for its intended structural capacity. Any mistakes could comprise the structural integrity of the slabs. The second important detail was the coordination of the coring for the different conduit, pipe, etc. that must pass through the slab. Using new Trimble equipment, the location of these spots was located from the BIM model. It was extremely important to confirm the correctness of the model and ensure the proper use of the equipment. An improperly cored slab could result in rework, and as such, could require a complete re-pour of the slab. This would create an extremely uncomfortable delay for all the parties involved.

Finish Sequence

The most significant aspects of the finish sequence for this project are the tenant requests. The office building is a core and shell structure, designed with customization in mind. The goal of the developer is to find a tenant during the earlier phases of construction and alter the finishes upon request of the tenant. As a result, the designers and contractors must come to an initial value of the finishes and negotiate with the tenant the price change of the new proposal, if such is desired. If a change is desired by the tenant, the contractors must work around securing the long lead items and modifying the schedule to fit the changes into the new program. This can lead to major delays if the materials are not acquired early and crews are not planned carefully.

***Please refer to Appendix A for project schedule**

Building Systems Summary

Yes	No	Work Scope
x		Demolition Required
x		Structural Steel Frame
x		Cast in Place Concrete
	x	Precast Concrete
x		Mechanical System
x		Electrical System
	x	Masonry
x		Curtain Wall
x		Support of Excavation

Table 1: Building Systems Summary

Demolition

Since the demolition of the old convention center in 2004, the only structure on site was a temporary slab-on-grade parking lot. Approximately 300,000 sq. ft. of parking lot was removed for the entire project (all 6 buildings). For parcel 1, that amounts to about 50,000 sq. ft. The other half of the parking lot remained to serve as employee parking, and will be demolished for a future project.

Structural Steel Frame

The only sections of the building that utilize steel construction are the atrium and mechanical penthouse. The atrium, which extends the entire height of the building, is composed of W and HSS beams, as seen in Figure 1. An enclosed curtain-wall bridge, also composed of various W beams, connects the atriums of each building. The penthouse mezzanine and roof framing are also composed of W beams, ranging from W10 to W18. This is due to the heavy loads associated with the mechanical equipment. Also, by using steel beams, more space is allotted for openings, chases, and cores in between the beams, whereas the typical post-tensioned slab would have reinforcement that would interfere. If concrete beams were to replace the steel beams, they would have a much larger depth because of the loads, and as a result, take away from the ceiling height on the lower level. Structural steel framing is used on each floor at the core of the building, to enclose the bathrooms, mechanical, electrical, and storage spaces.

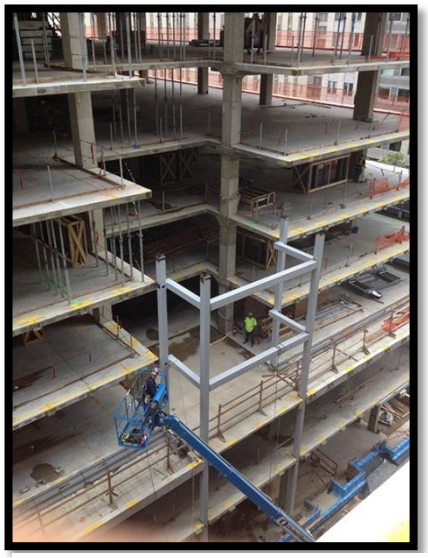


Figure 1: Atrium | Andy Penev

The inability to place cranes around the buildings called for an embedded arrangement within the structures. Seven tower cranes (see Figure 2), with reaches from 124' to 213', were placed at strategic locations throughout the development to ensure that all points of the site could be reached by at least one crane. After the erection of the superstructure is complete, the cranes will be disassembled and the holes filled in with the appropriate material.

Figure 2: Cranes | Andy Penev

Cast-in-Place Concrete

The majority of the structure, including the floor slabs, drop panels, columns, and shear walls are cast-in-place concrete. Typical on every floor are 8" thick post-tensioned slabs with 6" drop panels at the columns. Formwork for the slabs consists of No. 2 lumber and plywood, supported by traditional shoring. Temporary steel beams support the plywood and lumber, where the rebar and post-tensioning cable are arranged on stools. The crane hoists buckets to the desired location and the slab is poured and formed. A concrete batch plant was set up due to the extremely large demand for concrete for the entire project. The addition of this plant eliminated the travel time for trucks, and fresh concrete was more readily available.

Underneath the office building is a four-story garage. As a result, the first floor slab includes rigid insulation between the garage roof slab and the office building first floor slab. This was done in order to reduce the noise from the garage below and minimize the heat loss through the floor. The foundations of the office building tie into the parking garage structure, which was designed to carry the loads of all 6 buildings.

Mechanical System

The office building utilizes a chilled water system to provide cooling to the spaces. A chilled water air handling unit is located in the mechanical room on every floor of the structure. Outside air, along with return air, is cooled via chilled water coils and circulated to the fan powered terminal units. Each floor is separated into zones to provide optimal control for the user. Due to the lack of walls, the multiple FPTUs have been designed to allow tenants to control and condition zones of the floor differently. Electric heaters in the AHU and FPTUs provide heat to the space during the winter months. The AHU on each floor is located in the core, with the pipes and ductwork webbing out to the remaining space. Three cooling towers, outside air handlers, and several other rainwater filtration systems are housed in the mechanical penthouse on the roof of the building.

Fire suppression for this office building is quite extensive, due in part to the high-rise classification. Smokeproof/pressurized stairways, sprinklers, and fire dampers are utilized throughout the building. Two hour ratings are mandatory for most assemblies, including shafts, elevator hoistways, exit passageways, the structural frame, and the floor.

Electrical System

City Center Parcel 1 uses a 480/277V electrical distribution system. Service is provided by PEPCO at 480/277V, run through a utility meter, and into the switchboards. The two office buildings share an electrical room on level B1, the uppermost level of the garage. There are four switchboards, 2-3000A and 2-4000A. Each 4000A switchboard feeds the electrical closets on every floor of its respective building via a 4000A busway. The remaining two switchboards are shared between the two buildings. 480/277V to 208/120V step-down transformers are located in each electrical closet and at every location that requires lower voltage. This allows runs to floors to have smaller wire sizes due to the higher voltage feeders. In the case of interrupted or lost service, there is a 750kW standby generator designated for backup power to the fire pump, life safety systems, smoke removal systems, equipment, and elevators. Automatic transfer switches are used to detect outages and relay to the generator.

Curtain Wall

A curtain wall system is used for the entirety of the building façade. It is identical on every floor and wraps around the entire building. The curtain wall is supported via embed plates in the slabs, as seen in Figure 3. The curtain wall runs from slab to slab, and clings on at these connection locations. Insulation is included in the curtain wall assembly. At the top and bottom of each floor, special attachments to the assembly fasten to the ceiling and floor to create a uniform and flush appearance.

Figure 3: Curtain Wall Embed Connection | Andy Penev

Excavation

Typical to the region, this project consisted of a massive excavation, about 4 stories, supported by soldier piles and lagging (see Figure 4). The quality of these supports was crucial, as three sides of the site were bordered by existing, operating, busy streets. CityCenterDC is located in the middle of downtown D.C., and as a result, calls for stringent mud control. Each truck entering or leaving the site must go through a cleaning station prior to its exit off the site. The extra space on site, created by the excess parking lot, allowed for extra room for this cleaning station and control of all trucks.

Figure 4: Excavation | OxBlue

LEED Rating & Green Features

In order to achieve the desired LEED Gold rating, several construction techniques have been applied. A Construction Waste Management Plan was distributed to each foreman and subcontractor, outlining rules for disposal and recycling of land clearing debris, concrete and masonry, metals, untreated wood, gypsum wallboard scrap, and paper products. Another action taken towards obtaining this goal in the design was the use regionally extracted, harvested, recycled, and manufactured materials. The use of green roofs on all buildings is aimed to provide better insulation, retain rainwater, reduce the "urban heat island" effect, extend roof lifespan, and increase air quality.

Project Cost Evaluation

CityCenterDC Office Building 1 Actual Cost			
Concrete		Cost/SF	% of Construction Cost
Masonry/Stone			
Metals			
Carpentry			
Roofing/Waterproofing			
Doors/Glass			
Finishes			
Specialties			
Equipment			
Elevators			
Mechanical/Plumbing/Fire/Controls			
Electrical			
Building Construction Cost			
Building Construction Cost/SF			
Building 1 Project Cost			
Building 1 Project Cost/SF			
Office Bldgs. 1 + 2 Cost			
Garage & Site Office Building 1			
Garage & Site Cost/SF			

Table 2: Building Cost Summary

The construction cost for Office Building is approximately With the addition of general conditions, fees, bonds, etc., the project price jumps to about Since the two office buildings are almost identical, the cost for the bundle, as packaged in the contract, is ~$96 million. The cost of the sitework and garage/foundation for the office buildings is approximately Once again, broken down to just Office Building 1, this amounts to around In order to recognize where the majority of the costs are coming from, Table 2 breaks down the project into various systems. As seen in Table 2, the most prevalent cost comes from the doors and glass of the building. This is owed to the curtain wall system that encloses the entire building. While 43% is a substantial amount of the final cost, it was an important asset to the owner and architect.

RSMeans Square Foot Estimate	
Building Type	Commercial, Office, 11-20 Story
Construction Type	Double Glazed Heat Absorbing Tinted Plate Glass Panels Reinforced Concrete Frame
Location	Washington, D.C.
Date	2012 Quarter 3
Labor	Union
Story Height	11’
Story Count	12
Area (SF)	257,500
Perimeter (LF)	671
Total Building Cost	$32,031,500
SF Cost	$124.39

Table 3: RSMeans Square Foot Estimate

***See Appendix B for estimate details**

RSMeans Square Foot Estimate (version 2012) was used to arrive at the above SF building cost estimate. Parcel 1 is 257,500 square feet, and has a 671 LF perimeter. Interpolation was necessary to arrive at the proper initial cost of the building due to the rounding used by RSMeans. From there, location, height, perimeter, and time adjustment factors were used to come up with the final square foot estimate.

There are many factors that influence and differentiate the square foot estimate from the actual cost. One of the first glaring differences is the foundation. The office building package does not include the subgrade structure, the garage. This structure has a separate contract and price associated with it. It is designed with the intent of the office buildings to sit on top of it, but the office building’s design and budget does not include it. Therefore, the square foot foundation cost is not applicable to this project. The next issue is the limited construction types RSMeans provides. The double glazed heat absorbing tinted plate glass panels are different than the curtain wall system used at Parcel 1. The actual cost of the curtain wall is three times as much as the RSMeans square foot estimate price. Also, the post-tensioning cables and shear walls would be priced differently than the RSMeans equivalents.

Another very important influence that drives the actual cost of the project up is the intended market. All six buildings of City Center are considered luxury spaces, targeting the higher end market. The materials and equipment used in construction are the best on the market. Also, the future tenants of the office building have the option of coordinating with the architect for custom designs.

RSMeans MEP Assemblies Estimate					
Mechanical	$938,433	Cost/SF	$3.64	% of MEP Assemblies Cost	11
Electrical	$3,206,221		$12.45		37
Plumbing	$4,539,517		$17.63		52
Assemblies Cost	$8,684,171				
Assemblies Cost/SF	$33.72				

Table 4: RSMeans Assemblies Estimate

***See Appendix C for estimate details**

An MEP assemblies estimate was created using the RSMeans Mechanical, Electrical, & Plumbing Assemblies Cost Books. The estimate produced a cost for the MEP systems of $8,684,171, or $33.72. Compared to the MEP construction costs, there is a difference of around $2.5 million. Careful analysis yields several key factors influencing the difference between the actual cost and estimate.

The MEP actual construction costs total . This figure is broken down into two categories: mechanical and plumbing systems together and the electrical system separate. In addition, costs for controls and fire protection are included in the mechanical and plumbing systems category.

The actual electrical cost is more than the assemblies estimate. This difference is owed to the lack of panelboards and transformers, as well as contractor mark-up, in the electrical assemblies book. The other category of the actual MEP construction cost, including mechanical, plumbing, controls, and fire protection, is more than the mechanical/plumbing assemblies estimate. This difference is due to the inclusion of controls and fire protection systems in the actual costs, as well as the lack of contractor mark-up in the assemblies. The controls and fire protection systems in a new office building are quite substantial and as a result inflate the difference significantly. With these several considerations, the difference in the actual cost and the assemblies estimate is justifiable.

Existing Conditions – *please refer to Appendix D*

CityCenterDC is a two block development located in the heart of Washington, D.C. (see Figure 5). The site of the project was once the Washington Convention Center. Since it's demolition in 2004, the lot has been used as a parking lot for the surrounding businesses. Office Building 1 is located on 11th St. and New York Avenue, as seen outlined in Figure 6.

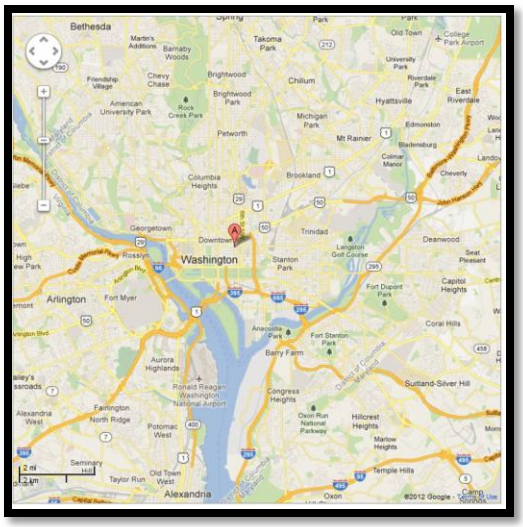


Figure 5: Map | Google Maps

While space is not a constraining factor on site, the surroundings raise some safety and logistical issues. The construction site is located in the middle of a multitude of operating businesses and busy streets. This means that construction is in progress in the midst of heavy pedestrian and vehicular traffic. To ensure the safety of those around the site, all sidewalks bordering the site are closed. Sidewalks on the opposite side of those streets are wide enough to accommodate the pedestrian traffic. An 8' fence surrounds the entire site, and access to the site is carefully monitored. The layout of the trailers and concrete batch plant are consistent throughout the entirety of the project. Multiple streets and access points prevent major traffic jams on any of the streets.

Figure 6: Aerial | Hines-Archstone

A unique aspect of this project is the introduction of two new streets. As highlighted in Figure 6, new sections of 10th Street and I Street will be introduced. The current lot does not include any part of these new streets, and as a result, the city utility grid needs to be extended under the streets. This requires additional work under the surface of the road. For 10th Street, this will be done simultaneously with the project. Since the trailers and material lay down areas are in the future place of the I Street extension during construction, the grid and street will be constructed at a later date.

The underground utilities that run through this part of the city are very extensive. Underneath all of the streets surrounding the site are existing water lines, electric lines, gas lines, telecom lines, fiber lines, etc. Ten 36" pipes in a sewer manifold run on the southern edge of the site. This abundance of utilities is due to the prime location of the project. Due to the existing, former, and future buildings in the area, utilities under the streets have been previously installed with expansion in mind. All of the tunnels are easily accessible and will only require tie-ins for the new buildings.

Site Layout Planning

Excavation – *Please refer to Appendix E for Site Layout Planning Map*

The first phase of this project is to excavate the entire site. In order to remove the massive amount of soil from the site, the process needs to be executed in an organized manner to ensure the continuous flow of work. The fencing around the entire site for the rest of the project will be erected at this stage. Contractors' trailers will also be mobilized at this point and removed at the end of the project. The east gate will be used for dump trucks to exit the site, while the west gate will be used as an entrance. The north gate will be used for all other deliveries. Trucks will drive down a ramp into the excavation, load the soil in their buckets, and exit up another ramp. Before the trucks exit the site, a cleaning station will ensure major dirt and debris is knocked off. Excavators will work from the east and west sides of the site in towards the center. Soldier piles and lagging will be placed on the sides of the excavation to prevent any collapses and ensure safety of workers. The northeast corner of the old parking lot will remain to serve as parking for employees throughout the project.

Substructure – *Please refer to Appendix E for Site Layout Planning Map*

The parking garage serves as the substructure for all six buildings. As soon as the excavation is complete, all seven tower cranes will be erected, as the remaining substructure and superstructure will be built around them. A concrete batch plant will be placed in the northwest corner of the site to provide the massive amounts of concrete required for this job. This will substantially reduce the delays and troubles associated with concrete deliveries. Once again, work will start from the west and east sides, and move in towards the middle. Material lay down areas will be set up next to the excavation so that cranes can easily hoist the material. Deliveries will still be made via the west, east, and north gates. Temporary power will be provided by the electrical subcontractor. At this point, most major trades have mobilized on site. Crane swings must be carefully executed to ensure safety below.

Superstructure – *Please refer to Appendix E for Site Layout Planning Map*

Site set-up for the superstructure will be very similar to that of the substructure. The concrete batch plant, trailers, toilets, and many material lay down areas will remain the same. Additions will include a food truck, in response to the large quantity of workers, as well as dumpsters with chutes for each of the northern buildings. As construction progresses, the biggest challenge will be keeping the site organized and uncluttered. Material must be hoisted to its final destination by the cranes in order to keep a clear path for other delivery trucks. This can cause clutter inside the buildings themselves, so the construction teams must coordinate on-time deliveries to avoid setbacks.

Local Conditions

The construction methods utilized for CityCenterDC were typical to those used within the geographical region. The massive excavation supported by solider piles and lagging, is the most widely used technique in the region. Methods such as top-down construction have been recently used at the nearby Marriott Marquis, but turned out extremely unsuccessful. Also very typical to the region, the building is made of cast-in-place concrete rather than a steel frame. This is, in part, due to the high cost of steel in the region and the abundance of experienced concrete specialists.

As mentioned before, the existing site was completely covered by a parking lot. The northeastern corner was left untouched to serve as construction parking throughout the entirety of the project. There are also several Metro stations within walking distance that employees are encouraged to utilize. Hines-Archstone has taken the task of acquiring all permits and permissions. All of the legislative actions will be handled by Hines-Archstone due to their close relationship with the District.

The District was adamant about holding contractors responsible for recycling, and as a result, a Waste Management Plan was enacted. As part of the plan, the contractor must collect, segregate, recycle, and recover at least 75% of construction waste and debris created by the work. The containers on site must be emptied as demand requires, and are subject to local tipping fees. Separation of materials is also required for certain, more complex, materials. Soil conditions were not atypical to region; no blasting or unusual composites were found. Garage is waterproofed to eliminate risk of ground water damage to structure.

Client Information

One of the two main developers of City Center, Hines, is a privately owned firm, specializing in international real estate. The firm's assets are valued at approximately $23 billion, and their presence extends in more than 100 cities around the world. The firm's portfolio includes skyscrapers, headquarters, mixed-use centers, industrial parks, medical facilities, and resort and residential communities. Hines prides itself on its quality, service, and value they provide to their clients and investors.

One of the main driving factors in the pursuit of the CityCenterDC project for Hines was the potential for a financial gain. Hines's experience and history in these types of projects has shown they are both profitable and feasible. The location and targeted high-end commercial and residential market also promise for higher asking prices for the spaces.

With the high standards Hines sets in the industry, come high expectations for cost, quality, schedule, and safety. To ensure that these expectations are met, Hines took the following, but not limited to, actions:

- **Pre-bid conferences**: Meet individually with candidates to answer questions and discuss the proposal process
- **Detailed RFP** (schedule & cost requirements): Outlines detailed instructions about expected deliverables in response. Detailed schedules are expected and cost must be broken down into several categories and explained. Professional presentations are necessary.
- **Stringent qualifications**: Contractors and design firms must have extensive experience and ability to perform project of this magnitude.
- **Community Involvement Plan:** Provide the community with information about, and input into, the project as it is designed, developed, constructed, and operated.
- **Internship program:** Provide high school and college students internship opportunities throughout design and construction phases.
- **First Source Employment Agreement:** Recruitment, referral, and placement of District of Columbia residents.
- **CBE contractors:** Utilize CBE contractors for contracts worth an aggregate value equal to no less than 35%.
- **Staffing, management, construction, site plans:** Contractors must provide these plans to owner at all phases of project to ensure quality and safety.
- **Quality Control Program:** Goal of program of winning bidder should be to achieve zero defects in the construction of the project without impacting the project schedule.
- **Forums:** Gatherings with all participants as well as community.
- **Quality through design:** Emphasis on quality design, architectural and engineering.
- **Subcontractor events:** Hold subcontractor meeting events to discuss goals and values.
- **Minority and small business involvement:** Employ minority and small businesses to boost local economy.
- **Warranty Service Program:** Provide a warranty program to the owner with follow-ups and reports.
- **LEED certification:** Each building shall have a LEED rating of silver or higher.

Presently, one of the largest law firms in the area plans to occupy the office building. As for the retail space on the first two floors, Apple recently announced it will lease one of the larger spaces. The investment already has high profile clients lined up, and as a result, the participants of the project must deliver a high quality product. Owner's involvement is crucial to the successful completion of this project. With an involved owner, the participants of the project are aware of the expectations. The thorough design has also helped in reducing potential problems. The many years designers and engineers have worked to polish the design has decreased many of the issues often encountered in construction. Contractors must keep the owner as involved as possible and make sure the proper information is passed down every subcontractor. With proper and constant communication, all sides of the team will produce a quality product.

Project Delivery System

The delivery method for the City Center project is Design-Bid-Build. This occurred rather naturally in respect to the way the development came to be. After being awarded the project by the District, Hines-Archstone hired Foster+Partners to design the development. It took three years from that point for the owner to send out an RFP for contractors. In the meantime, design constantly changed and took different forms. Once the go-ahead was given to bid the project, Hines-Archstone selected a GC they were confident could perform this complex task. It wasn't until another three years after that point that the project broke ground. This second delay was mostly due to financial reasons during a tough economic period. At this point construction consulting and pre-construction services were beginning to develop.

The project is broken down into four packages due to its size. The owner bid the project as a "Master Project," and awarded one contractor the entire project. Each individual package though, had a separate contract. The contractor then bid the individual packages to subcontractors. The owner expects the contractor to go through with all four packages

Hines-Archstone's contracts took on a custom-hybrid-form, due to the complex nature of the project. The contracts did not follow the traditional and standard formats, such as AIA. As mentioned earlier, the Master Project was broken down into four separate contracts. In the RFP, Hines-Archstone asked for a lump-sum fee for pre-construction services, cost for general conditions, a lump sum contractor' s fee, contingency estimate, and an insurance , bonds, and budget estimate. The contractor will then be responsible for acquiring his subcontractors, and preparing four separate GMP contracts, one for each package of the project. Hines-Archstone bid the project privately, selecting what they deemed the most appropriate contractors for the job. One of the main priorities was to have a joint venture contractor on the job. A joint venture allowed for comfort on both the owner's and contractor's side in regard to the feasibility of the project. The contractor also had to show full understanding of the terms in the RFP and embrace the minority participation component set forth by the District. Full payment and performance bonds, along with builder's risk insurance and general liability insurance were also required. The owner took responsibility for paying for the building permit, approvals, certifications, licenses, and inspection fees. Hines-Archstone also required a 10% retainage to be withheld from the contractor. One of the other important factors the owner sought was the experience and professionalism of the contractor. It was very important to Hines-Archstone that the contractor understand the local conditions and terms and be capable of compiling a professional, experienced team. After a careful selection process, Clark/Smoot was awarded the project. They went on to hiring their subcontractors using lump-sum contracts. Hines-Archstone has played a very involved role with all contracting companies on the job.

Organizational Chart

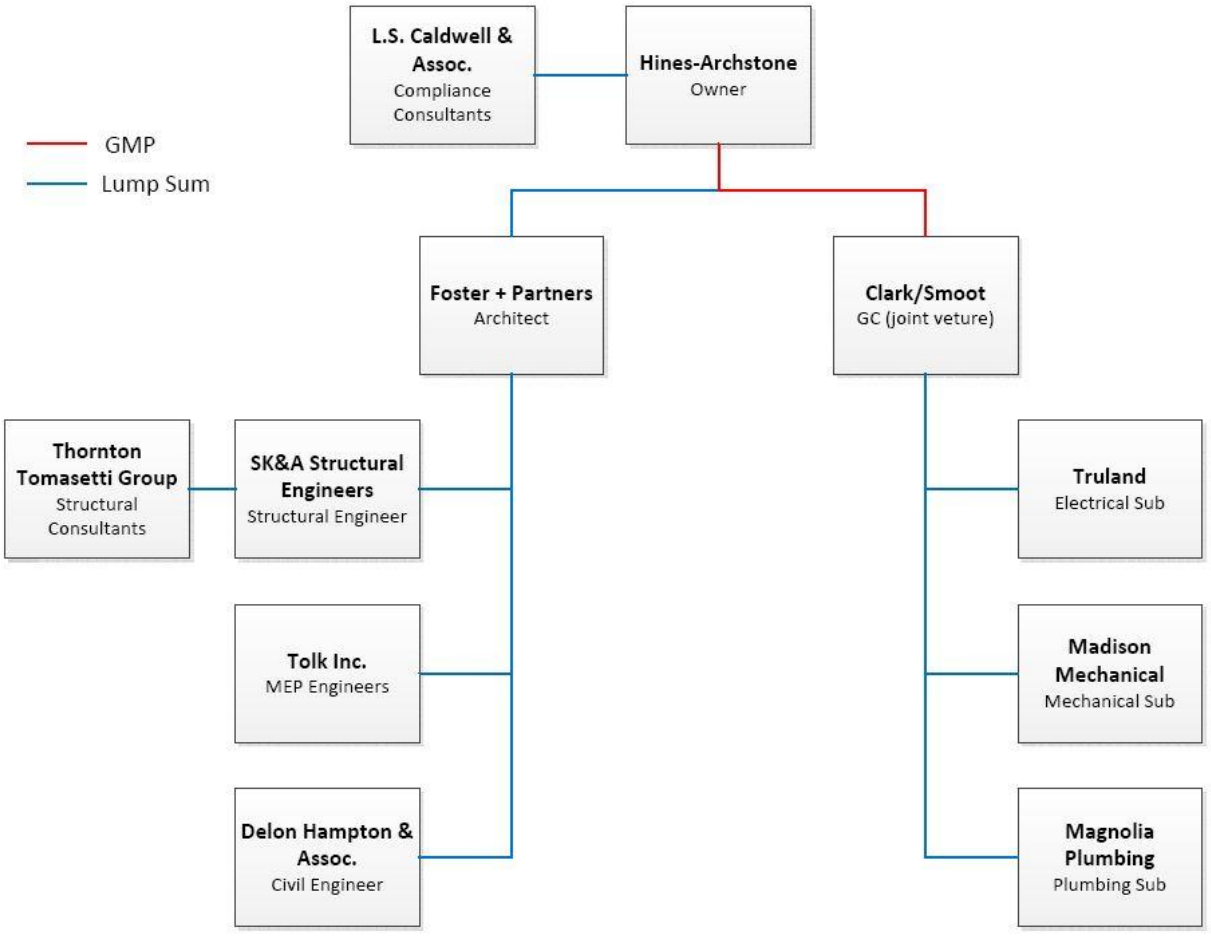


Figure 7: Organizational Chart

The above organizational chart describes the major players of the CityCenterDC project. Hines-Archstone, the owner, awarded the Clark/Smoot joint venture a GMP contract, as previously mentioned. The GC then subcontracted out the work for all four packages. McKissack (not shown) was hired later on in the process to assist with quality control. In response to the District's terms, a variety of specialty contractors were selected for the different packages, the goal being to support local small and minority businesses. The above chart focuses on Office Building 1. Foster + Partners, along with the CBE compliance consultants, were given lump sum contracts by the owner. Thornton Tomasetti was brought on to assist SK&A Structural Engineers in the structural design process. Despite the amount of players involved in this project, communication between all parties has been vital to the progress of the job.

Staffing Plan

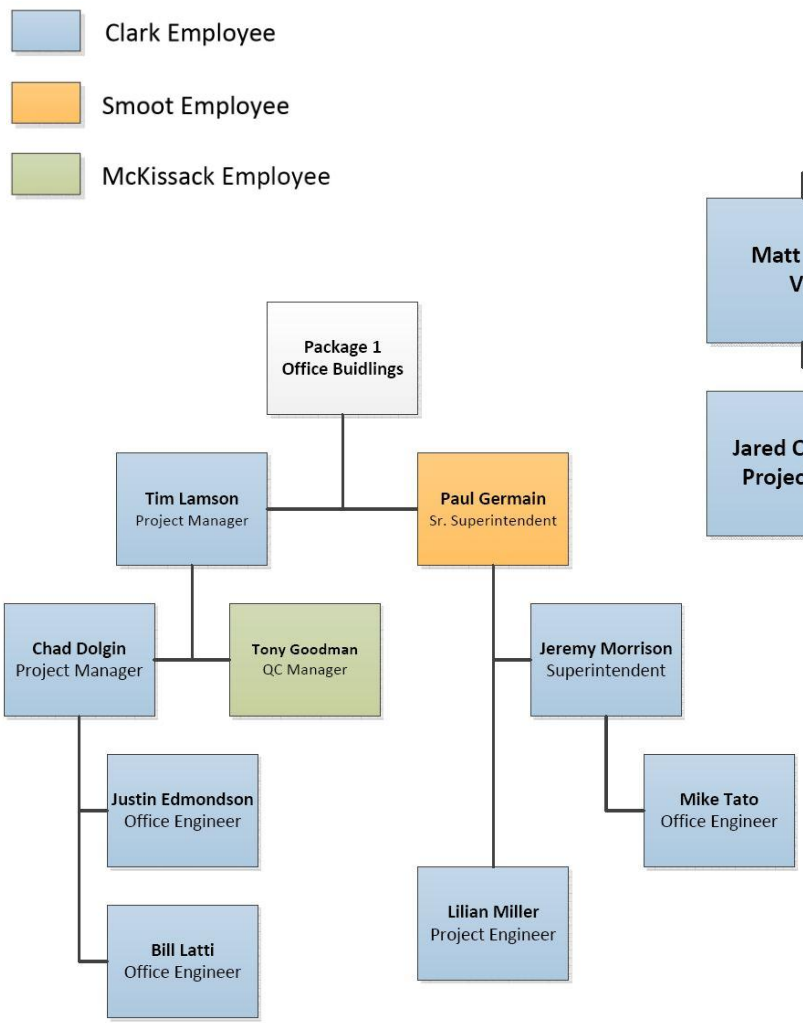


Figure 8: Office Building 1 Staffing Chart

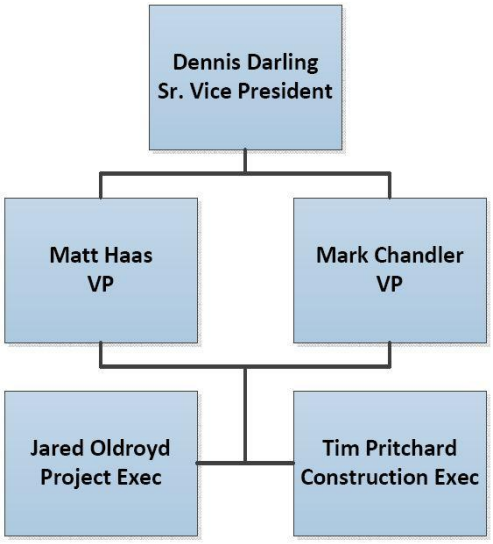


Figure 9: Clark Project Heads

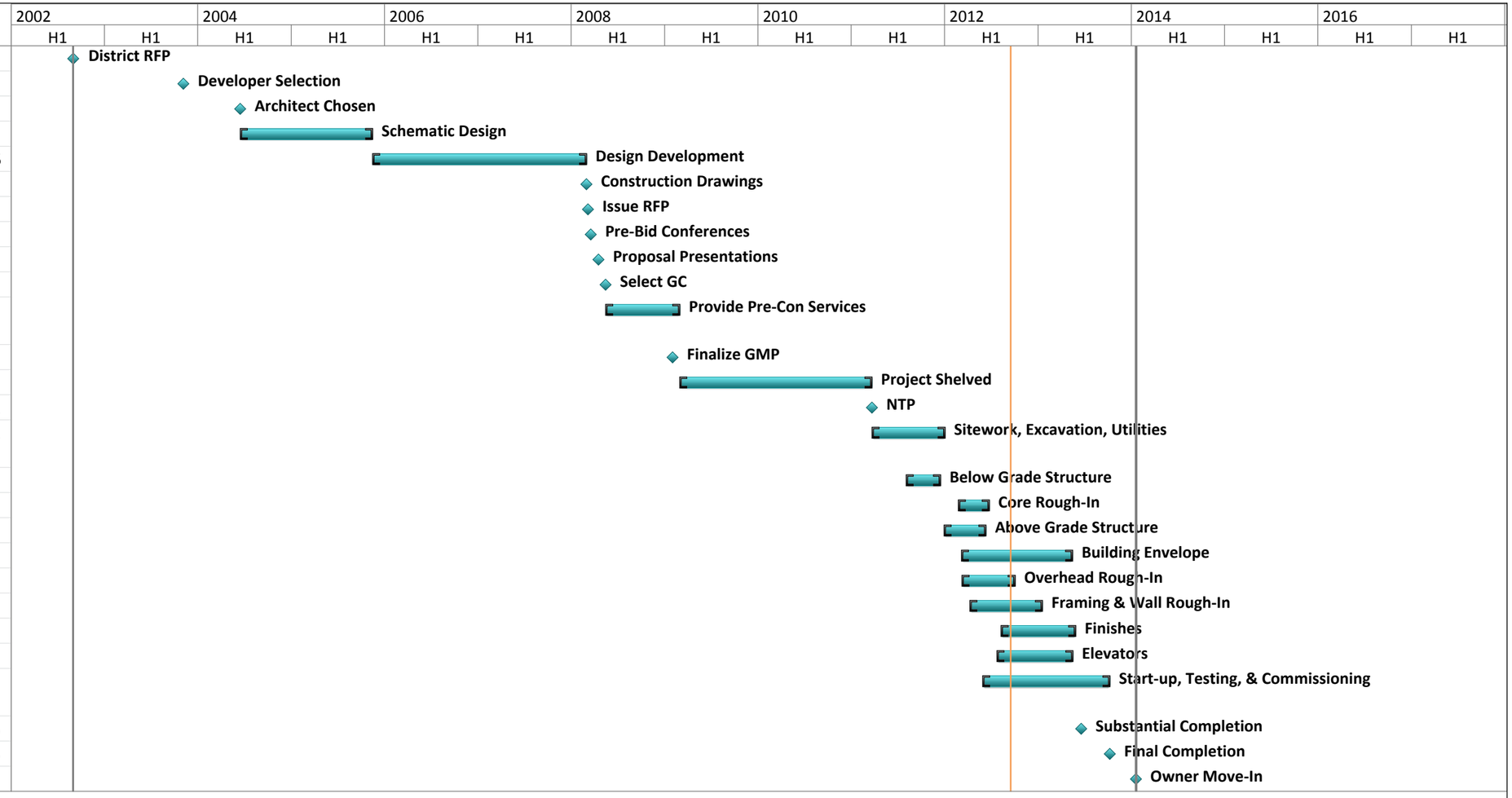
Due to the size of the project, Clark/Smoot created three staffing plans, one for each set of the building types. Figure 8 shows the individuals involved for the construction of Office Building 1. Tim Lamson serves as the PM from Clark and Paul Germain is the Sr. Superintendent from Smoot. On top of the remaining employees seen in the chart, Clark also hired several interns during the summer to assist the PM and engineers. Tony Goodman, the QC Manager, is actually a McKissack employee brought on to the job to assist with quality control for the office buildings.

Figure 7 desrcibes the senior management for the entire CityCenterDC project. Dennis Darling oversees the entire job along with Matt Haas, Mark Chandler, Jared Oldroyd, and Tim Pritchard. Issues involving the entire project are handled by these individuals. PM's for each package report to these project heads.

Appendix A

Project Schedule

ID	Task Name	Duration	Start
1	District RFP	0 days	Sun 9/1/02
2	Developer Selection	0 days	Thu 11/6/03
3	Architect Chosen	0 days	Tue 6/15/04
4	Schematic Design	371 days	Tue 6/15/04
5	Design Development	600 days	Tue 11/15/05
6	Construction Drawings	0 days	Sat 3/1/08
7	Issue RFP	0 days	Fri 3/7/08
8	Pre-Bid Conferences	0 days	Tue 3/18/08
9	Proposal Presentations	0 days	Thu 4/17/08
10	Select GC	0 days	Thu 5/15/08
11	Provide Pre-Con Services	208 days	Thu 5/15/08
12	Finalize GMP	0 days	Sun 2/1/09
13	Project Shelved	539 days	Sun 3/1/09
14	NTP	0 days	Wed 3/23/11
15	Sitework, Excavation, Utilities	205 days	Wed 3/23/11
16	Below Grade Structure	97 days	Thu 8/4/11
17	Core Rough-In	87 days	Fri 2/24/12
18	Above Grade Structure	117 days	Fri 12/30/11
19	Building Envelope	312 days	Wed 3/7/12
20	Overhead Rough-In	149 days	Fri 3/9/12
21	Framing & Wall Rough-In	205 days	Mon 4/9/12
22	Finishes	209 days	Thu 8/9/12
23	Elevators	214 days	Tue 7/24/12
24	Start-up, Testing, & Commissioning	357 days	Tue 5/29/12
25	Substantial Completion	0 days	Wed 6/19/13
26	Final Completion	0 days	Wed 10/9/13
27	Owner Move-In	0 days	Sun 1/19/14



Project: City Center Schedule
Date: Sun 9/16/12

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline	
Split	External Tasks	Inactive Summary	Manual Summary	Progress	
Milestone	External Milestone	Manual Task	Start-only		
Summary	Inactive Task	Duration-only	Finish-only		

Appendix B

RSMeans Square Foot Estimate

Square Foot Cost Estimate Report

Estimate Name:	**City Center Parcel 1**
Building Type:	**Office, 11-20 Story with Double Glazed Heat Absorbing Tinted Plate Glass Panels / R/Conc. Frame**
Location:	**WASHINGTON, DC**
Story Count:	**12**
Story Height (L.F.):	**11**
Floor Area (S.F.):	**257500**
Labor Type:	**Union**
Basement Included:	**No**
Data Release:	**Year 2012 Quarter 3**
Cost Per Square Foot:	**$155.49**
Building Cost:	**$40,039,500**

Costs are derived from a building model with basic components.

Scope differences and market conditions can cause costs to vary significantly.

		% of Total	Cost Per S.F.	Cost
A Substructure		**6.30%**	**$7.85**	**$2,021,500**
A1010	**Standard Foundations**		**$0.78**	**$202,000**
	1856 K column			
	size, 2776 K column			
A1020	**Special Foundations**		**$6.13**	**$1,579,000**
	Steel H piles, 50' long, 1200K load, end bearing, 11 pile cluster			
	Steel H piles, 50' long, 2000K load, end bearing, 18 pile cluster			
	Grade beam, 30' span, 52" deep, 14" wide, 12 KLF load			
A1030	**Slab on Grade**		**$0.43**	**$109,500**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**$0.02**	**$5,500**
	site storage			
A2020	**Basement Walls**		**$0.49**	**$125,500**
	thick			
B Shell		**34.20%**	**$42.55**	**$10,957,500**
B1010	**Floor Construction**		**$17.31**	**$4,458,000**
	height, 253 lbs/LF, 4000PSI			
	1000K load, 10'-14' story height, 740 lbs/LF, 4000PSI			
	1800K load, 10'-14' story height, 1220 lbs/LF, 4000PSI			
	superimposed load, 194 PSF total load			
B1020	**Roof Construction**		**$1.25**	**$321,500**
	20" deep beam, 9" slab, 152 PSF total load			
B2020	**Exterior Windows**		**$22.97**	**$5,913,500**
	opening, no intermediate horizontals			
	Glazing panel, plate glass, 1/2" thick, tempered			
B2030	**Exterior Doors**		**$0.62**	**$158,500**
	hardware, 6'-0" x 7'-0" opening			
	hardware, 6'-0" x 10'-0" opening			
B3010	**Roof Coverings**		**$0.41**	**$106,000**
	adhesive			
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			

	Roof edges, aluminum, duranodic, .050" thick, 6" face			
	Flashing, aluminum, no backing sides, .019"			
C Interiors		**15.90%**	**$19.79**	**$5,096,500**
C1010	**Partitions**		**$2.54**	**$655,000**
	board, 1 side			
	board base, 3-5/8" @ 24", same opposite face, no insulation			
	1/2" fire ratedgypsum board, taped & finished, painted on metal furring			
C1020	**Interior Doors**		**$3.03**	**$779,000**
	3'-0" x 7'-0" x 1-3/8"			
C1030	**Fittings**		**$0.39**	**$101,500**
	Toilet partitions, cubicles, ceiling hung, plastic laminate			
C2010	**Stair Construction**		**$1.89**	**$487,500**
	Stairs, steel, cement filled metal pan & picket rail, 16 risers, with landing			
C3010	**Wall Finishes**		**$0.74**	**$191,500**
	primer & 2 coats			
	Vinyl wall covering, fabric back, medium weight			
C3020	**Floor Finishes**		**$4.83**	**$1,242,500**
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 35 oz			
	Vinyl, composition tile, maximum			
	Tile, ceramic natural clay			
C3030	**Ceiling Finishes**		**$6.37**	**$1,639,500**
	channel grid, suspended support			
D Services		**43.60%**	**$54.20**	**$13,956,000**
D1010	**Elevators and Lifts**		**$8.10**	**$2,086,500**
	group, 350 FPM			
D2010	**Plumbing Fixtures**		**$3.93**	**$1,011,000**
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, vanity top, PE on CI, 20" x 18"			
	Service sink w/trim, PE on CI,wall hung w/rim guard, 24" x 20"			
	Water cooler, electric, wall hung, 8.2 GPH			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		**$0.31**	**$81,000**
	Gas fired water heater, commercial, 100< F rise, 300 MBH input, 278 GPH			
D2040	**Rain Water Drainage**		**$0.17**	**$43,500**
	Roof drain, CI, soil,single hub, 4" diam, 10' high			
	Roof drain, CI, soil,single hub, 5" diam, for each additional foot add			
D3020	**Heat Generating Systems**		**$2.32**	**$598,000**
	Plate heat exchanger, 1800 GPM			
	Utility fan set system, belt drive, 7500 CFM			
	Boiler, cast iron, gas & oil, hot water, 6000 MBH			
	GPM			
D3030	**Cooling Generating Systems**		**$16.53**	**$4,257,000**
	190.00 ton			
D4010	**Sprinklers**		**$2.87**	**$738,500**
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 10,000 SF			
	10,000 SF			
	Standard High Rise Accessory Package 16 story			

D4020	**Standpipes**		**$0.51**	**$131,000**
	Wet standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor			
	additional floors			
	Fire pump, electric, with controller, 5" pump, 100 HP, 1000 GPM			
	Fire pump, electric, for jockey pump system, add			
D5010	**Electrical Service/Distribution**		**$1.16**	**$298,000**
	phase, 4 wire, 120/208 V, 2000 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 60 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 200 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 2000 A			
	Switchgear installation, incl switchboard, panels & circuit breaker, 2000 A			
D5020	**Lighting and Branch Wiring**		**$12.22**	**$3,146,000**
	with transformer			
	Miscellaneous power, 1.2 watts			
	Central air conditioning power, 4 watts			
	Motor installation, three phase, 460 V, 15 HP motor size			
	460 V 15 HP, 575 V 20 HP			
	Motor connections, three phase, 200/230/460/575 V, up to 5 HP			
	Motor connections, three phase, 200/230/460/575 V, up to 100 HP			
	fixtures @32watt per 1000 SF			
D5030	**Communications and Security**		**$5.50**	**$1,417,000**
	Telephone wiring for offices & laboratories, 8 jacks/MSF			
	detectors, includes outlets, boxes, conduit and wire			
	Fire alarm command center, addressable with voice, excl. wire & conduit			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		**$0.58**	**$148,500**
	engine with fuel tank, 200 kW			
	kW			
E Equipment & Furnishings		**0.00%**	**$0.00**	**$0**
E1090	**Other Equipment**		**$0.00**	**$0**
F Special Construction		**0.00%**	**$0.00**	**$0**
G Building Sitework		**0.00%**	**$0.00**	**$0**

SubTotal	**100%**	**$124.39**	**$32,031,500**
Contractor Fees (General Conditions,Overhead,Profit)	**25.00%**	**$31.10**	**$8,008,000**
Architectural Fees	**0.00%**	**$0.00**	**$0**
User Fees	**0.00%**	**$0.00**	**$0**
Total Building Cost		**$155.49**	**$40,039,500**

Appendix C

RSMeans Assemblies Estimate

Cost Estimate Report
CostWorks
RSMeans

Assembly Detail Report

Washington DC,
DC , 20001
Year 2012 Quarter 3

CCDC Office 1

Date: 20-Sep-12

Line Number			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
D Services							
D20101102080			Water closet, vitreous china, bowl only with flush valve, wall hung	72	Ea.	$2,570.99	$185,111.28
D20102102000			Urinal, vitreous china, wall hung	24	Ea.	$1,397.88	$33,549.12
D20104404260			Service sink w/trim, PE on CI, corner floor, 28" x 28", w/rim guard	60	Ea.	$3,460.87	$207,652.20
D20108102200			Drinking fountain, 1 bubbler, wall mounted, full recessed, stainless steel	20	Ea.	$2,499.13	$49,982.60
D20202401820			Electric water heater, commercial, 100< F rise, 50 gallon tank, 9 KW 37 GPH	2	Ea.	$6,172.60	$12,345.20
D20202401860			Electric water heater, commercial, 100< F rise, 80 gal, 12 KW 49 GPH	1	Ea.	$8,142.53	$8,142.53
D20202401940			Electric water heater, commercial, 100< F rise, 120 gal, 36 KW 147 GPH	1	Ea.	$11,443.43	$11,443.43
D20402106440			Roof drain, steel galv sch 40 grooved, 8" diam piping, 10' high	15	Ea.	$6,087.46	$91,311.90
D20402106480			Roof drain, steel galv sch 40 threaded, 8" diam piping, for each additional foot add	2550	Ea.	$132.90	$338,895.00
D30303101050			Cooling tower, galvanized steel, packaged unit, draw thru, 1000 ton	3	Ea.	$151,568.60	$454,705.80
D30401121040			AHU, central station, cool/heat coils, VAV, filters, 20,000 CFM	12	Ea.	$102,640.40	$1,231,684.80
D30401161050			AHU, rooftop, cool/heat coils, VAV, filters, 30,000 CFM	1.1	Ea.	$209,127.30	$230,040.03
D30401321050			VAV terminal, cooling only, with actuator / controls, 1000 CFM	396	Ea.	$6,246.21	$2,473,499.16
D30406101030			Plate heat exchanger, 1200 GPM	1	Ea.	$149,587.70	$149,587.70

D50101200560			Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 2000 A	2.8	Ea.	$41,389.60	$115,890.88
D50102300560			Feeder installation 600 V, including RGS conduit and XHHW wire, 2000 A	1000	L.F.	$637.50	$637,500.00
D50102301560			Branch installation 600 V, including EMT conduit and THW wire, 200 A	2880	L.F.	$36.04	$103,795.20
D50102400400			Switchgear installation, incl switchboard, panels & circuit breaker, 2000 A	4.2	Ea.	$56,597.80	$237,710.76
D50201250560			Receptacle duplex 120 V grounded, 20 A with box, plate, 3/4" EMT & wire	240	Ea.	$277.55	$66,612.00
D50201300200			Wall switches, 1.0 per 1000 SF	257500	S.F.	$0.31	$79,825.00
D50201550200			Motor feeder systems, single phase, feed up to 115 V 1 HP or 230 V 2 HP	23760	L.F.	$10.07	$239,263.20
D50201750240			Motor, dripproof, class B insulation, 1 HP, 1200 rpm, with magnetic starter	396	Ea.	$897.08	$355,243.68
D50202100500			Fluorescent fixtures recess mounted in ceiling, 0.8 watt per SF, 20 FC, 5 fixtures @32 watt per 1000 SF	257500	S.F.	$2.83	$728,725.00
D50303100400			Telephone systems, underfloor duct, poke thru fittings, low density	50000	S.F.	$2.26	$113,000.00
D50309100450			Communication and alarm systems, fire detection, addressable, 12 detectors, includes outlets, boxes, conduit and wire	12	Ea.	$11,771.50	$141,258.00
D50309200102			Internet wiring, 2 data/voice outlets per 1000 S.F.	257	M.S.F.	$663.88	$170,617.16
D50902101200			Generator sets, w/battery, charger, muffler and transfer switch, diesel engine with fuel tank, 750 kW	750	kW	$289.04	$216,780.00
D Services Subtotal							**$8,684,171.63**

Appendix D

Existing Conditions

LEGEND

- One Way Street
- Sidewalk Closed/Temporary Cones
- Property Line/Fence
- Electric Line (PEPCO)
- Gas Line
- Communications
- Water Line
- Fire Hydrant

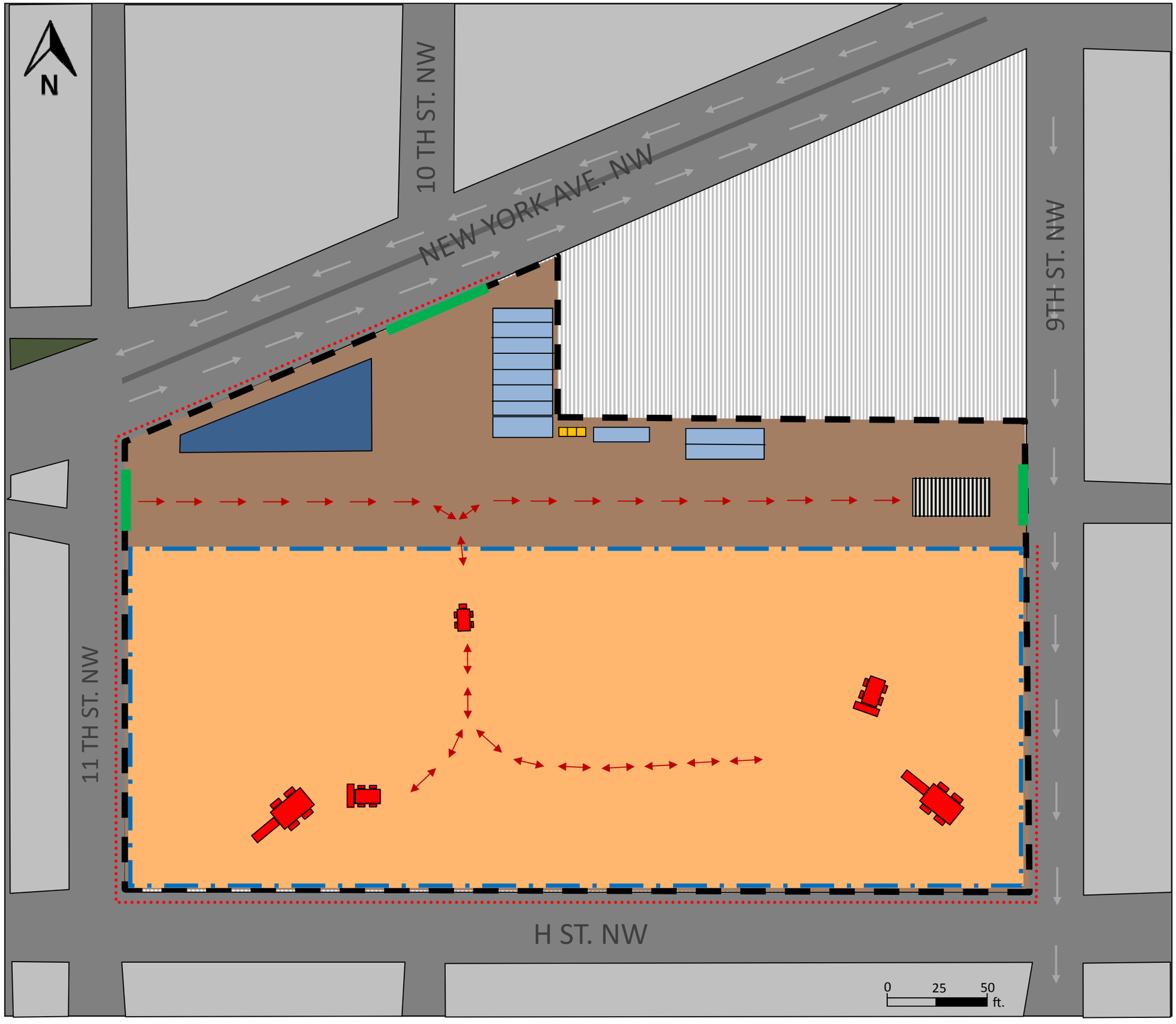
- Parking Lot
- Sewer Manifold
- Street
- Grass
- C.C. Parcel 1
- Adj. Building

- Unless otherwise indicated, all streets are two way
- Sidewalks on all sides of buildings of surrounding buildings
- All utility lines run underneath all streets. Only those surrounding building of interest are shown in order to reduce clutter on map

Andy Penev CM Option	Existing Conditions
	City Center
9/21/12	Washington, D.C.
Tech #1	Dr. Messner

Appendix E

Site Layout Planning | Excavation | Substructure | Superstructure



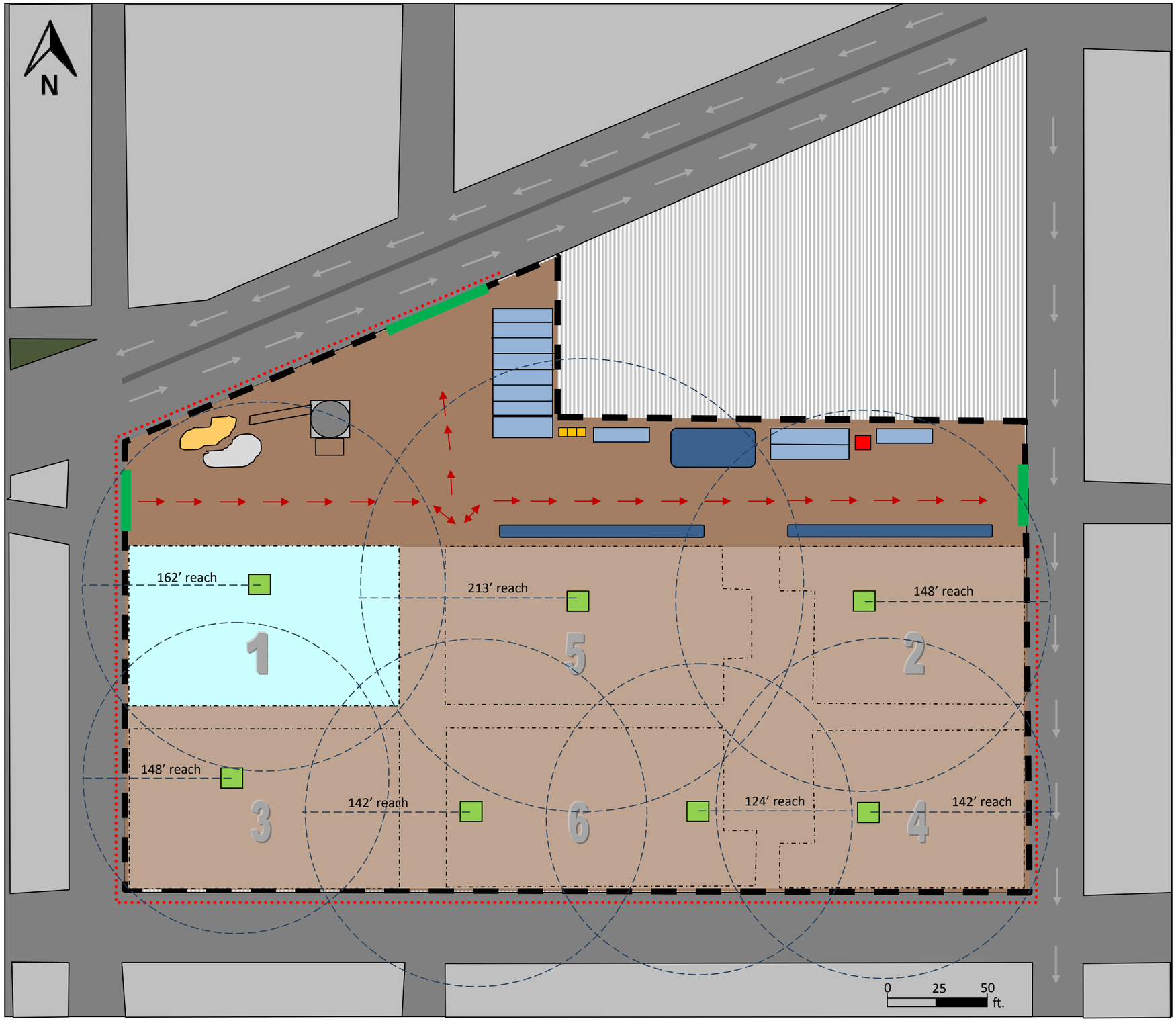
LEGEND

- One Way Street
- Sidewalk Closed/Temporary Cones
- Property Line/Fence
- Soldier Piles & Lagging
- Trailer
- Toilets
- Equip. traffic flow
- Gate
- Dump Truck
- Wheel Loader
- Excavator

- Parking Lot
- City Center Site
- Street
- Material Stock-Pile
- Cleaning Grates
- Grass
- Excavation
- Adj. Building

- Unless otherwise indicated, all streets are two way
- Sidewalks on all sides of buildings

Andy Penev **CM Option**	**Excavation**
	City Center
9/21/12	Washington, D.C.
Tech #1	Dr. Messner



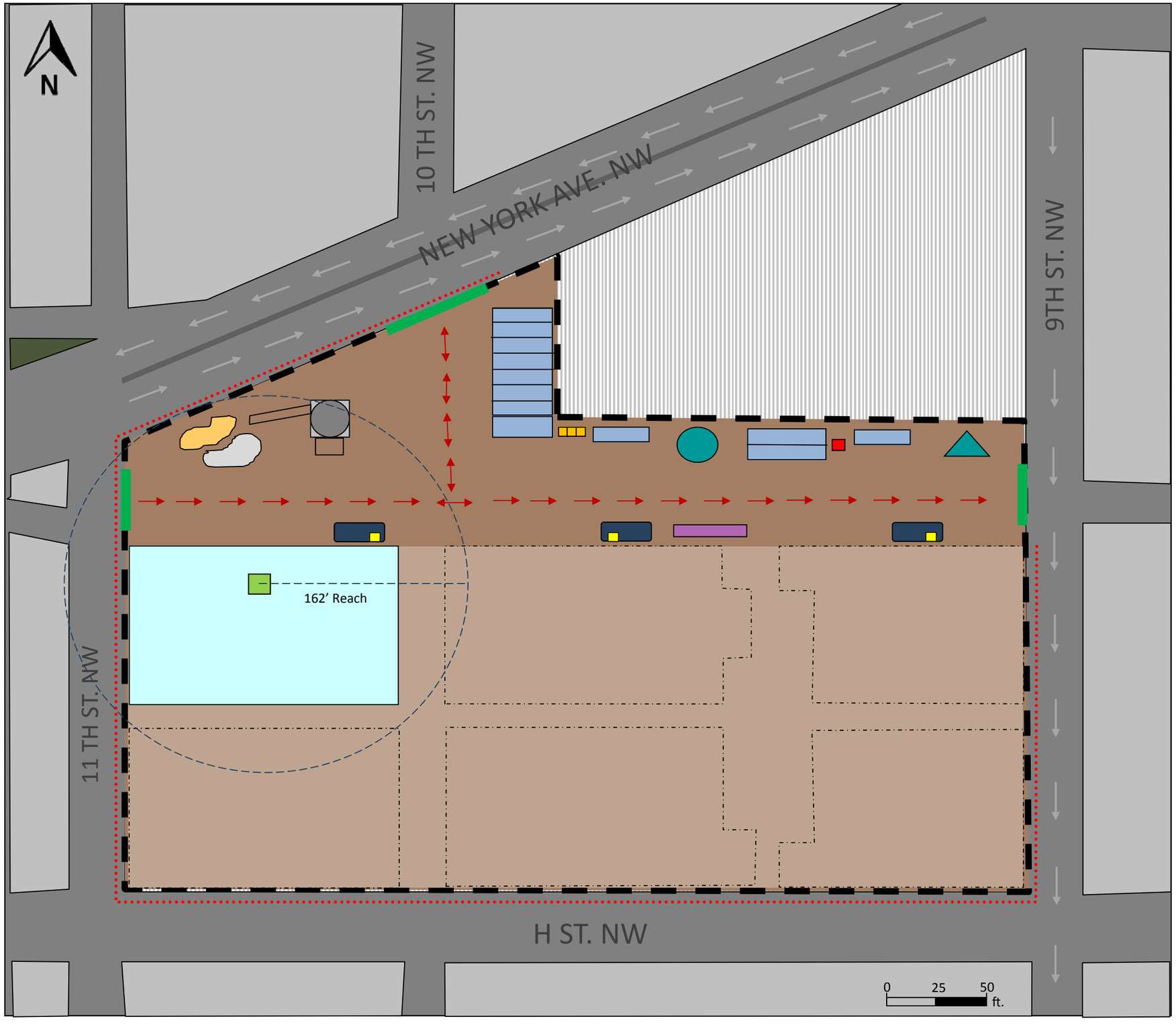
LEGEND

- One Way Street
- Sidewalk Closed/Temporary Cones
- Property Line/Fence
- Remaining Buildings Outline
- Trailer
- Toilets
- Equip. traffic flow
- Gate
- Crane
- Sand, cement, etc.
- Material Lay Down
- Concrete Batch Plant
- Temp. Power
- 1,2,3,4,5,6 Sequence of work

- Parking Lot
- Grass
- City Center Site
- Remaining Develop.
- Street
- Adj. Building
- Office Building

- Unless otherwise indicated, all streets are two way
- Sidewalks on all sides of buildings

Andy Penev CM Option	**Substructure**
	City Center
9/21/12	Washington, D.C.
Tech #1	Dr. Messner



LEGEND

- One Way Street
- Sidewalk Closed/Temporary Cones
- Property Line/Fence
- Remaining Buildings Outline
- Trailer
- Toilets
- Equip./Delivery Traffic Flow
- Gate
- Crane
- Sand, cement, etc.
- Food Truck
- Dumpster w/ chute
- Material storage/laydown
- Concrete Batch Plant
- Temp. Power
- Parking Lot
- Grass
- City Center Site
- Remaining Develop.
- Street
- Adj. Building
- Office Building

- Unless otherwise indicated, all streets are two way
- Sidewalks on all sides of buildings
- Remaining cranes still existent, not shown on this plan

Andy Penev	**Superstructure**
CM Option	City Center
9/21/12	Washington, D.C.
Tech #1	Dr. Messner