Technical Assignment 1

Kaiser Permanente- Medical Office Building

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McLean, VA 22102

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September 23, 2011

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Executive Summary

Exploration of the characteristics of the Kaiser Permanente MOB Project such as sustainability, schedule, cost, site layout and building systems is documented in this report. The project is located in McLean Virginia, right outside of Washington D.C. The scope of work for the project includes the renovation of an existing office building into a medical healthcare building along with the addition of a 75 foot mechanical tower.

This project is tracking points for the Green Guide to Healthcare version 2.0, incorporates sustainability features such as day-lighting with a storefront system and focuses on reducing energy consumption by researching other forms of temporary lighting. During construction sustainable practices such as having a paperless document system, maintaining a sustainable trailer complex and enacting a waste management plan on site were enforced.

The schedule highlighted key milestones and utilized sequencing in order to meet the Kaiser Permanente requirements of the first patient on September 14, 2012. In order to conduct a productive work flow, work progressed from the 5th floor down with a counter-clockwise work flow on each floor. Site layout was imperative to ensuring that not only the mechanical tower addition and existing building were being constructed but also the 8-floor parking garage on the KP site that was being erected simultaneously by Coakley Williams Construction.

The total construction cost for the project was originally $44, 078, 649 although through many bulletins and change orders, the price increased. One factor that remained stringent was Kaiser Permanente's requirement that first patient date was September 14, 2012 despite the change orders and bulletins. A breakdown of the building system designs utilized in the renovation of the existing building and mechanical tower addition are researched. Also, the expectations of the owner, Kaiser Permanente and the project staff, relationships, and delivery methods employed on this project are explored.

Project Schedule Summary

**Please refer to Appendix A for further Project Schedule documents.

For the Kaiser Permanente project the major flow of work begins with the design phase and creating the BIM model, since BIM was heavily used on this project. The mechanical tower addition construction begins early in March by removing the precast panels on the existing building that share a face with the new mechanical tower. Continuing from March, work will be ongoing on the mechanical tower addition. Simultaneously the interior work on the existing building will begin with the 5th floor MEP rough-in and work down floor by floor through the building. Site work will mobilize early in May. The construction of the 8-story parking garage by Coakley Williams starts in late May and will sequence tasks accordingly throughout the project to allow for ease of work on site. Working down through the building in June and July will be finishes on each floor so that the glass and glazing replacement can begin in early August. Interior wall enclosure will be a crucial task so that inspections can be scheduled and the punch lists for each floor can be complete. Permanent power is available at the end of September so that temporary power sources may be removed. Commissioning is necessary before the first patient so KP and DPR will need to first complete their final inspection March 2, 2012. This will allow for substantial completion and occupancy of the building to be met by March 15, 2012. With this substantial completion date, it will allow for commissioning, testing and the Kaiser Permanente team to move into the building. First patient date will be met according to contract with Kaiser Permanente on September 14, 2012.

Building Systems Summary

Although The Kaiser Permanente MOB is not a LEED rated project, DPR Construction and Kaiser Permanente are taking the initiative to build a sustainable building and construction site. The Green Guide for Healthcare version 2.0 is being tracked on this project. The GGHC is modeled off the Green Building Council's LEED rating system and focuses on innovative technologies to reduce consumption, utilize design elements to enhance to healing process and eliminate toxic materials used during construction. The main sustainable features of the building include use of day-lighting with the storefront glazing system and ribbon windows. This design allows for more natural light and less artificial lighting, which helps promote healing.

During building construction, sustainable practices are enacted such as temporary LED lighting research to measure the consumption of LED temporary lights versus fluorescent temporary lights. If this LED system results in a successful outcome of reducing cost and consumption, these energy saving practices will be utilized on future Kaiser Permanente projects as well as DPR Projects. Also DPR as a company is emphasizing a paperless environment where all paper documents are replaced with electronic files when permitting. All RFI's and submittals are done electronically as well as plans and specs. The DPR trailer complex won the Resource Efficient Energy Saver Award for their sustainable practices and recycling efforts.

Yes	No	Work Scope	Questions/ Issues
X		Demolition Required	Types of materials, lead paint, or asbestos?
X		Structural Steel Frame	Type of bracing, composite slab, crane size, type, location
X		Cast in Place Concrete	Horiz. and vert. formwork types, concrete placement methods
	X	Precast Concrete	Casting location, connection methods, crane size/ type/ location
X		Mechanical System	Mech. room location, system type, types of distribution systems, types of fire suppression
X		Electrical system	Size/ capacity, redundancy
	X	Masonry	Load bearing or veneer, connection details, scaffolding
X		Curtain Wall	Materials included, construction methods, design responsibility
X		Support of Excavation	Type of excavation support system, dewatering system, permanent vs. temporary

Demolition

Demolition on this project will be minor and only involve concrete. Primarily demolition will be of existing exterior concrete sidewalks and areas of concrete waffle slab within the building. Also, the removal of existing precast panels will take place where the new mechanical tower will be erected and attached to the existing building. No harmful/ toxic materials will need to be dealt with.

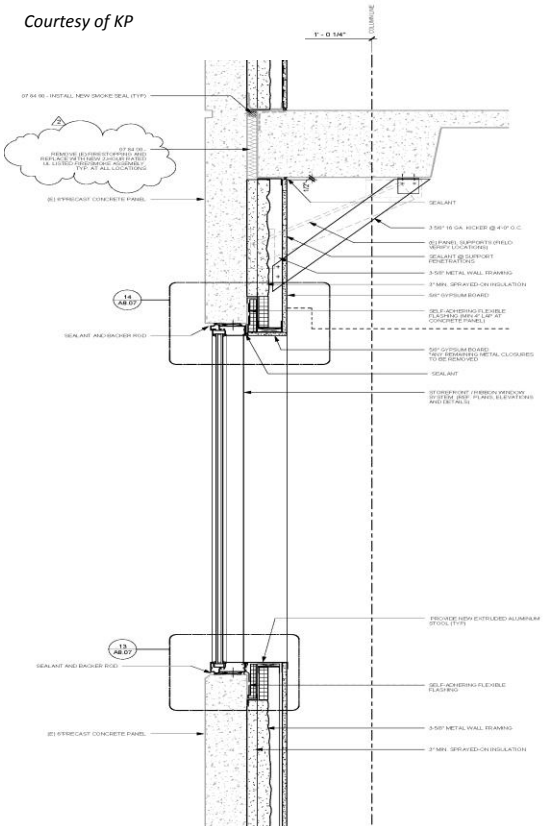
Cast-in-Place Concrete

Cast in place concrete will be used for the Slab on Grade of the new mechanical tower addition as well as a retaining wall around the mechanical tower, in-fills of the sanitary trenches in the basement, thickened MRI slabs, etc. The horizontal and vertical formwork types used were both smooth formed and rough formed consisting of plywood and metal. Ready mixed concrete was used and poured continuously in one layer or in horizontal layers. For in-fills and slabs, the concrete was finished with a hand trowel. For larger areas, such as the retaining wall concrete, a machine trowel was utilized.

Precast Concrete

Although precast concrete panels will not be installed on this project, the existing building is constructed of 6” precast concrete panels that will remain as the enclosure of the building. As seen in the typical exterior wall detail (figure 1) precast panels and a storefront/ ribbon window will be the building enclosure. During construction these panels were removed to allow for the erection of the new mechanical tower, which will be made of insulated metal panels.

Courtesy of KP



Typical Exterior Detail

Figure 1

Structural Steel

Structural steel will primarily be used for the construction of the 75 foot mechanical tower. It will consist of HSS 8x8 X-bracing up the sides of the tower as evidenced in Figure 2. Horizontal bracing will be used inside of the tower for the framing using HSS8x4. There will be six perimeter HSS columns and three interior columns Figure 3. A line of interior rigid moment connections will exist closest to the connection of the tower to the existing structure. Insulated metal wall panels will be fastened directly to the HSS members for the exterior enclosure of the tower.

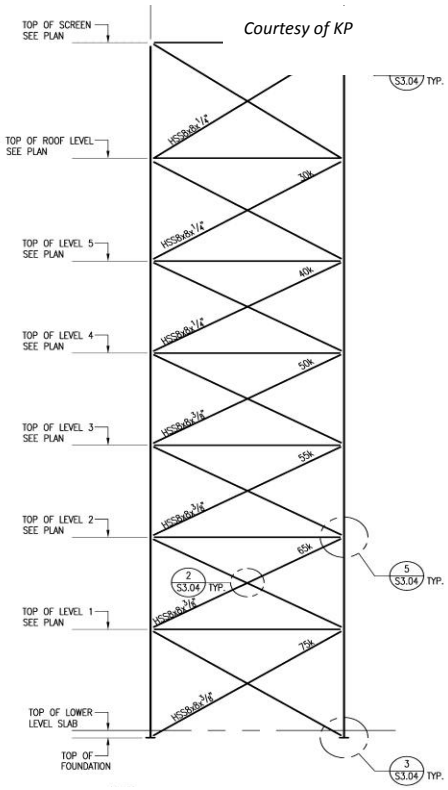


Figure 2

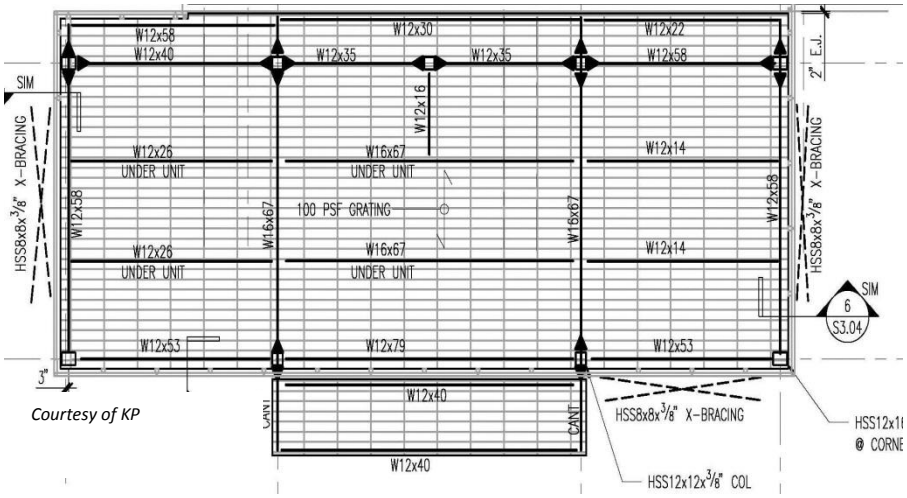


Figure 3

A concrete composite slab will be used for the mechanical tower floors as shown in Figure 4. As for the existing building, structural steel members are needed on varying floors for support of added loads from the medical equipment to be installed. Since the existing slab is a concrete waffle slab, steel members will be placed horizontally under the floor slab between the ribs or the ribs will be cut to fit the members. This will occur in locations that require extra reinforcing, perimeters of new stairway openings and framing of mechanical shafts. Structural steel members will also be used vertically between floors as single story support posts.

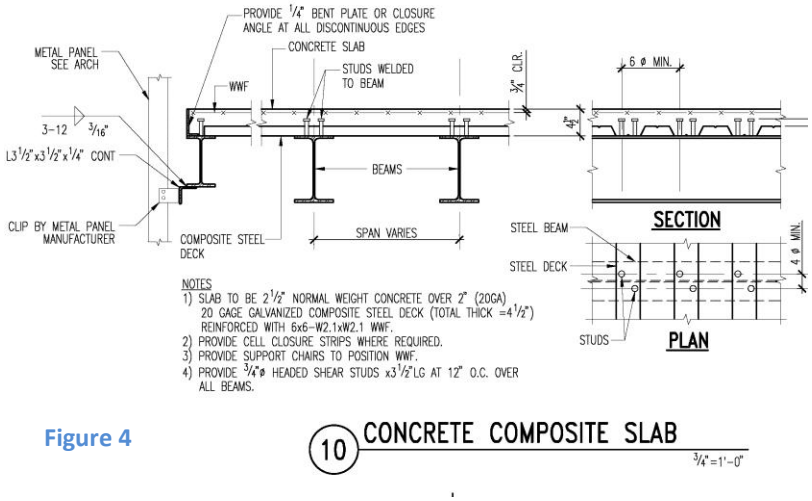


Figure 4

Mechanical

The air distribution system used in the KP MOB will consist of multiple Variable Air Volume Control Units located on the lower level, level 2, level 4 and the roof. There will be gas fired steam generators and electronic steam humidifiers in the mechanical room located in the basement.

Courtesy of KP

DESIG.	LOCATION	SERVICE	TOTAL CFM (NOTE 7) MAX	TOTAL CFM (NOTE 7) CURRENT CONNECTED LOAD	MIN. OA (CFM)	EXT. / TOTAL STATIC PRESSURE (IN. W.C.)
AHU-1	LOWER LEVEL	LOWER LEVEL AND LEVEL 1 INTERIOR ZONE	46,000	41,520	11,500	3.95 / 7.71
AHU-2	LEVEL 2	LEVEL 2 AND LEVEL 3 INTERIOR ZONE	50,000	44,665	12,500	3.95 / 7.26
AHU-3	LEVEL 4	LEVEL 4 INTERIOR ZONE	34,000	30,100	8,500	3.5 / 7.05
AHU-4	ROOF	LEVEL 2 THROUGH LEVEL 5 PERIMETER ZONE	54,000	50,745	13,500	5.0 / 7.86
AHU-5	ROOF	BASEMENT THROUGH LEVEL 5 PERIMETER ZONE	70,000	63,430	17,500	5.2 / 8.42
AHU-6	ROOF	LEVEL 5 O.R. SUITE	40,000	33,285	10,000 (NOTE 8)	4.0 / 8.24

Figure 5 **AHU Schedule**

The hot water system will be comprised of fire-tube gas boilers and clean steam boilers located in the basement boiler room. The water treatment system will be run by a twin tank alternating concept with a meter initiation method. Chilled water will be distributed from 500 ton minimum cooling capacity centrifugal water chiller located in the basement. Located on the roof will be the stainless steel cooling tower seen in Figure 5, which has an induced draft counter -flow and super-low sound fan.

Courtesy of KP

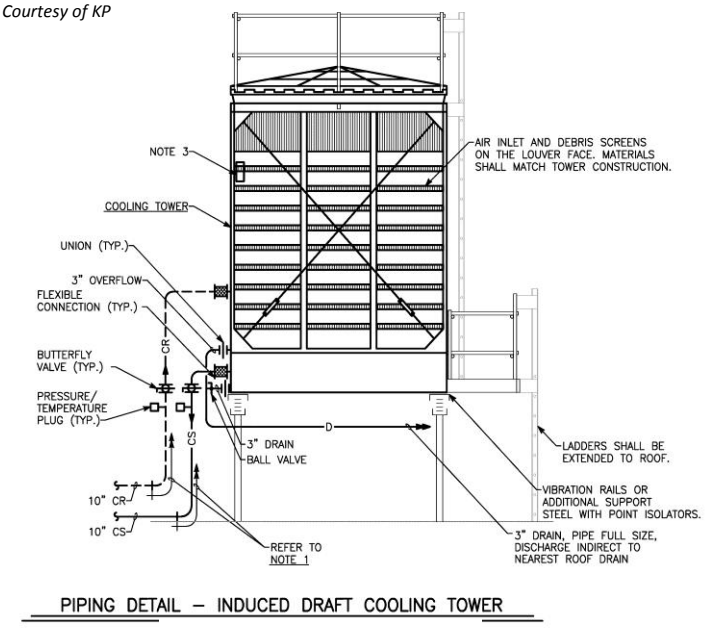


Figure 5

The fire protection used in the building will be a combination of a wet type automatic sprinkler and standpipe system. The building and mechanical equipment rooms will utilize this standard sprinkler system design. However, the Telecommunication Equipment Room and electrical rooms will have double interlock pre-action systems. The main entrance and loading dock areas have dry-pipe systems. The fire protection will also include installation of new fire stopping and smoke seals around the perimeters of the floors.

Electrical

Since the KP building is a healthcare facility, it will require advanced electrical systems to be installed that the existing office building did not originally have. Because of this fact, the existing switchboard room in the basement will be remodeled to a MDP switchboard and paralleling low voltage switchgear. The new switchboard will be 5000A and a voltage of 480Y/277. The power source for interior lighting is a 120/277V circuit and the static uninterrupted power supply will have an output voltage of 208Y/120V and input voltage of 480V. The communications systems will be low voltage electrical power conductors and cables. The different communications pathways throughout the building will include mass notification systems and nurse call stations. Throughout the

Courtesy of KP

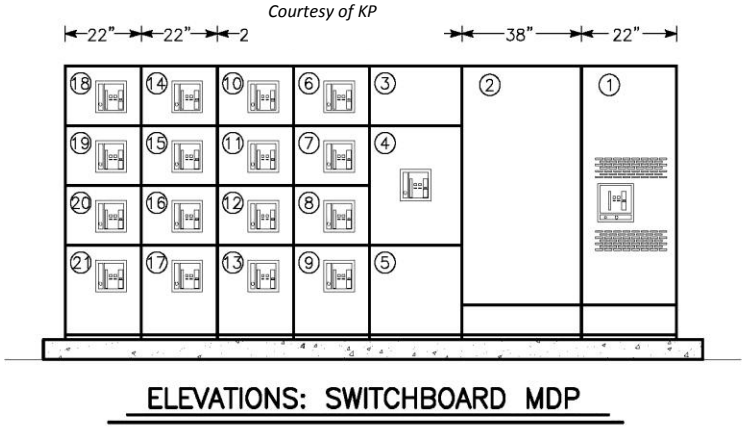


Figure 6

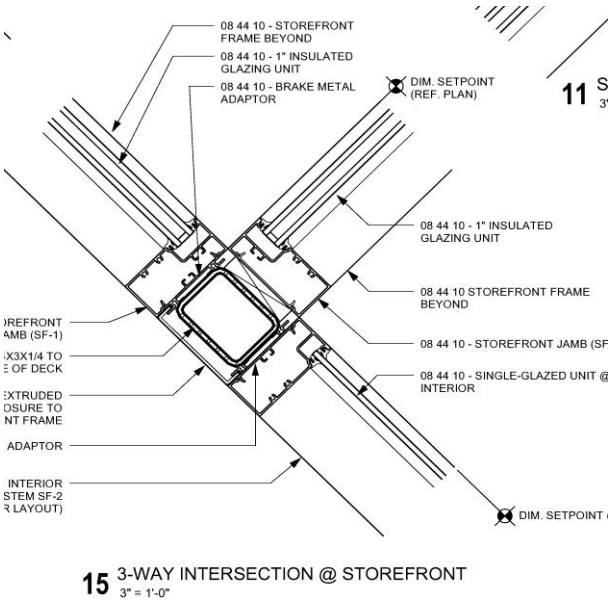
building will be 100A three phase enclosed bus-way assemblies with 200% neutral and are 4 pole at 208V. All temporary construction power will be used from the existing switchboard and transformer located in the basement level main electrical room. The permanent transformers to be installed will be low voltage floor mounted and ceiling mounted transformers.

The electrical work on this project also includes a duct bank for the Verizon communications line to be routed across the site and to feed into the TER room located in the basement. The Verizon line will use 4" conduit connecting from the junction box on West Park Drive to the North side of the building at the location of the TER room.

Curtain wall

A curtain wall system will not be used on this building although a storefront system will be used at the entrance vestibule. A storefront system is only comprised of one story versus a curtain wall which is multiple stories. The storefront system will be constructed of different types of glass including: insulated vision glass, monolithic glass and laminated vision glass. The storefront will be held up by an aluminum frame that will fasten to the glass panels. This system can be seen in Figure 7.

Courtesy of KP



15 3-WAY INTERSECTION @ STOREFRONT
3" = 1'-0"

Figure 7

Plumbing

Plumbing will include Medical Gas boxes dispersed throughout the building primarily on the fifth floor. The medical gas will either be wall mounted panels above patient beds providing ½" compressed air, ½" carbon dioxide, ½" nitrogen and ¾" vacuum piping. Also, ceiling mounted medical gas will be located in surgical suites above the operating tables supplying ¾" oxygen, ½" Medical air, ¾" vacuum, ¾" anesthesia and ½" nitrous Oxide piping. Plumbing will also include installing sanitary trenches in the basement and all overhead plumbing for chilled and hot water systems.

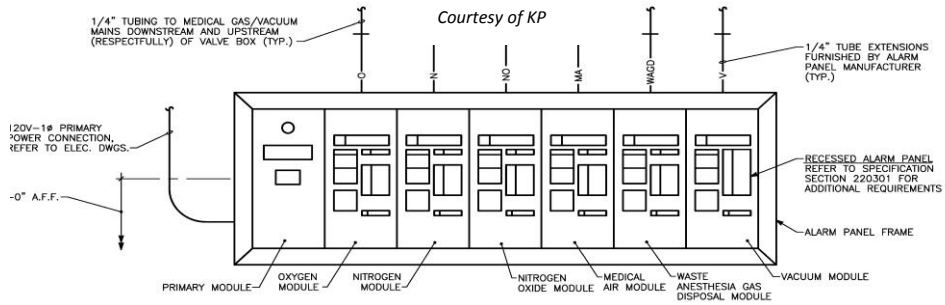


Figure 8

Support of Excavation:

The main excavation on site will be for the mechanical tower addition and the elevator pit located on the lower level of the existing building. The mechanical tower excavation will not use any support for excavation except a 1 to-1 slope step back. As for the elevator pit, an 8" x 8" timber shoring system engineered by the subcontractor will be used to support excavation.

No dewatering system is specified for this project and there has been no need thus far for any dewatering.

Project Cost Evaluation

**Please refer to Appendix B for further cost details and Building Assemblies Estimate.

The Direct Building Construction Cost:
This is excluding: land costs, site work, general conditions, taxes, insurance, and fee

$37,868,053

The building is 240,000 SF so this cost comes to:

$157.78 per SF

The Total project Cost is:

$44,078,649

With the square footage at 240,00SF this comes to:

$183.66 per SF

The Mechanical System Cost is:

$14,375,000 or
$59.90 per SF

Electrical System Cost is:

$7,842,891 or
$32.68 per SF

The Structural System Cost is:

$2,323,100 or
$9.68 per SF

The Total Assemblies Cost of the MEP systems (including plumbing, mechanical, electrical, communications cabling) is:

$23,517,953

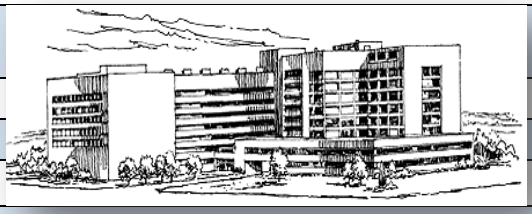
	Square Foot Cost Estimate Report	
Estimate Name:	*Kaiser Permanente-MOB*	
Building Type:	Hospital, 4-8 Story with Precast Concrete Panels With Exposed Aggregate / R/Conc. Frame	
Location:	FAIRFAX, VA	
Story Count:	6	
Story Height (L.F.):	14	
Floor Area (S.F.):	241175	
Labor Type:	Union	
Basement Included:	Yes	
Data Release:	Year 2010	Costs are derived from a building model with basic components.
Cost Per Square Foot:	$190.52	Scope differences and market conditions can cause costs to vary significantly.
Building Cost:	$45,947,500	

Table 1

The square foot cost estimate was developed using the RS Means Cost Works program. Some of the assumptions made for this estimate were that the Kaiser Permanente MOB is a renovation of the existing building. RS means does not provide square foot cost data for renovations so the estimate is based on new construction. The building type for the estimate was a 4-8 story hospital. The reason for this selection is to get the best possible estimate based on the structure of the building. RS means data does not provide information for Medical Office buildings with a concrete frame and precast concrete panels. The decision was made to follow cost data based on the structure, since the KP MOB will need to be able to support the weight of the medical equipment, much like a hospital. There are 5 above grade levels and 2 below grade levels on the KP project so a 6 story building with a basement was assumed for this estimate. Also, no architectural or designer fees were included in the estimate. The square foot estimate resulted in $45, 947, 500, which is a fair cost compared to the direct building cost of $37,868 053. Other factors that could have impacted this price are the building systems assumed in the estimate.

For the assemblies estimate evaluation, the results differ slightly then the actual assemblies cost because of some other influences. The assumptions made for this estimate were the quantities of each of the system's components . Generalizations were made based on

the most typical designs seen througout the contract drawings. There are other systems within the building that were minor in comparison to the systems selected, which results in cost fluctuation. The total for plumbing, fire protection, HVAC and electrical assemblies in the estimate came to $13,054,090. This cost is about 10 million dollars less then the actural cost of $23,517,953. It can be assumed that this is because communcations was included in the actual cost, where as in the estimate communications systems were not accounted for. Also, the takeoff of L.F. of mechanical duct work and plumbing piping were not taken into consideration. This assemblies estimate was meant to summarize the major systems and equiptment utilized in the building and perform an approximate cost evaluation.

Site Plans

**Please refer to Appendix C for existing conditions plan and phasing plans.

The site of the Kaiser Permanente MOB includes the existing office building to be turned into the healthcare facility, the existing parking garage and the proposed mechanical tower and parking garage. The Federal Home Loan Mortgage building is the closest surrounding structure and shares Private Drive with the site. The existing utilities are domestic water, electric and a communications line junction box. KP will not tap into the gas line but instead will supply their own propane tank source, further information about this utility has not been determined. Included in construction will be the propped Verizon line that will lead directly to the TER room in the basement of the building which is shown in yellow on the existing conditions plan. Egress in and out of the site is limited to personnel only and delivery traffic and vehicular traffic has designated locations as noted on the plan. The delivery circle on the north side of the building will change egress depending on the phase of construction. Private drive will remain open to the public and must remain clear at all times during construction. The trailers are located on the roof of the existing parking garage, which is also where all construction personnel will park.

The phasing for the Verizon line duct bank involved moving the site fencing on the North side of the building to block off one side of the delivery circle so that no traffic could affect digging the duct bank. Likewise, the other side of the delivery circle will be closed off once digging effects that area and site fencing will be open again on the original side. Another major issue is the material hoist crane must be disassembled in order to feed the duct bank into the TER room located in the basement. This affects deliveries so that all deliveries must be lifted through the window openings to the upper floors instead of using the hoist. Also, the north side pedestrian entrance into the building will need to be moved to a side door located on the north-east side of the building and the ramp from the parking garage will have kited pedestrian access depending on the location of duct bank work. Another change made is that Private Drive needed to be brought down to one-lane traffic so that the sidewalk could be demolished and the duct bank could be run underneath. This required the contractor to provide workers for traffic control so that private drive was not affected. The contractor thought the site plan through very well and tried to utilize the space that was available. Although not having the material hoist was an inconvenience, it was temporary and a necessary action to construct the duct bank.

During the erection of the mechanical tower, the site plan will need to be modified in order to accommodate the 90 ton hydraulic truck crane necessary for this phase. The crane will be located behind the mechanical tower in order to lift steel members for the framing and bracing of the tower. The crane has a main boom length of 140 ft. in order to reach the top of the 75 ft. mechanical tower. Access into the building via the entrance on the South side to the

lower level will no longer be available, so egress will need to be limited to the South east door into the basement. The site fencing on the south side will need to be moved to enclose the mechanical tower work from the lot where areas will be made on the south side. For safety and convenience purposes, all above ceiling rough-in work in the existing building will be complete on the face where the mechanical tower attaches.

An 8-story parking garage will be erected on the Kaiser Permanente site and will be constructed by Coakley Williams construction. Although the construction will not be done by DPR, they are still responsible for the entire site and need to plan accordingly to allow Coakley Williams to perform their work. During the excavation of the parking garage, the site plan for the Kaiser Permanente building needs to be altered by having site fencing at the North West corner of KP MOB to block any egress near that corner. This will allow for Coakley to have their equipment and deliveries come into their area of the site without any interruptions. As noted in the plan by the large blue arrow, the entrance into the site at this location is solely for Coakley Williams. A wash rack will also be installed at the entrance to the garage area to ensure that no dirt or debris is carried onto Private Drive, since it is a public road. This plan closely follows the plan that the contractor enacted although for this plan, site fencing was added at the South West corner of the building to keep parking garage construction and mechanical tower construction separate.

Local Conditions

Tysons Corner is known to be a highly populated business district right outside Washington D.C., which means that parking is scarce. With the Tysons I and II malls located minutes from the site, traffic congestion is an issue. Luckily with the KP project there is an existing parking garage on site east of the building. This area allowed for four levels of parking for all parties involved in the project plus any extra room for visitors. Regulations are strict about parking on public access roads to the neighboring businesses so having this parking garage is crucial to site egress. Also, there is an existing delivery roundabout in the north area of the building which was used for delivery trucks so idling on public roads is not an issue. There are no preferred methods of construction for Fairfax County. Since it is in a highly congested area, space can be limited and so construction sites need to plan accordingly.

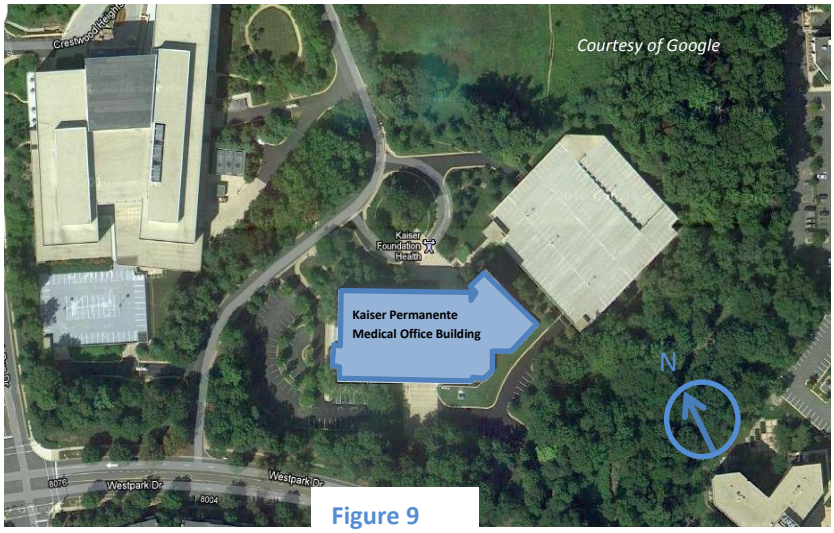
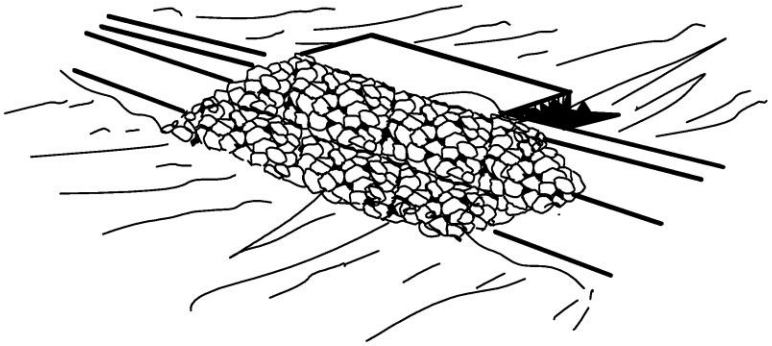


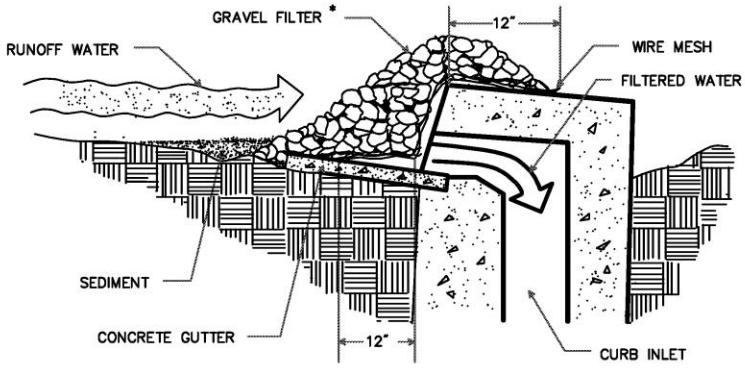
Figure 9

To meet recycling guidelines of the county, a construction waste management plan is being utilized on this project. All construction and demolition waste will be disposed of on site in a comingled container (excluding chemical waste, aggregate and large quantities of glass). This waste will be sorted by a Con-Serv Industries and will be based on weight. These weights are identified by CSI after sorting a container and disseminated to DPR on a monthly basis. The reports will include a container-by-container breakdown, a monthly summary, and a project summary. There are recycling and tipping fees enforced for Fairfax County based on the materials and weight that construction sites must obey. Also, necessary permits for commercial renovations of existing buildings in Fairfax County are the building permit, electrical permit, mechanical permit and plumbing permit.

Tysons Corner is located in the central region of Fairfax County known as the Piedmont Upland region. This area is predominantly covered with soil and weathered rock. Bedrock is common and usually has soils that are thick plastic clays. The type of soil on site is mainly compromised of silt loam, loam, and gravelly sand to loam, according to Fairfax County Surveys. The typical solid profile is 0 to 8 inches of silt loam, 8 to 60 inches of loam and 50 to 62 inches of gravelly sand to loam. The depth of the water table is between 10 to 24 feet and the available water capacity is about 8.6 inches.

Fortunately on the KP project, no dewatering methods have been necessary since excavation is minimal and the existing building foundation is already present. The existing storm inlets are being monitored by a sediment and erosion plan during the construction phase. A gravel and wire mesh inlet protection system is being utilized, as seen in figure 10. Weekly sediment and erosion reports are documented to ensure any water runoff is not clogging storm sewers on site or that any dewatering action needs to be taken.





Specific Application

THIS METHOD OF INLET PROTECTION IS APPLICABLE AT CURB INLETS WHERE PONDING IN FRONT OF THE STRUCTURE IS NOT LIKELY TO CAUSE INCONVENIENCE OR DAMAGE TO ADJACENT STRUCTURES AND UNPROTECTED AREAS.

* GRAVEL SHALL BE VDOT #3, #357 OR 5 COARSE AGGREGATE.

Gravel Curb Inlet Sediment Filter IP

Figure 10

Client Information

Kaiser Permanente is the owner on this project. They are a company that is on the cutting edge of healthcare by offering several "Hubs" that provide health care to Kaiser Members. They are taking over the healthcare industry, especially in Northern VA, with KP Tysons being one of the eleven medical offices that offer primary/ specialty care and outpatient services (Kass). The purpose of this project is to continue promoting growth within the healthcare industry and making Kaiser Permanente an accessible and convenient place for healthcare.

The expectations that Kaiser Permanente has as a client for this project is that schedule is a critical factor. With a first patient date in place for September 14, 2012, it is crucial that construction is on time. This being said, quality is no way compromised in order to meet the schedule requirements. Daily inspections were enacted on the jobsite to ensure every detail of construction was according to standard. If assembly, product type or other discrepancies were found, further installation would stop until it was according to KP code. Since DPR has been a GC for Kaiser Permanente before, they were familiar with the higher standards that KP requires on their healthcare facilities. For instance, since the existing structure is an older structure it used an outdated waffle slab. With this, some discrepancy about quality ensued with the design for fire rating the coffers. The task wound up to be a severe hindrance on the schedule since KP had certain standards to be met and changes in design were back and forth. The issue was eventually handled although time needed to be made up since this set back wall framing and other trades installing above ceiling rough-in.

In addition to a strict schedule and high level quality, Kaiser Permanente issued many bulletins/ changes during construction. With these bulletins frequently being issued, increase in productivity was expected and overtime became a norm for some trades. As mentioned early, DPR drywall was required to work overtime and weekends in order to make up time for the coffer setback.

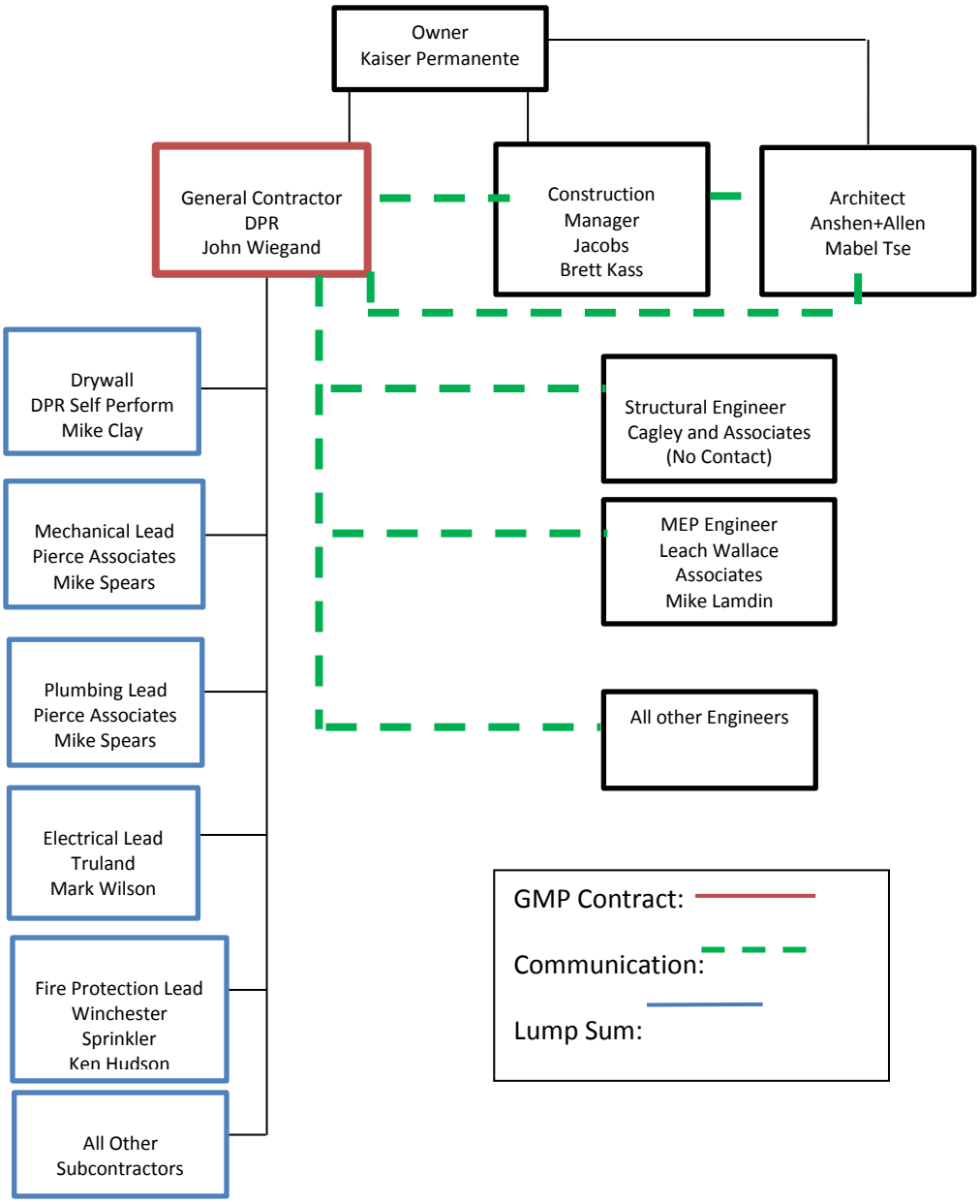
As for sequencing, Kaiser Permanente was specifically interested in the mock rooms being complete so that Kaiser Representatives could visualize the rooms and make changes as needed. The owner's satisfaction was mainly contingent on having everything be of highest quality and according to KP standard, having the building complete by final completion and having any bulletin/ change be done regardless of cost or overtime needed to complete it.

Project Delivery System

This project is being delivered as a Design-Bid-Build with contracted GMP. This approach was chosen because this is the typical system that Kaiser Permanente follows on their construction projects. A Design Build was not an option on this project because of the complexity of the MEP systems in a healthcare facility.

For this project the "just in time" delivery method was used. In order to increase productivity, the less materials stored on site is crucial. Deliveries were made on an as needed basis and it kept the jobsite more organized and safer. Also, construction was from the 5th floor down in order to keep a logical flow of work down and out of the building. Each floor consisted of five areas or quadrants and work flowed work counterclockwise from A2 to A1.

The general contractor on the Kaiser Permanente project is DPR Construction and the CM is Jacobs. Jacob's role was to act as the owner's representative and perform all duties and responsibilities that the owner would exercise, including changing contract documents, (please refer to project organizational chart on following page).The KP staff and Jacob's staff were housed in one trailer on site while DPR was in another. Jacobs and DPR worked closely so that any communication DPR would have with Kaiser Permanente would include Jacobs as well. Jacobs would also relay information from KP and in turn, DPR would then ensure it was followed through on site. DPR owned the entire site and therefore was liable for all subcontractors and onsite activity. They had full risk of any errors or omissions of the scope of all the subcontractors on site.

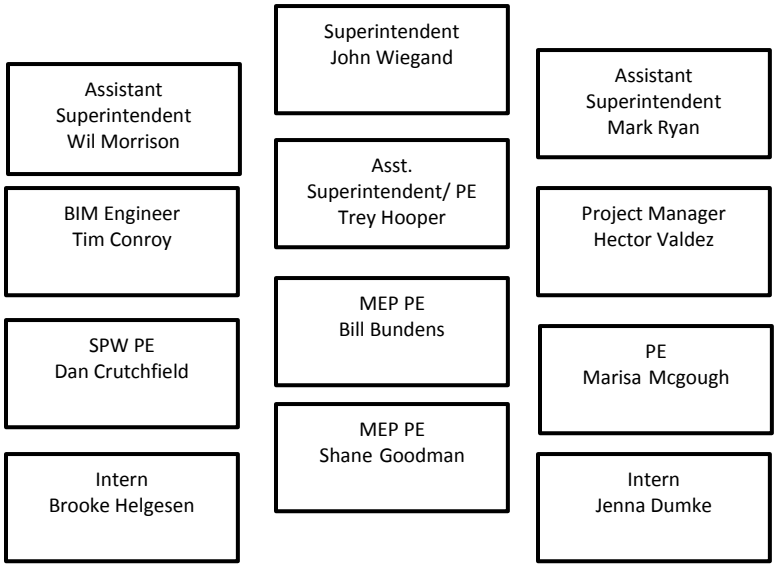


The contract held between DPR and Kaiser Permanente is a GMP. This contract entitles upon project completion that the contractor will receive 30% of unused portion of the GMP amount and the owner will retain 70%. DPR's general conditions cost, general requirements cost and direct cost of construction which they initially paid for will be reimbursed to them but not exceeding the GMP amount.

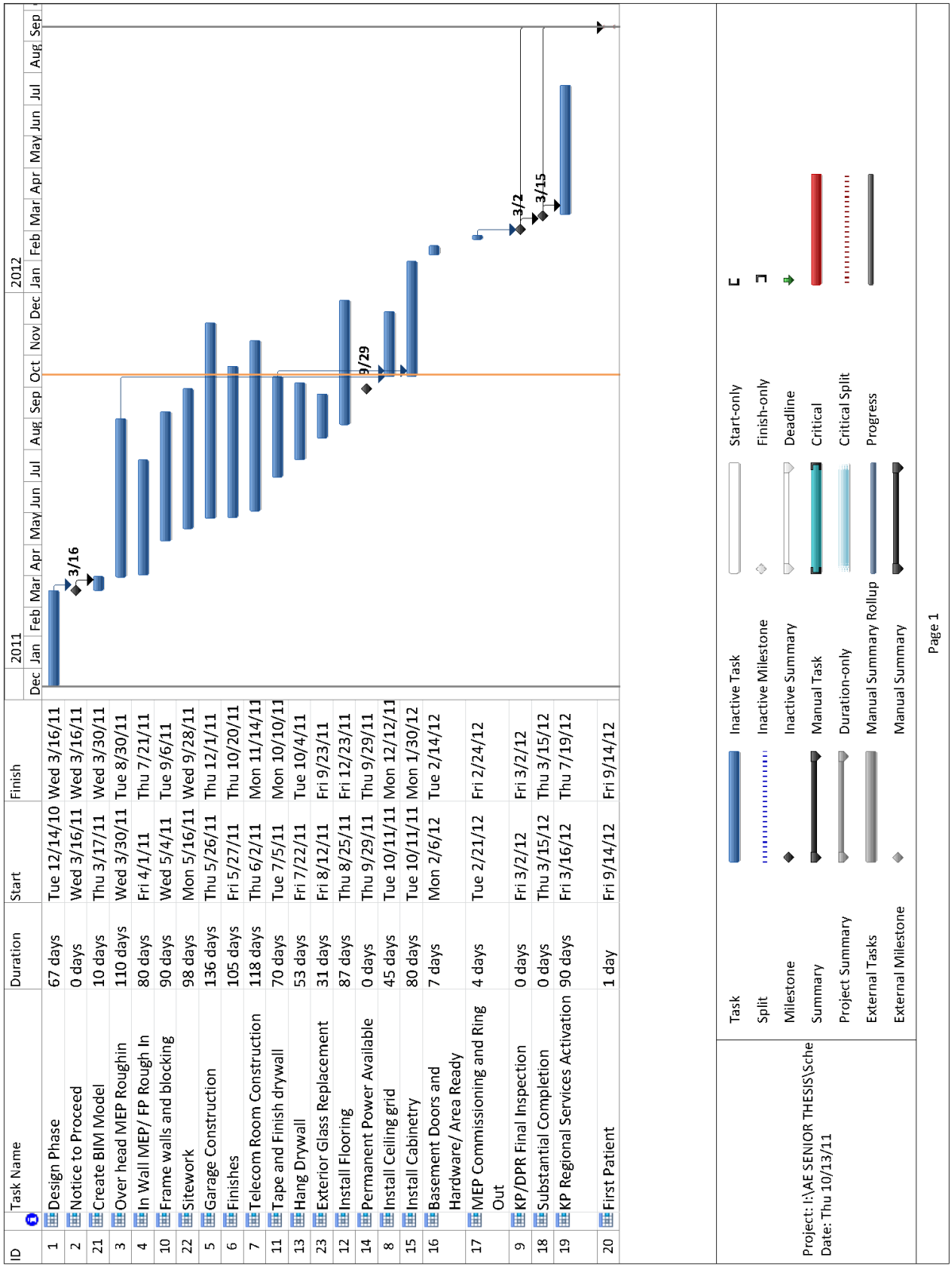
The general contractor under this agreement is responsible for providing insurance. They must furnish Kaiser Permanente with certificates of insurance completed. The types of insurance acquired on this project were: Commercial General Liability, Business auto insurance, workers compensation, umbrella liability insurance, contractor's equipment and contractor's pollution legal liability insurance.

Staffing Plan

DPR Construction



DPR functions not by "titles" but instead has "roles." An open floor and no cubicles in the DPR trailer means that everyone is on an equal playing field but are responsible for different tasks. An issue may be handled by a certain DPR individual although responsibility is on DPR as a team. As seen in the staffing plan, there are no lines to indicate hierarchy within the DPR staff because of DPR's beliefs and core values as a company. There was one superintendent with two assistant superintendents, a PM, certain MEP leads, PE's that take on specific trades, a PE for DPR SPW and a BIM engineer. The smaller subcontractors such as steel, roofing, site work/ demo, glass/glazing etc. were distributed among DPR staff in order for those subcontractors to report to with any issues while larger subs could report to any DPR member for daily issues


ID
Task Name
Duration
Start
Finish
2011
2012
Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
1 Design Phase 67 days Tue 12/14/10 Wed 3/16/11
2 Notice to Proceed 0 days Wed 3/16/11 Wed 3/16/11
21 Create BIM Model 10 days Thu 3/17/11 Wed 3/30/11
3 Over head MEP Roughin 110 days Wed 3/30/11 Tue 8/30/11
4 In Wall MEP/ FP Rough In 80 days Fri 4/1/11 Thu 7/21/11
10 Frame walls and blocking 90 days Wed 5/4/11 Tue 9/6/11
22 Sitework 98 days Mon 5/16/11 Wed 9/28/11
5 Garage Construction 136 days Thu 5/26/11 Thu 12/1/11
6 Finishes 105 days Fri 5/27/11 Thu 10/20/11
7 Telecom Room Construction 118 days Thu 6/2/11 Mon 11/14/11
11 Tape and Finish drywall 70 days Tue 7/5/11 Mon 10/10/11
13 Hang Drywall 53 days Fri 7/22/11 Tue 10/4/11
23 Exterior Glass Replacement 31 days Fri 8/12/11 Fri 9/23/11
12 Install Flooring 87 days Thu 8/25/11 Fri 12/23/11
14 Permanent Power Available 0 days Thu 9/29/11 Thu 9/29/11
8 Install Ceiling grid 45 days Tue 10/11/11 Mon 12/12/11
15 Install Cabinetry 80 days Tue 10/11/11 Mon 1/30/12
16 Basement Doors and Hardware/ Area Ready 7 days Mon 2/6/12 Tue 2/14/12
17 MEP Commissioning and Ring Out 4 days Tue 2/21/12 Fri 2/24/12
9 KP/DPR Final Inspection 0 days Fri 3/2/12 Fri 3/2/12
18 Substantial Completion 0 days Thu 3/15/12 Thu 3/15/12
19 KP Regional Services Activation 90 days Fri 3/16/12 Thu 7/19/12
20 First Patient 1 day Fri 9/14/12 Fri 9/14/12
3/16
3/29
3/2
3/15
Project: I:\AE SENIOR THESIS\Sche
Date: Thu 10/13/11
Task
Split
Milestone
Summary
Project Summary
External Tasks
External Milestone
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
Deadline
Critical
Critical Split
Progress
Page 1

Appendix B

Square Foot Cost Estimate Report

Estimate	**Kaiser Permanente-MOB**
Building Type:	**Hospital, 4-8 Story with Precast Concrete Panels With Exposed Aggregate / R/Conc. Frame**
Location:	**FAIRFAX, VA**
Count:	**6**
Height	**14**
Area	**241175**
Type:	**Union**
Included:	**Yes**
Release:	**Year 2010**
Square Cost:	**$190.52**
	$45,947,500

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		**2.30%**	**$4.40**	**$1,061,500**
A1010	**Standard Foundations**		**$2.28**	**$549,000**
	KSF, 12" deep x 32" wide			
	8' - 6" square x 27" deep			
A1030	**Slab on Grade**		**$0.72**	**$173,500**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**$0.47**	**$114,000**
	site storage			
A2020	**Basement Walls**		**$0.93**	**$225,000**
	thick			
B Shell		**20.60%**	**$39.28**	**$9,473,000**
B1010	**Floor Construction**		**$19.71**	**$4,753,500**
	height, 251 lbs/LF, 4000PSI			
	height, 394 lbs/LF, 4000PSI			
	15'x15' bay, 75 PSF superimposed load, 153 PSF total load			
	75 PSF superimposed load, 204 PSF total load			
B1020	**Roof Construction**		**$3.01**	**$725,000**
	16" deep beam, 14" slab, 174 PSF total load			
B2010	**Exterior Walls**		**$10.63**	**$2,563,500**
	insulation, low rise			
B2020	**Exterior Windows**		**$4.13**	**$996,000**
	Windows, aluminum, sliding, insulated glass, 5' x 3'			
B2030	**Exterior Doors**		**$0.75**	**$180,000**
	6'-0" x 10'-0" opening			
	hardware, 6'-0" x 10'-0" opening			
	0" opening			
B3010	**Roof Coverings**		**$1.03**	**$249,000**
	adhesive			

	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			
	Roof edges, aluminum, duranodic, .050" thick, 6" face			
	Flashing, copper, no backing, 16 oz, < 500 lbs			
B3020	**Roof Openings**		**$0.02**	**$6,000**
	steel, 165 lbs			
C Interiors		**21.10%**	**$40.10**	**$9,671,000**
C1010	**Partitions**		**$6.33**	**$1,526,000**
	board base, 3-5/8" @ 24",s ame opposite face, no insulation			
	Gypsum board, 1 face only, 5/8" with 1/16" lead			
C1020	**Interior Doors**		**$10.52**	**$2,536,000**
	3'-0" x 7'-0" x 1-3/8"			
	0" x 1-3/8"			
C1030	**Fittings**		**$0.92**	**$221,500**
	Partitions, hospital curtain, ceiling hung, poly oxford cloth			
C2010	**Stair Construction**		**$1.20**	**$290,500**
	Stairs, steel, cement filled metal pan & picket rail, 12 risers, with landing			
C3010	**Wall Finishes**		**$6.30**	**$1,518,500**
	Glazed coating			
	primer & 2 coats			
	Vinyl wall covering, fabric back, medium weight			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	**Floor Finishes**		**$8.53**	**$2,058,000**
	Composition flooring, epoxy terrazzo, maximum			
	Terrazzo, maximum			
	Vinyl, composition tile, maximum			
	Tile, ceramic natural clay			
C3030	**Ceiling Finishes**		**$6.30**	**$1,520,500**
	crc, 36" OC support			
	channel grid, suspended support			
D Services		**47.50%**	**$90.39**	**$21,800,500**
D1010	**Elevators and Lifts**		**$6.04**	**$1,456,500**
	200 FPM			
D2010	**Plumbing Fixtures**		**$10.83**	**$2,612,000**
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, wall hung, PE on CI, 19" x 17"			
	Kitchen sink w/trim, raised deck, PE on CI, 42" x 21" dual level, triple bowl compartment			
	Service sink w/trim, PE on CI,wall hung w/rim guard, 22" x 18"			
	Bathtub, recessed, PE on CI, mat bottom, 5'-6" long			
	Shower, stall, baked enamel, terrazzo receptor, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		**$6.43**	**$1,551,000**
	Electric water heater, commercial, 100< F rise, 1000 gal, 480 KW 1970 GPH			

D2040	**Rain Water Drainage**	**$0.48**	**$116,000**
	Roof drain, CI, soil,single hub, 5" diam, 10' high		
	Roof drain, CI, soil,single hub, 5" diam, for each additional foot add		
D3010	**Energy Supply**	**$3.19**	**$769,500**
	Hot water reheat system for 200,000 SF hospital		
D3020	**Heat Generating Systems**	**$0.35**	**$85,500**
	Boiler, electric, steel, steam, 510 KW, 1,740 MBH		
D3030	**Cooling Generating Systems**	**$2.51**	**$606,500**
	Chiller, reciprocating, water cooled, standard controls, 100 ton		
	Chiller, reciprocating, water cooled, standard controls, 150 ton		
	Chiller, reciprocating, water cooled, standard controls, 200 ton		
D3090	**Other HVAC Systems/Equip**	**$29.87**	**$7,203,000**
	Ductwork for 200,000 SF hospital model		
	Boiler, cast iron, gas, hot water, 2856 MBH		
	Boiler, cast iron, gas, hot water, 320 MBH		
	AHU, rooftop, cool/heat coils, VAV, filters, 5,000 CFM		
	AHU, rooftop, cool/heat coils, VAV, filters, 10,000 CFM		
	AHU, rooftop, cool/heat coils, VAV, filters, 20,000 CFM		
	VAV terminal, cooling, hot water reheat, with actuator / controls, 200 CFM		
	AHU, rooftop, cool/heat coils, VAV, filters, 30,000 CFM		
	draft damper, 1500 CFM		
	draft damper, 2750 CFM		
	Commercial kitchen exhaust/make-up air system, rooftop, gas, 5000 CFM		
	Plate heat exchanger, 400 GPM		
D4010	**Sprinklers**	**$2.38**	**$574,000**
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 10,000 SF		
	10,000 SF		
	Standard High Rise Accessory Package 8 story		
D4020	**Standpipes**	**$0.38**	**$92,000**
	Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, 1 floor		
	floors		
	steel door & frame		
	Alarm, electric pressure switch (circuit closer)		
	Escutcheon plate, for angle valves, polished brass, 2-1/2"		
	Fire pump, electric, with controller, 5" pump, 100 HP, 1000 GPM		
	Fire pump, electric, for jockey pump system, add		
	Siamese, with plugs & chains, polished brass, sidewalk, 4" x 2-1/2" x 2-1/2"		
	Valves, angle, wheel handle, 300 lb, 2-1/2"		
	Cabinet assembly, includes. adapter, rack, hose, and nozzle		
D5010	**Electrical Service/Distribution**	**$3.28**	**$791,500**
	phase, 4 wire, 120/208 V, 2000 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**	**$18.08**	**$4,361,500**

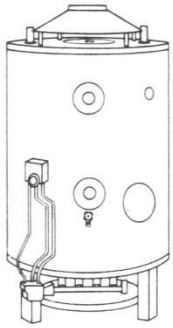
	with transformer			
	Wall switches, 5.0 per 1000 SF			
	Miscellaneous power, 1.2 watts			
	Central air conditioning power, 4 watts			
	Motor installation, three phase, 460 V, 15 HP motor size			
	V 15 HP, 575 V 20 HP			
	fixtures @32 watt per 1000 SF			
D5030	**Communications and Security**		**$2.33**	**$561,000**
	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**		**$4.23**	**$1,020,500**
	engine with fuel tank, 100 kW			
	engine with fuel tank, 400 kW			
	kW			
E Equipment & Furnishings		**8.60%**	**$16.34**	**$3,941,500**
E1020	**Institutional Equipment**		**$12.38**	**$2,986,500**
	distilled water, economy			
	Architectural equipment, sink, epoxy resin, 25" x 16" x 10"			
	Architectural equipment, laboratory equipment eye wash, hand held			
	Fume hood, complex, including fixtures and ductwork			
	double door, 28"x67"x52"			
	hospital			
	semiautomatic, 50 racks/hr			
	KW			
	gallons			
	burners, 2 ovens & 24" griddle			
	system, economy			
	Special construction, refrigerators, prefabricated, walk-in, 7'-6" high, 6' x 6'			
	sinks, washers & dry tables			
E1090	**Other Equipment**		**$0.00**	**$0**
E2020	**Moveable Furnishings**		**$3.96**	**$955,000**
	per room			
F Special Construction		**0.00%**	**$0.00**	**$0**
G Building Sitework		**0.00%**	**$0.00**	**$0**

SubTotal	**100%**	**$190.52**	**$45,947,500**
Contractor Fees (General Conditions,Overhead,Profit)	**0.00%**	**$0.00**	**$0**
Architectural Fees	**0.00%**	**$0.00**	**$0**
User Fees	**0.00%**	**$0.00**	**$0**
Total Building Cost		**$190.52**	**$45,947,500**

Assemblies Estimate using RS Means Cost Data Reference 2010						
Equipment/ System	**System Components**	**RS Means Parameters**	**Price/ quantity**	**Quantity**	**Total**	**RS Means 2010 page#**
Plumbing						
Domestic Hot Water Heater	1125 MBH, 1500 GPH, 500 Gallons	600 MBH, 576 GPH	$22,275/each	2	$44,550	286
Wall hung water closets	Wall hung, grouped side by side	Wall hung, close couple	$2310/each	Approx. 40	$92,400	267
Wall hung lavatory sinks	Wall hung	Wall hung 20"x18"	$1545/ each	Approx. 45	$69, 525	270
Total					**$206, 475**	
HVAC						
Gas Boiler	4423 MBH	4720 MBH	$88,400/unit	2	$176, 800	317
Steam Boiler	4423 MBH	4720 MBH	$84,400/unit	1	$84,400	317
Chilled Water/Cooling Tower system	500 tons	Medical Center 60,000 S.F., 140,000 ton	$45.40/SF (adjusted for 241,175 SF)	241,175 SF	$10,949,345	324
Total					**$11,210,545**	
Fire Protection						
Wet sprinkler system	Approx. 34,000 SF coverage on each floor	Ordinary hazard, one floor, 50,000 S.F.	$3.66/ SF (add'tl floors) $3.06/SF	34,000 + 34,000 (6)	$748, 680	345
Total					**$748, 680**	
Electrical						
Electric Service, 3 Phase, 4 wire	3 phase, 4 wire, 120/208 V, 100 A	3 phase, 4 wire,120/208 V, 100A	$2, 275/each	1	$2, 275	354
Duplex receptacle	125 V, 2 Pole, 3 wire, 20 A	16 per 1000 S.F.	$3.40/ sf	241, 175	$819,995	357
Switchgear/Switchboard/Panels/ Circuit Breaker	5000A, 277/480V	2000A, 277/ 480 V	$55,100/each (add 20% for 277/480V)	1	55,100+$11020= $66,120	356
Total					**$888, 390**	
Total of Assemblies					**$13,054,090**	

D20 Plumbing

D2020 Domestic Water Distribution



Units may be installed in multiples for increased capacity.

Included below is the heater with self-energizing gas controls, safety pilots, insulated jacket, hi-limit aquastat and pressure relief valve.

Installation includes piping and fittings within 10' of heater. Gas heaters require vent piping (not included in these prices).

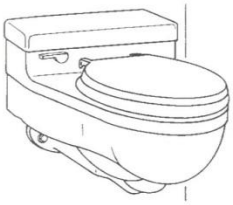
System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D2020 250 1780					
GAS FIRED WATER HEATER, COMMERCIAL, 100° F RISE					
75.5 MBH INPUT, 63 GPH					
Water heater, commercial, gas, 75.5 MBH, 63 GPH	1.000	Ea.	1,725	445	2,170
Copper tubing, type L, solder joint, hanger 10' OC, 1-1/4" diam	30.000	L.F.	276	322.50	598.50
Wrought copper 90° elbow for solder joints 1-1/4" diam	4.000	Ea.	53.20	166	219.20
Wrought copper Tee for solder joints, 1-1/4" diam	2.000	Ea.	55	139	194
Wrought copper union for soldered joints, 1-1/4" diam	2.000	Ea.	137	89	226
Valve, gate, bronze, 125 lb, NRS, soldered 1-1/4" diam	2.000	Ea.	182	83	265
Relief valve, bronze, press & temp, self-close, 3/4" IPS	1.000	Ea.	137	22.50	159.50
Copper tubing, type L, solder joints, 3/4" diam	8.000	L.F.	33.68	65.60	99.28
Wrought copper 90° elbow for solder joints 3/4" diam	1.000	Ea.	3.60	33	36.60
Wrought copper, adapter, CTS to MPT, 3/4" IPS	1.000	Ea.	5.60	36.50	42.10
Pipe steel black, schedule 40, threaded, 3/4" diam	10.000	L.F.	47.10	102.50	149.60
Pipe, 90° elbow, malleable iron black, 150 lb threaded, 3/4" diam	2.000	Ea.	6.32	89	95.32
Pipe, union with brass seat, malleable iron black, 3/4" diam	1.000	Ea.	13.25	48	61.25
Valve, gas stop w/o check, brass, 3/4" IPS	1.000	Ea.	12.30	28.50	40.80
TOTAL			2,687.05	1,670.10	4,357.15

D2020 250	Gas Fired Water Heaters - Commercial Systems		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
1760	Gas fired water heater, commercial, 100°F rise				
1780	75.5 MBH input, 63 GPH		2,675	1,675	4,350
1860	100 MBH input, 91 GPH	RD2020 -100	6,400	1,750	8,150
1980	155 MBH input, 150 GPH		9,100	2,025	11,125
2060	200 MBH input, 192 GPH		9,725	2,450	12,175
2140	300 MBH input, 278 GPH		11,200	3,025	14,225
2180	390 MBH input, 374 GPH		13,100	3,050	16,150
2220	500 MBH input, 480 GPH		17,700	3,300	21,000
2260	600 MBH input, 576 GPH		18,700	3,575	22,275

D20 Plumbing

D2010 Plumbing Fixtures

Systems are complete with trim seat and rough-in (supply, waste and vent) for connection to supply branches and waste mains.



One Piece Wall Hung

Supply

Waste/Vent

Floor Mount

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D2010 110 1880					
WATER CLOSET, VITREOUS CHINA, ELONGATED					
TANK TYPE, WALL HUNG, TWO PIECE					
Water closet, tank type vit china wall hung 2 pc. w/seat supply & stop	1.000	Ea.	655	212	867
Pipe Steel galvanized, schedule 40, threaded, 2" diam.	4.000	L.F.	76	70.20	146.20
Pipe, CI soil, no hub, cplg 10' OC, hanger 5' OC, 4" diam.	2.000	L.F.	29.10	38.70	67.80
Pipe, coupling, standard coupling, CI soil, no hub, 4" diam.	2.000	Ea.	45	68	113
Copper tubing type L solder joint, hangar 10' O.C., 1/2" diam.	6.000	L.F.	16.44	46.20	62.64
Wrought copper 90° elbow for solder joints 1/2" diam.	2.000	Ea.	3.20	62	65.20
Wrought copper Tee for solder joints 1/2" diam.	1.000	Ea.	2.74	48	50.74
Supports/carrier, water closet, siphon jet, horiz, single, 4" waste	1.000	Ea.	830	117	947
TOTAL			1,657.48	662.10	2,319.58

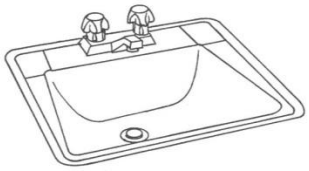
D2010 110	Water Closet Systems		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
1800	Water closet, vitreous china, elongated				
1840	Tank type, wall hung				
1880	Close coupled two piece	RD2010 -400	1,650	660	2,310
1920	Floor mount, one piece		930	705	1,635
1960	One piece low profile		970	705	1,675
2000	Two piece close coupled		625	705	1,330
2040	Bowl only with flush valve				
2080	Wall hung		1,425	750	2,175
2120	Floor mount		750	715	1,465
2160	Floor mount, ADA compliant with 18" high bowl		770	735	1,505

267

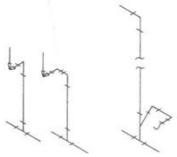
D20 Plumbing

D2010 Plumbing Fixtures

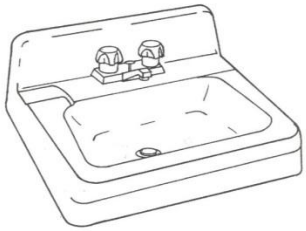
Systems are complete with trim and rough-in (supply, waste and vent) to connect to supply branches and waste mains.



Vanity Top



Supply Waste/Vent



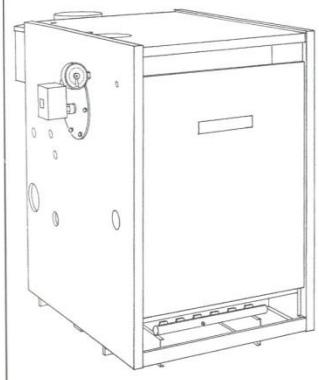
Wall Hung

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D2010 310 1560					
LAVATORY W/TRIM, VANITY TOP, P.E. ON C.I., 20″ X 18″					
Lavatory w/trim, PE on CI, white, vanity top, 20″ x 18″ oval	1.000	Ea.	286	176	462
Pipe, steel, galvanized, schedule 40, threaded, 1-1/4″ diam.	4.000	L.F.	48	50.60	98.60
Copper tubing type DWV, solder joint, hanger 10′ OC 1-1/4″ diam.	4.000	L.F.	43.20	41.60	84.80
Wrought copper DWV, Tee, sanitary, 1-1/4″ diam.	1.000	Ea.	30.50	69.50	100
P trap w/cleanout, 20 ga., 1-1/4″ diam.	1.000	Ea.	103	34.50	137.50
Copper tubing type L, solder joint, hanger 10′ OC 1/2″ diam.	10.000	L.F.	27.40	77	104.40
Wrought copper 90° elbow for solder joints 1/2″ diam.	2.000	Ea.	3.20	62	65.20
Wrought copper Tee for solder joints, 1/2″ diam.	2.000	Ea.	5.48	96	101.48
Stop, chrome, angle supply, 1/2″ diam.	2.000	Ea.	17.50	57	74.50
TOTAL			564.28	664.20	1,228.48

D2010 310	Lavatory Systems		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
1560	Lavatory w/trim, vanity top, PE on CI, 20″ x 18″, Vanity top by others.		565	665	1,230
1600	19″ x 16″ oval		475	665	1,140
1640	18″ round	RD2010 -400	550	665	1,215
1680	Cultured marble, 19″ x 17″		485	665	1,150
1720	25″ x 19″		520	665	1,185
1760	Stainless, self-rimming, 25″ x 22″		660	665	1,325
1800	17″ x 22″		650	665	1,315
1840	Steel enameled, 20″ x 17″		480	680	1,160
1880	19″ round		475	680	1,155
1920	Vitreous china, 20″ x 16″		585	695	1,280
1960	19″ x 16″		585	695	1,280
2000	22″ x 13″		595	695	1,290
2040	Wall hung, PE on CI, 18″ x 15″		845	730	1,575
2080	19″ x 17″		845	730	1,575
2120	20″ x 18″		815	730	1,545
2160	Vitreous china, 18″ x 15″		700	755	1,455
2200	19″ x 17″		645	755	1,400
2240	24″ x 20″		915	755	1,670
2300	20″ x 27″, handicap		915	755	1,670

D30 HVAC

D3020 Heat Generating Systems



Boiler Selection: The maximum allowable working pressures are limited by ASME "Code for Heating Boilers" to 15 PSI for steam and 160 PSI for hot water heating boilers, with a maximum temperature limitation of 250°F. Hot water boilers are generally rated for a working pressure of 30 PSI. High pressure boilers are governed by the ASME "Code for Power Boilers" which is used almost universally for boilers operating over 15 PSIG. High pressure boilers used for a combination of heating/process loads are usually designed for 150 PSIG.

Boiler ratings are usually indicated as either Gross or Net Output. The Gross Load is equal to the Net Load plus a piping and pickup allowance. When this allowance cannot be determined, divide the gross output rating by 1.25 for a value equal to or greater than the next heat loss requirement of the building.

Table below lists installed cost per boiler and includes insulating jacket, standard controls, burner and safety controls. Costs do not include piping or boiler base pad. Outputs are Gross.

D3020 106	Boilers, Hot Water & Steam		COST EACH		
			MAT.	INST.	TOTAL
0600	Boiler, electric, steel, hot water, 12 K.W., 41 M.B.H.		4,125	1,300	5,425
0620	30 K.W., 103 M.B.H.		4,925	1,425	6,350
0640	60 K.W., 205 M.B.H.	RD3020 -010	6,025	1,550	7,575
0660	120 K.W., 410 M.B.H.		6,750	1,900	8,650
0680	210 K.W., 716 M.B.H.	RD3020 -020	7,900	2,850	10,750
0700	510 K.W., 1,739 M.B.H.		18,900	5,275	24,175
0720	720 K.W., 2,452 M.B.H.		22,900	5,950	28,850
0740	1,200 K.W., 4,095 M.B.H.		29,600	6,850	36,450
0760	2,100 K.W., 7,167 M.B.H.		56,500	8,600	65,100
0780	3,600 K.W., 12,283 M.B.H.		87,000	14,500	101,500
0820	Steam, 6 K.W., 20.5 M.B.H.		3,850	1,425	5,275
0840	24 K.W., 81.8 M.B.H.		4,775	1,550	6,325
0860	60 K.W., 205 M.B.H.		6,625	1,700	8,325
0880	150 K.W., 512 M.B.H.		9,575	2,625	12,200
0900	510 K.W., 1,740 M.B.H.		24,400	6,450	30,850
0920	1,080 K.W., 3,685 M.B.H.		34,100	9,300	43,400
0940	2,340 K.W., 7,984 M.B.H.		70,000	14,500	84,500
0980	Gas, cast iron, hot water, 80 M.B.H.		1,975	1,625	3,600
1000	100 M.B.H.		2,525	1,750	4,275
1020	163 M.B.H.		3,100	2,375	5,475
1040	280 M.B.H.		4,550	2,625	7,175
1060	544 M.B.H.		9,025	4,675	13,700
1080	1,088 M.B.H.		13,600	5,925	19,525
1100	2,000 M.B.H.		19,700	9,250	28,950
1120	2,856 M.B.H.		23,700	11,900	35,600
1140	4,720 M.B.H.		72,000	16,400	88,400
1160	6,970 M.B.H.		103,500	26,600	130,100
1180	For steam systems under 2,856 M.B.H., add 8%				
1520	Oil, cast iron, hot water, 109 M.B.H.		2,175	1,975	4,150
1540	173 M.B.H.		2,750	2,375	5,125
1560	236 M.B.H.		3,525	2,800	6,325
1580	1,084 M.B.H.		10,300	6,300	16,600
1600	1,600 M.B.H.		13,300	9,050	22,350
1620	2,480 M.B.H.		20,400	11,600	32,000
1640	3,550 M.B.H.		26,300	13,900	40,200
1660	Steam systems same price as hot water				

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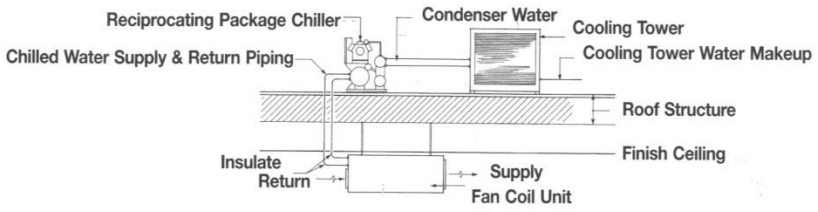
D30 HVAC

D3030 Cooling Generating Systems



General: Water cooled chillers are available in the same sizes as air cooled units. They are also available in larger capacities.

Design Assumptions: The chilled water systems with water cooled condenser include reciprocating hermetic compressors, water cooling tower, pumps, piping and expansion tanks and are based on a two pipe system. Chilled water piping is insulated. No ducts are included and fan-coil units are cooling only. Area distribution is through use of multiple fan coil units. Fewer but larger fan coil units with duct distribution would be approximately the same S.F. cost. Water treatment and balancing are not included.

System Components	QUANTITY	UNIT	COST EACH MAT.	INST.	TOTAL
SYSTEM D3030 115 1320					
PACKAGED CHILLER, WATER COOLED, WITH FAN COIL UNIT					
APARTMENT CORRIDORS, 4,000 S.F., 7.33 TON					
Fan coil air conditioner unit, cabinet mounted & filters, chilled water	2.000	Ea.	4,641.70	684.04	5,325.74
Water chiller, water cooled, 1 compressor, hermetic scroll,	1.000	Ea.	5,358.60	3,343.40	8,702
Cooling tower, draw thru single flow, belt drive	1.000	Ea.	1,312.07	141.84	1,453.91
Cooling tower pumps & piping	1.000	System	656.04	337.18	993.22
Chilled water unit coil connections	2.000	Ea.	2,600	2,800	5,400
Chilled water distribution piping	520.000	L.F.	9,282	22,360	31,642
TOTAL			23,850.41	29,666.46	53,516.87
COST PER S.F.			5.96	7.42	13.38
*Cooling requirements would lead to choosing a water cooled unit.					

D3030 115	Chilled Water, Cooling Tower Systems	COST PER S.F. MAT.	INST.	TOTAL
1300	Packaged chiller, water cooled, with fan coil unit			
1320	Apartment corridors, 4,000 S.F., 7.33 ton	5.98	7.43	13.41
1600	Banks and libraries, 4,000 S.F., 16.66 ton RD3030 -010	10.40	8.15	18.55
1800	60,000 S.F., 250.00 ton	7.40	6.55	13.95
1880	Bars and taverns, 4,000 S.F., 44.33 ton	18.75	10.30	29.05
2000	20,000 S.F., 221.66 ton	18.50	8.55	27.05
2160	Bowling alleys, 4,000 S.F., 22.66 ton	12.45	8.95	21.40
2320	40,000 S.F., 226.66 ton	10.30	6.25	16.55
2440	Department stores, 4,000 S.F., 11.66 ton	6.75	8.05	14.80
2640	60,000 S.F., 175.00 ton	6.60	6	12.60
2720	Drug stores, 4,000 S.F., 26.66 ton	13.20	9.20	22.40
2880	40,000 S.F., 266.67 ton	10.20	7.05	17.25
3000	Factories, 4,000 S.F., 13.33 ton	8.95	7.75	16.70
3200	60,000 S.F., 200.00 ton	6.60	6.30	12.90
3280	Food supermarkets, 4,000 S.F., 11.33 ton	6.65	8	14.65
3480	60,000 S.F., 170.00 ton	6.55	6	12.55
3560	Medical centers, 4,000 S.F., 9.33 ton	5.70	7.35	13.05
3760	60,000 S.F., 140.00 ton	5.30	6.05	11.35
3840	Offices, 4,000 S.F., 12.66 ton	8.65	7.70	16.35
4040	60,000 S.F., 190.00 ton	6.35	6.25	12.60
4120	Restaurants, 4,000 S.F., 20.00 ton	11.10	8.30	19.40
4320	60,000 S.F., 300.00 ton	8.30	6.80	15.10
4400	Schools and colleges, 4,000 S.F., 15.33 ton	9.85	8	17.85
4600	60,000 S.F., 230.00 ton	6.80	6.35	13.15

D40 Fire Protection

D4010 Sprinklers

D4010 410	Wet Pipe Sprinkler Systems	COST PER S.F.		
		MAT.	INST.	TOTAL
0680	1000 S.F.	1.29	2.24	3.53
0700	2000 S.F.	1.20	2.02	3.22
0720	5000 S.F.	.96	1.71	2.67
0740	10,000 S.F.	.93	1.60	2.53
0760	50,000 S.F.	.80	1.24	2.04
1000	Ordinary hazard, one floor, 500 S.F.	2.76	3.02	5.78
1020	1000 S.F.	3.56	2.85	6.41
1040	2000 S.F.	3.83	3.07	6.90
1060	5000 S.F.	2.16	2.19	4.35
1080	10,000 S.F.	1.79	2.32	4.11
1100	50,000 S.F.	1.47	2.19	3.66
1140	Each additional floor, 500 S.F.	1.77	2.71	4.48
1160	1000 S.F.	1.25	2.20	3.45
1180	2000 S.F.	1.35	2.22	3.57
1200	5000 S.F.	1.35	2.10	3.45
1220	10,000 S.F.	1.34	2.16	3.50
1240	50,000 S.F.	1.14	1.92	3.06
1500	Extra hazard, one floor, 500 S.F.	6.65	4.69	11.34
1520	1000 S.F.	4.53	4.07	8.60
1540	2000 S.F.	4.17	4.14	8.31
1560	5000 S.F.	3.15	3.58	6.73
1580	10,000 S.F.	2.61	3.44	6.05
1600	50,000 S.F.	2.81	3.32	6.13
1660	Each additional floor, 500 S.F.	2.02	3.38	5.40
1680	1000 S.F.	1.95	3.21	5.16
1700	2000 S.F.	1.80	3.20	5
1720	5000 S.F.	1.61	2.82	4.43
1740	10,000 S.F.	1.67	2.61	4.28
1760	50,000 S.F.	1.66	2.49	4.15
2020	Grooved steel, black sch. 40 pipe, light hazard, one floor, 2000 S.F.	3.37	2.46	5.83
2060	10,000 S.F.	1.30	1.59	2.89
2100	Each additional floor, 2000 S.F.	.89	1.61	2.50
2150	10,000 S.F.	.60	1.36	1.96
2200	Ordinary hazard, one floor, 2000 S.F.	3.41	2.62	6.03
2250	10,000 S.F.	1.24	1.95	3.19
2300	Each additional floor, 2000 S.F.	.93	1.77	2.70
2350	10,000 S.F.	.79	1.79	2.58
2400	Extra hazard, one floor, 2000 S.F.	3.68	3.38	7.06
2450	10,000 S.F.	1.68	2.53	4.21
2500	Each additional floor, 2000 S.F.	1.34	2.62	3.96
2550	10,000 S.F.	1.11	2.26	3.37
3050	Grooved steel black sch. 10 pipe, light hazard, one floor, 2000 S.F.	3.31	2.45	5.76
3100	10,000 S.F.	1.02	1.51	2.53
3150	Each additional floor, 2000 S.F.	.83	1.60	2.43
3200	10,000 S.F.	.56	1.34	1.90
3250	Ordinary hazard, one floor, 2000 S.F.	3.36	2.60	5.96
3300	10,000 S.F.	1.18	1.93	3.11
3350	Each additional floor, 2000 S.F.	.88	1.75	2.63
3400	10,000 S.F.	.73	1.77	2.50
3450	Extra hazard, one floor, 2000 S.F.	3.63	3.38	7.01
3500	10,000 S.F.	1.56	2.49	4.05
3550	Each additional floor, 2000 S.F.	1.29	2.62	3.91
3600	10,000 S.F.	1.04	2.23	3.27
4050	Copper tubing, type M, light hazard, one floor, 2000 S.F.	3.97	2.45	6.42
4100	10,000 S.F.	1.63	1.51	3.14
4150	Each additional floor, 2000 S.F.	1.51	1.63	3.14
4200	10,000 S.F.	1.17	1.35	2.52
4250	Ordinary hazard, one floor, 2000 S.F.	4.15	2.75	6.90

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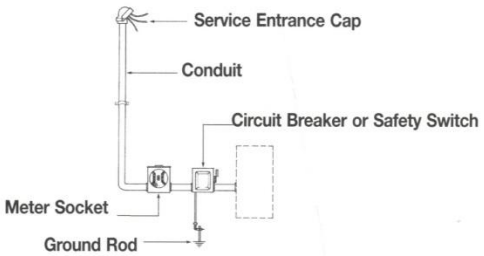
D50 Electrical

D5010 Electrical Service/Distribution



System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D5010 120 0220					
SERVICE INSTALLATION, INCLUDES BREAKERS, METERING, 20' CONDUIT & WIRE					
3 PHASE, 4 WIRE, 60 A					
Circuit breaker, enclosed (NEMA 1), 600 volt, 3 pole, 60 A	1.000	Ea.	695	208	903
Meter socket, single position, 4 terminal, 100 A	1.000	Ea.	48.50	182	230.50
Rigid galvanized steel conduit, 3/4", including fittings	20.000	L.F.	62.80	146	208.80
Wire, 600V type XHHW, copper stranded #6	.900	C.L.F.	87.75	80.55	168.30
Service entrance cap 3/4" diameter	1.000	Ea.	11.55	45	56.55
Conduit LB fitting with cover, 3/4" diameter	1.000	Ea.	15.75	45	60.75
Ground rod, copper clad, 8' long, 3/4" diameter	1.000	Ea.	33.50	110	143.50
Ground rod clamp, bronze, 3/4" diameter	1.000	Ea.	7.35	18.20	25.55
Ground wire, bare armored, #6-1 conductor	.200	C.L.F.	31	65	96
TOTAL			993.20	899.75	1,892.95

D5010 120	Electric Service, 3 Phase - 4 Wire		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
0200	Service installation, includes breakers, metering, 20' conduit & wire				
0220	3 phase, 4 wire, 120/208 volts, 60 A		995	900	1,895
0240	100 A		1,200	1,075	2,275
0280	200 A		1,825	1,675	3,500
0320	400 A	RD5010 -110	4,300	3,050	7,350
0360	600 A		8,100	4,150	12,250
0400	800 A		10,400	4,975	15,375
0440	1000 A		12,900	5,750	18,650
0480	1200 A		16,000	5,850	21,850
0520	1600 A		29,300	8,400	37,700
0560	2000 A		32,400	9,600	42,000
0570	Add 25% for 277/480 volt				
0580					
0610	1 phase, 3 wire, 120/240 volts, 100 A		525	980	1,505
0620	200 A		1,100	1,425	2,525

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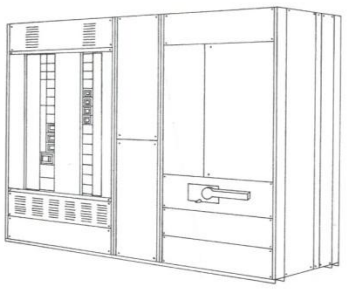
D50 Electrical

D5010 Electrical Service/Distribution



System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D5010 240 0240					
SWITCHGEAR INSTALLATION, INCL SWBD, PANELS & CIRC BREAKERS, 600 A					
Panelboard, NQOD 225A 4W 120/208V main CB, w/20A bkrs 42 circ	1.000	Ea.	2,425	2,075	4,500
Switchboard, alum. bus bars, 120/208V, 4 wire, 600V	1.000	Ea.	4,775	1,175	5,950
Distribution sect., alum. bus bar, 120/208 or 277/480 V, 4 wire, 600A	1.000	Ea.	2,500	1,175	3,675
Feeder section circuit breakers, KA frame, 70 to 225 A	3.000	Ea.	4,125	546	4,671
TOTAL			13,825	4,971	18,796

D5010 240	Switchgear		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
0200	Switchgear inst., incl. swbd., panels & circ bkr, 400 A, 120/208volt		4,425	3,675	8,100
0240	600 A		13,800	4,975	18,775
0280	800 A	RD5010 -110	17,500	7,075	24,575
0320	1200 A		21,000	10,900	31,900
0360	1600 A		28,300	15,200	43,500
0400	2000 A		35,700	19,400	55,100
0410	Add 20% for 277/480 volt				

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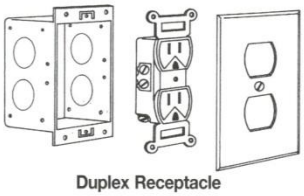
D50 Electrical

D5020 Lighting and Branch Wiring



Duplex Receptacle

System Components	QUANTITY	UNIT	COST PER S.F. MAT.	INST.	TOTAL
SYSTEM D5020 110 0200					
RECEPTACLES INCL. PLATE, BOX, CONDUIT, WIRE & TRANS. WHEN REQUIRED					
2.5 PER 1000 S.F., .3 WATTS PER S.F.					
Steel intermediate conduit, (IMC) 1/2" diam	167.000	L.F.	.35	.98	1.33
Wire 600V type THWN-THHN, copper solid #12	3.382	C.L.F.	.04	.18	.22
Wiring device, receptacle, duplex, 120V grounded, 15 amp	2.500	Ea.		.04	.04
Wall plate, 1 gang, brown plastic	2.500	Ea.		.02	.02
Steel outlet box 4" square	2.500	Ea.	.01	.07	.08
Steel outlet box 4" plaster rings	2.500	Ea.	.01	.02	.03
TOTAL			.41	1.31	1.72

D5020 110	Receptacle (by Wattage)		COST PER S.F. MAT.	INST.	TOTAL
0190	Receptacles include plate, box, conduit, wire & transformer when required				
0200	2.5 per 1000 S.F., .3 watts per S.F.		.41	1.31	1.72
0240	With transformer	RD5010 -110	.48	1.37	1.85
0280	4 per 1000 S.F., .5 watts per S.F.		.47	1.53	2
0320	With transformer		.57	1.63	2.20
0360	5 per 1000 S.F., .6 watts per S.F.		.55	1.80	2.35
0400	With transformer		.68	1.93	2.61
0440	8 per 1000 S.F., .9 watts per S.F.		.58	1.99	2.57
0480	With transformer		.76	2.17	2.93
0520	10 per 1000 S.F., 1.2 watts per S.F.		.61	2.16	2.77
0560	With transformer		.91	2.45	3.36
0600	16.5 per 1000 S.F., 2.0 watts per S.F.		.70	2.70	3.40
0640	With transformer		1.22	3.20	4.42
0680	20 per 1000 S.F.,2.4 watts per S.F.		.74	2.93	3.67
0720	With transformer		1.34	3.51	4.85

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