DORMITORY BUILDINGS C & D

MANSFIELD UNIVERSITY, MANSFIELD PA

TECHNICAL REPORT NO. 1

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Department of Architectural Engineering
Construction Management Option

AE481 – Fall 2012
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EXECUTIVE SUMMARY

Mansfield University is currently constructing two new dormitory buildings on the south west corner of its campus in Mansfield, PA. This project is the second phase of dormitory expansion plan on Mansfield's campus. The Construction Manager, Wohlsen Construction Co., has a GMP contract with the university. The GMP contract is set at $39 million. Building C is due to be complete by the beginning of the fall semester 2013. Building D should be completed by mid-October 2013.

Construction of these dormitory buildings will use a modular system. Modular units will be created in a factory off site and then transported to the site and set in place by a crane. The modular units are preassembled with all of the final finishes and MEP installed. Once set, the MEP contractor will tie the units into mains in the hallway.

The modular system will decrease the length of the schedule. There is an extensive phasing plan for the erection of the modular units. Building C is broke into three parts: two modular phases and a structural steel core area. Building D is broke into four parts: three modular phases and a structural steel core area. The core areas will be built before the modular phases begin.

The masonry façade includes brick and precast stone. A large scaffolding structure will allow for the masons to work on the façade four stories above grade. There is also a large glazing store front at the core areas of the buildings. The core areas are the only part of the buildings that will require installation of MEP's and finishes.

The MEP subcontractors have a design-build contract with the Construction Manager. They are required to design the Mechanical, Electrical and Plumbing mains in the hallway. These contractors will have to coordinate with each other and with the modular contractor. Because the GMP contract was just recently finalized, the MEP's are still in the design phase of their drawings. This could affect the student in their research of this project.

The square foot cost estimate calculated by RS Means Costworks was found to be within 5% of the actual total cost. That was surprising, because it based the estimate off of a completely different structural system. The assemblies estimate was further off though. The specific systems in these dormitory buildings, such as a ground water heat pump, were not available in the RS Means book. Also, the contract values for the MEP's are skewed due to the modular contractor installing MEP's in every unit.

The site layout during superstructure construction was really constricted due to the modular construction. A crane sized to lift modular units requires crane pads. There also must be an access road for the delivery of these units. There is very little room onsite for storage, so most of the storage will be south of Building D or in a large parking lot east of the site.

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PROJECT SCHEDULE SUMMARY

*See Appendix A for Summary Project Schedule

SCHEDULE NARRATIVE

Construction of the two dormitories was delayed from its initial start date of early July due to owner financing. The owner asked the Construction Manager to provide value engineering so the price could decrease about $2 million. The CM got the number down to $39 million and the financing finally cleared on August 16, 2012. On that day, Wohlsen Construction was issued the notice to proceed. The end date of Building C was not pushed back due to the delay. This building will be needed by the beginning of the fall semester in 2013.

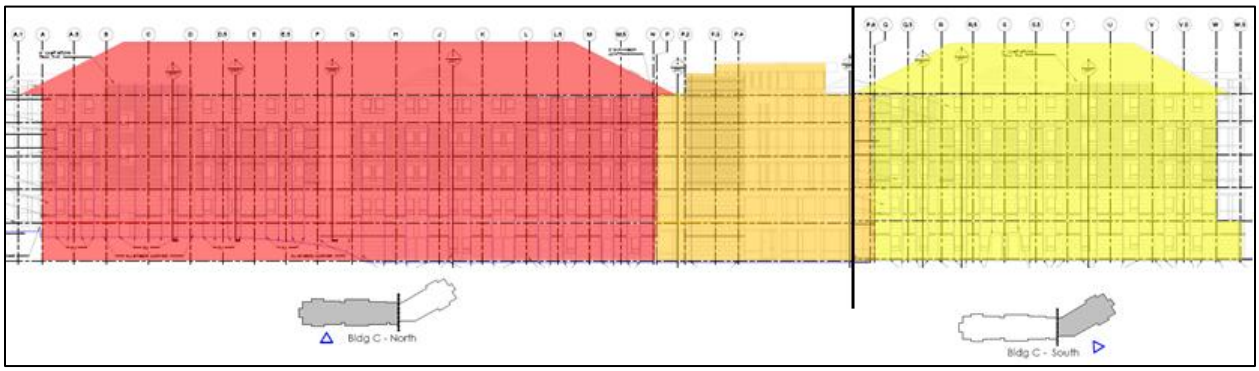


Figure 1 Building C Phasing Plan

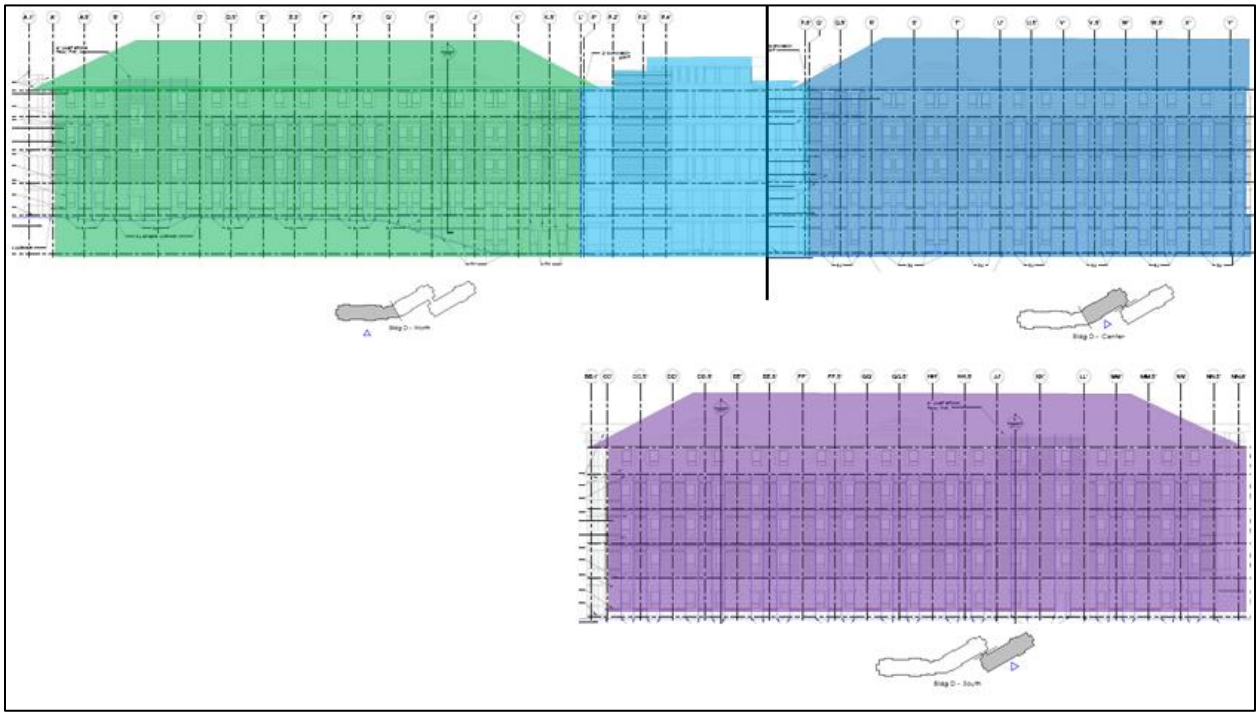


Figure 2 Building D Phasing Plan

There are two dormitory buildings broke into 5 modular construction phases. The phases can be seen in the Figure 1 and Figure 2 above. The basement floor is made of CMU block and will be built before any of the units can be set. Building C will begin setting modular units first due to the time constraint. The orange section is not modular and will be field built mostly of structural steel first. The red section will be the first phase of modular setting. The next modular phase is the yellow section of Building C. Once all the modular units are set in Building C the crane will move to Building D, where the light blue field built section is already completed. The next modular setting phase will be the green section. The dark blue section will follow the green, and the purple will be the final erection phase.

There will be very little finishes completed onsite. The middle core areas are field built and will contain most of the interior scope of work. The Figure 3 below shows the flow of work in on each floor. The Figure is of Building C, but Building D follows the same process with an extra modular phase. Flow of construction will start with the setting of modular units in phase 1 which is represented in orange. Once the units are set, the MEP's will enter the hallway, shown in yellow. The MEP's will run mains down the hallway and begin to tie in each unit. Meanwhile on the exterior, the masonry contractor will begin constructing the brick and stone façade. The green section is the field built section and the structure will be completed before the modular units are being set. The store front façade, shown in dark green, will be constructed as the modular units are being set in the orange color. The MEP's will work on the green section before they start tying in the units and the finishes will follow. The modular setting will continue from the orange section to the blue section for phase 2. Once the units are set, the MEP's will follow in the hallway, purple, and the masonry contractor will follow on the exterior façade, dark blue. The hallways will need final finishes before the construction process is complete. The flow of construction will start on the first floor and move their way up.

Figure 3 Building C Floor Phasing Plan

BUILDING SYSTEMS SUMMARY

Table 1 Checklist

BUILDING SYSTEMS CHECKLIST		
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

DEMOLITION

Three buildings (seen to the right) were demolished before construction on the new dormitories could begin. The demolition contract was bid as a separate project from the new construction. Because the demo wasn't part of the Construction Manager contract for the dormitory construction, there a few details known of this process. There was consideration of asbestos during the demolition of these buildings.

Figure 4 Existing Site Picture
Courtesy of Google Maps

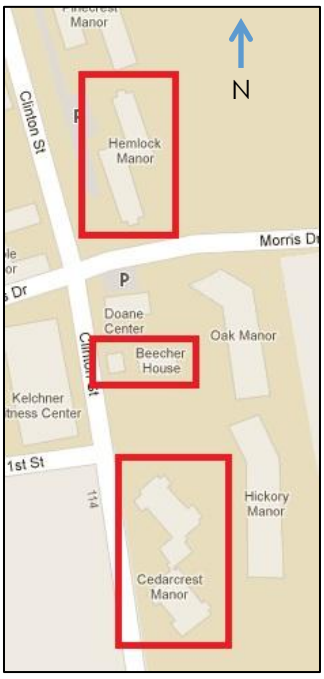


Figure 5 Demolished Buildings
Courtesy of Google Maps

STRUCTURAL STEEL

Structural steel is used mostly on the first floor and the core spaces of these buildings. Figure 6, to the right, shows the structural drawing for the second floor of Building C. Most of these buildings are modular units. The modular units are created to structurally support themselves. The core is the only part that is not modular on floors 2-4. The structural steel used in the core space is W10, W12 and W14 girders with HSS 6x6 steel columns. The girders range from 15 lbs/ft to 53 lbs/ft. All girder to beam connections are shear with optional moment reinforcement. All girder to column connections are welded-moment.

On the basement and first floor, structural steel columns and girders are used to provide additional support the modular units. HSS columns used were similar to the core space, but the girders are bigger. The girders range from W14 to W18. The weight ranges from 40 lbs/ft to 67 lbs/ft.

A separate, smaller, crane from the one used for the modular units will be used to erect the steel. The crawler crane will mostly be set at the inside of the angle of the core area.

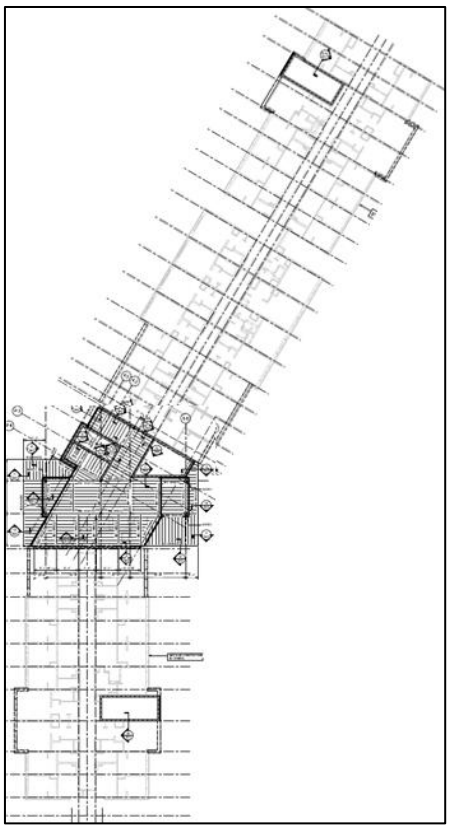


Figure 6 Building C Steel Core
Details from Sheets S1.2C - Architectural Plans – WTW Architects

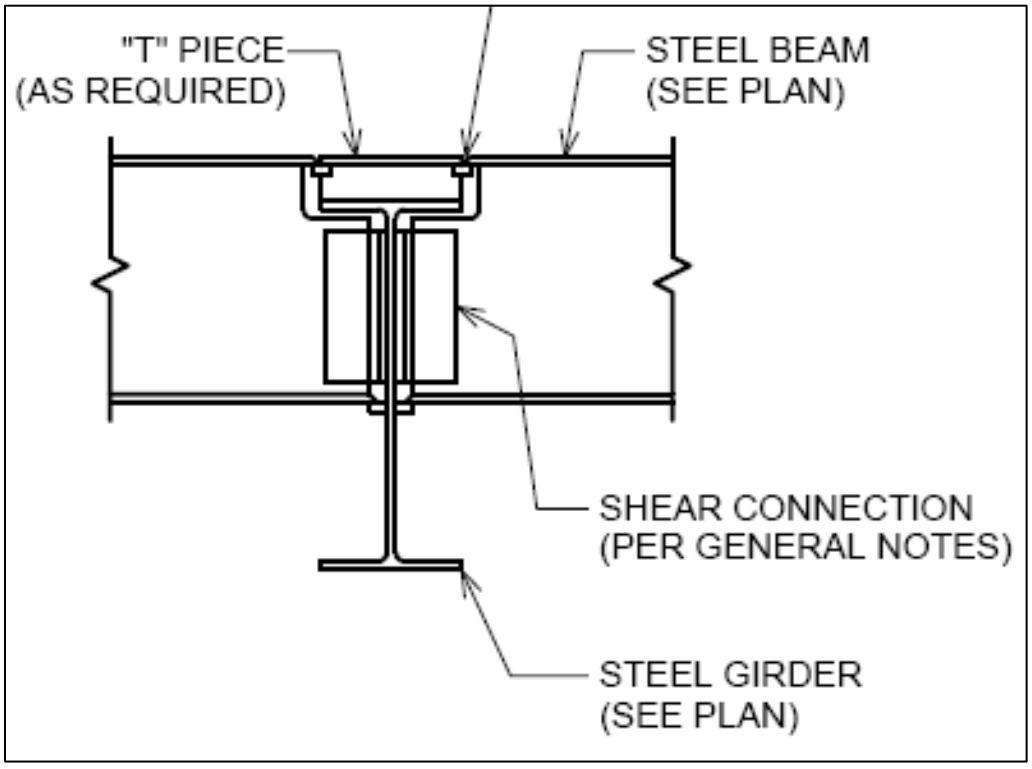


Figure 7 Girder to Beam Connection
Details from Sheets S2.1C - Architectural Plans – WTW Architects

CAST –IN-PLACE CONCRETE

Because the buildings are built on a hill, the basement level is only under a portion of the first floor. Some of the first floor sits on grade. A building footer will be poured under the basement level and parts of the first floor. This will provide support for the structural masonry block on the exterior of the building up to the second floor. The footer and spread footings are to be designed for a soil bearing pressure of 4000psf. On both buildings, a 4" concrete slab on grade will be poured on the basement floor and parts of the first. Lumber forms will be used for these horizontal pours. The foundation has 3000 psi concrete and the slabs have 4000 psi concrete. There are also 24" x 24" rebar reinforced concrete piers. Plywood sheathing with lumber reinforcing will be used for formwork for the piers. These piers are only under the core spaces of the buildings to withstand the support of the structural steel above. The concrete will be poured using a pumping truck with labor to screed.

PRECAST CONCRETE

MECHANICAL SYSTEMS

The mechanical drawings have not been completely designed at this time. The Construction Manager has just received the notice to proceed on August 16, 2012. Because the MEP contractors are design build, they are currently coordinating drawings for modular unit connections and mechanical units.

Both buildings have separate ground source water pump systems. There is a pump room on the west side of the basement level in both buildings. The water is pumped from the pump room to the energy recovery units in the attic of the buildings. Building C has 6 ERU's in the attic and Building D has 8 ERU's in the attic. The air then travel through duct down chases into the hallways. The modular units will be built with diffusers and returns. The units just need to be tied in to the mains in the hallway.

There are two types of fire suppression systems. The common fire suppression system is a wet pipe quick response system with recessed pendent sprinkler heads. This system is used in all area except the attic. The attic has a double interlock preaction system with quick response upright heads.

ELECTRICAL SYSTEM

The electrical drawings have not been completely designed at this time. The Construction Manager has just received the notice to proceed on August 16, 2012. Because the MEP contractors are design build, they are currently coordinating drawings for modular unit connections and electrical units.

These buildings will have electrical and tele-data parts. The power enters the building from a transformer to the south of each of the buildings. There is a main electrical room in the basement of each building. Also, there is a smaller electrical room and a server room on each floor located in the core areas.

MASONRY

Masonry block is used in these buildings mostly as a 2 hour fire rating around stairwells and elevators. There are three stairwells and two elevators. Also, CMU walls are in between the core spaces and the modular units. The block used in these walls is typically 16" x 8". Temporary scaffolding will be used to construct these walls.

CMU walls are used as the exterior walls on the basement level of the buildings. The CMU below grade are 14" thick typically. Once above grade, the block is typically 10" because of the façade. The walls connect to the spread footings with grouted rebar as shown below. The exterior façade of the top three floors of the buildings is mostly brick veneer. The basement and first floor exterior facade is masonry stone block. There are precast stone heads and sills around the windows. Behind the brick and precast stone are the modular units above the basement. The masonry facade ties into the modular units' sheathing which will help support the block. Metal lintels are used around window openings. A scaffolding structure will be built to complete the exterior façade.

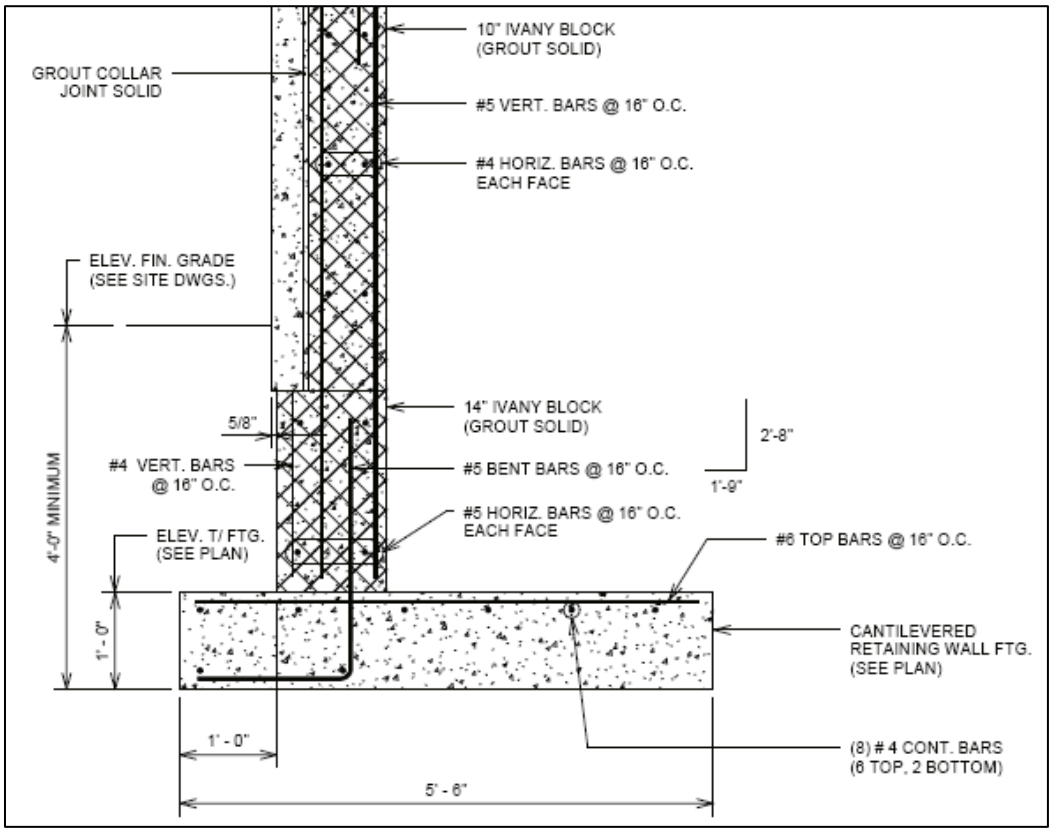


Figure 8 CMU to Footer Connection
Details from Sheets S3.0 - Architectural Plans – WTW Architects

CURTAIN WALL

In the core areas, there is a glass store front façade. The architect WTW Architects is responsible for the design. The mullions are aluminum with a carbon steel reinforcing. The mullions are 2" think and extend out 4.5". The glazing used is insulting glass. It is 1" thick with a 1/2" air gap. The glazing has a low-emissivity coating and allows 62% visible light transmittance.

The metal frame will be constructed after the structural steel in the core is set. The storefront will start at the basement and work its way up. The glass will be set in the frame with two workers on a man lift and one in the building. After the glass is set, the gaskets can be installed and the frame can be finished. Ideally there would be three crews. One would initially install the frame; another would set the glass, and the last would finish the frame and seal the glass.

SUPPORT OF EXCAVATION

Excavation will be used for the basement floor and parts of the first floors on each building. The excavation will be supported by benching. Most of the site has been leveled to the required grade by the demolition contractor. Most of the underground utility work will use trench boxes to excavate. The water table is below the excavation of the buildings, so no dewatering is necessary. The ground source water pump wells will be below the water table. Dewatering will be used for well excavation. The soil has been tested and has been reported as good quality.

PROJECT COST ELVALUATION

CONSTRUCTION COST

Buildings Construction Cost: $34,300,000

Total Area: 214,900 SF

Buildings Construction Square Foot Cost: $159.61/SF

TOTAL COST

Total Cost: $39,000,000

Total Area: 214,900 SF

Square Foot Cost: $181.48/SF

MEP COST

Total Cost: $12,900,00

Total Area: 214,900 SF

MEP Square Foot Cost: $60.03/SF

SQUARE FOOT ESTIMATE

In order to complete the square foot estimate, *RSMeans Costworks* was used. See Appendix B for the detailed report from *Costworks*. The program was run for both buildings separately. Mansfield, PA was not available in *Costworks*, so the closest location was Wellsboro, PA, which is less than 15 miles away.

Building Type:	**College, Dormitory, 4-8 Story with Face Brick with Concrete Block Back-up / Steel Frame**
Location:	WELLSBORO, PA
Stories Count (L.F.):	**5.00**
Stories Height	**14.00**
Floor Area (S.F.):	**135,400.00**
LaborType	**Open Shop**
Basement Included:	Yes
Data Release:	**Year 2012 Quarter 3**
Cost Per Square Foot	**$186.92**
Total Building Cost	**$25,308,000**

Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly

Figure 9 Building D Square Foot Estimate
RS Means Costworks

Building Type:	**College, Dormitory, 4-8 Story with Face Brick with Concrete Block Back-up / Steel Frame**
Location:	WELLSBORO, PA
Stories Count (L.F.):	**5.00**
Stories Height	**14.00**
Floor Area (S.F.):	**79,500.00**
LaborType	**Open Shop**
Basement Included:	Yes
Data Release:	**Year 2012 Quarter 3**
Cost Per Square Foot	**$194.95**
Total Building Cost	**$15,499,000**

Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly

Figure 10 Building C Square Foot Estimate
RS Means Costworks

ASSEMBLIES ESTIMATE

RS Means was used for this estimate. The coordinating pages for the information in the Table 2 and 3 can be found in Appendix B. The systems that were in the RS Means book were very common systems. Because of the modular construction, there are more complex systems in in this project. The information for this project's specific systems were not in *RS Means*, so a more conventional type of construction was estimated. This conventional estimate will then provide comparison for the design-build MEP costs from this project. In the assemblies estimate, a 0.88 location factor was used and a 1.95% inflation factor was included to change the cost from 2011 to 2012 prices.

Table 2 Building C Assemblies Cost Estimate

Building C				
Plumbing				
Number	System	Cost Per Unit	# of Units	Cost
D2010 110	Water Closet Systems	$2,420.00 EA	6 UN	$14,520.00
D2010 210	Urinal Systems	$1,355.00 EA	2 UN	$2,710.00
D2010 310	Lavatory Systems	$1,210.00 EA	6 UN	$7,260.00
D2010 410	Kitchen Sinks	$1,540.00 EA	22 UN	$33,880.00
D2010 810	Drinking Fountain Systems	$2,200.00 EA	10 UN	$22,000.00
D2010 926	Three Fixture Bathroom	$5,600.00 EA	132 UN	$739,200.00
D2020 240	Electric Water Heaters	$37,075.00 EA	6 UN	$222,450.00
Total Cost				$977,352.24
Cost per Square Foot				$4.55
HVAC				
Number	System	Cost Per Unit	# of Units	Cost
D3020 106	Boilers, Steam	$44,725.00 EA	6 UN	$268,350.00
D3050 155	Rooftop Multizone Unit Systems	$11.10 SF	79500 SF	$882,450.00
Total Cost				$1,079,381.35
Cost per Square Foot				$5.02
Fire Protection				
Number	System	Cost Per Unit	# of Units	Cost
D4010 410	Wet Pipe Sprinkler System	$3.38 SF	17050 SF	$57,629.00
D4010 410	Wet Pipe Sprinkler System Upper Floors	$3.29 SF	62450 SF	$205,460.50
Total Cost				$246,762.17
Cost per Square Foot				$1.15
Electrical				
Number	System	Cost Per Unit	# of Units	Cost
D5010 120	Electrical Service	$15,300.00 EA	1 UN	$15,300.00
D5010 230	Feeder Installation	$18.15 LF	1560 LF	$28,314.00
D5010 240	Switchgear	$24,600.00 EA	1 UN	$24,600.00
D5020 120	Wall Outlets	$0.56 SF	79500 SF	$44,520.00
D5020 130	Wall Switch	$0.44 SF	79500 SF	$34,980.00
D5020 210	Fluorescent Fixtures	$7.76 SF	79500 SF	$616,920.00
D5090 210	Generator	$859.00 kW	20 kW	$17,180.00
Total Cost				$733,294.62
Cost per Square Foot				$3.41

Table 3 Building D Assemblies Cost Estimate

Building D				
Plumbing				
Number	System	Cost Per Unit	# of Units	Cost
D2010 110	Water Closet Systems	$2,420.00 EA	15 UN	$36,300.00
D2010 210	Urinal Systems	$1,355.00 EA	3 UN	$4,065.00
D2010 310	Lavatory Systems	$1,210.00 EA	14 UN	$16,940.00
D2010 410	Kitchen Sinks	$1,540.00 EA	46 UN	$70,840.00
D2010 810	Drinking Fountain Systems	$2,200.00 EA	10 UN	$22,000.00
D2010 926	Three Fixture Bathroom	$5,600.00 EA	219 UN	$1,226,400.00
D2020 240	Electric Water Heaters	$37,075.00 EA	9 UN	$333,675.00
Total Cost				$1,604,083.75
Cost per Square Foot				$7.46
HVAC				
Number	System	Cost Per Unit	# of Units	Cost
D3020 106	Boilers, Steam	$44,725.00 EA	9 UN	$402,525.00
D3050 155	Rooftop Multizone Unit Systems	$11.10 SF	135400 SF	$1,502,940.00
Total Cost				$1,787,211.84
Cost per Square Foot				$8.32
Fire Protection				
Number	System	Cost Per Unit	# of Units	Cost
D4010 410	Wet Pipe Sprinkler System	$3.38 SF	28500 SF	$96,330.00
D4010 410	Wet Pipe Sprinkler System Upper Floors	$3.29 SF	106900 SF	$351,701.00
Total Cost				$420,226.20
Cost per Square Foot				$1.96
Electrical				
Number	System	Cost Per Unit	# of Units	Cost
D5010 120	Electrical Service	$15,300.00 EA	1 UN	$15,300.00
D5010 230	Feeder Installation	$18.15 LF	2340 LF	$42,471.00
D5010 240	Switchgear	$24,600.00 EA	1 UN	$24,600.00
D5020 120	Wall Outlets	$0.56 SF	135400 SF	$75,824.00
D5020 130	Wall Switch	$0.44 SF	135400 SF	$59,576.00
D5020 210	Fluorescent Fixtures	$7.76 SF	135400 SF	$1,050,704.00
D5090 210	Generator	$859.00 kW	20 kW	$17,180.00
Total Cost				$1,205,867.25
Cost per Square Foot				$5.61

COMPARISON

The square foot estimate was extremely close in price. *Costworks* estimated a total cost for both buildings of $40.77 million. *Costworks* assumed using a traditional project delivery method and a field built steel structure. That is only $1.77 million more than the actual total cost. That is a 4.6% difference. The one thing that Costworks could not estimate is the speed at which they are building these dormitories. Modular building will allow the Construction Manager to take weeks off the schedule.

The assemblies estimate was very far from the actual cost. All of the square foot costs added together to equal $37.48/SF. This cost does not have major mechanical and electrical equipment. There was no *RS Means* data for things such as transformers and ground water heat pump systems. This square foot cost would skyrocket if those costs were added. Another difference in the assemblies estimate and the actual cost is the modular contractor's scope of MEP work. The modular contractor is building all of the plumbing, electrical and mechanical systems in the rooms. The electrical and mechanical contractors just tie in the modular units to the mains in the hallway. Most of the MEP finishes are not completed by the MEP contractors.

SITE PLANS

EXISTING CONDITIONS

*See Appendix C for Existing Conditions Plan

The location of the site is close to two streets. Morris Dr. splits the two sites and will create logistical concerns. There is one building that needs to keep functional positioned right next to the site of Building D. This building requires an emergency access out of the south side so a new path was created once the site fence was constructed. There were four building demolished in order to build the dormitories. Two existing dormitories were demolished and two smaller campus office buildings. These two dorms were demolished after two new dormitories were built to west of Building D. These new dorms west of the site were completed last winter. They have a similar layout as Building C, but were stick built instead of mainly modular.

Most of the utilities run along Clinton St. There is an existing steam line that falls under the south part of Building C. This line will be relocated around Building C. There are many buildings around the site. Most of the buildings are university owned but to the south-west, there are residential houses. The Construction Manager must cater to the residents of these houses and resolve any university students concerns.

SUPERSTRUCTURE

*See Appendix D for Superstructure Site Layout

The crawler crane is so large on this project that crane pads will be created. An access road will be created for the modular units. Also, a delivery truck will need to have a big durable path to make it to the crane. A smaller crane will be used for the steel erection. There is space available for the steel contractor to layout their steel pieces before erection. The Construction Manager's trailer is placed next to Building D's site. Space for storage units will be available behind the trailer or at the parking lot 300 yards east of the site on Morris Dr. A material hoist is positioned at the core area of each building. That is where the majority of the material is put in place on site.

ENCLOSURE

*See Appendix E for Building Enclosure Site Layout

A large scaffolding structure will be used to construct the masonry façade. The façade construction will be phased, so the scaffolding structure will be taken down and reused. There will be an access path left open for distribution masonry material. There will be two regular dumpsters and 4 recycle dumpsters on both sites. They are centrally located, but still close to the entrances for removal.

LOCAL CONDITIONS

Modular building is a relatively new concept. There are very few other modular business buildings or schools in close proximity to Mansfield. This could create complications with the subcontractors. Using a system that no subcontractor has used before could create unforeseen difficulties. An example of a modular school built within 3 hours of Mansfield is the Millmont Elementary in Reading, PA. It was the managed by the same CM that is on this project. It was a new 98,000 SF public elementary school finished within a year. Another example, further away, is Indiana Tech's Evans-Kimmell Hall. It is a 58 student dormitory that was completely constructed over the college's summer break. Mansfield decided to use this technique to expedite the construction process.

Parking for the workers onsite will be provided at the parking lot by the baseball field. The baseball field is just south of the site as seen in Figure 11. If more parking is needed, there is a student parking lot to the east of the site. The parking lot is completely stoned and would be acceptable for construction crew parking.

The site of the two dormitories is on the south west corner of campus. There are two main roads close to the site. Clinton Street is runs north-south to the west of the site. Morris Drive runs east-west with Building C to the north and Building D to the south. Construction equipment will need to cross Morris Drive. To the east of Building D's site, is the two new dormitories not shown on the figure to the right. These buildings house students during the school year, so special considerations will need to be made for them.

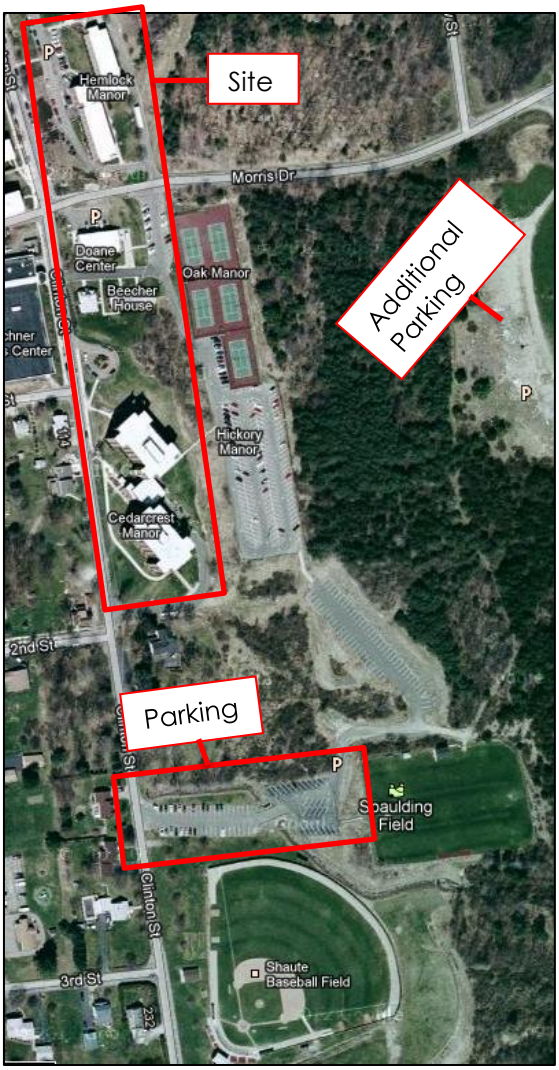


Figure 11 Site Photograph
Courtesy of Google

The tipping fee in Tioga County, Pennsylvania is $32.75 per ton with a minimum charge of $10. The site will have on site recycling. There will be separate dumpsters for wood, metal, drywall and clean fill. These dumpsters will be emptied at a recycling facility instead of the landfill.

The winters in northern Pennsylvania can be very cold. Because most of the heavy construction is being completed during the winter, weather will impact on the schedule of construction. Warming precautions will need to be used for mortar and concrete pours.

CLIENT INFORMATION

Mansfield University is a medium-sized college located in the small town of Mansfield, PA. They are one of 14 universities that are part of the Pennsylvania State System of Higher Learning. Mansfield University has a rural setting with a residential type campus. It started out as a small teaching college, but now offers over 80 different degrees and has an undergraduate population of about 3,000. MU prides itself on developing tomorrow's leaders (collegeboard).

DEMAND FOR NEW STUDENT HOUSING

According to their Mansfield's department of geography and geology website, Mansfield University has seen growth in recent years due to the increase in natural gas exploration in northern Pennsylvania. Mansfield University has added programs that supply these new businesses with educated employees. They now have a natural gas production and services bachelor's degree (mansfield). The increase in students has caused a strain on on-campus housing. This pushed the board of trustees to start analyzing possible solutions. According to Cheryl Clarke of the Sun Gazette at the current project site, there were dormitory buildings that were unsuitable for student use because of their decrepit status. They sat there unused for years. The board of trustees decided to demolish the existing buildings and create two new dormitories (sungazette).

OWNER EXPECTATIONS

Building C's substantial completion date was set at August 5, 2013. The university selected this date, because they wanted the building to be complete by the time students would be moving in for the fall semester. Building D's substantial completion date was set at October 17, 2013. Building D has an extra phase that will require extra time. The start of construction was September, 2012. This means that $39 million of work will be constructed in less than 14 months. The schedule is tight but the owner still expects the best quality. For example, building the modular units off site will allow for better quality and faster production. There is no mobilization and start up required at the beginning. It will all happen in a factory on a conveyor type system. A mock-up of the modular units is expected to be completed by early November.

The owner expects construction to cause as little disturbance to all university activities as possible. While students are on campus, construction cannot start before 7:00am. During university breaks, there are no restrictions on construction work hours. Driveways, footpaths and entrances adjacent to the site cannot be blocked at any time. Deliveries are expected to be scheduled so they do not interfere with regular university traffic. The contractor must give a two week notice before interrupting any services to existing buildings. The entire site is to be fenced in with a locked gate when no one is working.

SAFETY PLAN

The owner has not set any specific safety guidelines for the jobsite. Wohlsen Construction will be implementing their company-wide safety procedures. Before anyone works onsite, they must go through the safety orientation. During the safety orientation, the workers will receive all

of the necessary safety guidelines and also be checked to see that they are wearing the correct personal protective equipment. Also, there will be a safety coordinator onsite that will walk the site regularly to enforce the safety guidelines.

PROJECT DELIVERY SYSTEM

PROJECT ORGANIZATIONAL CHART

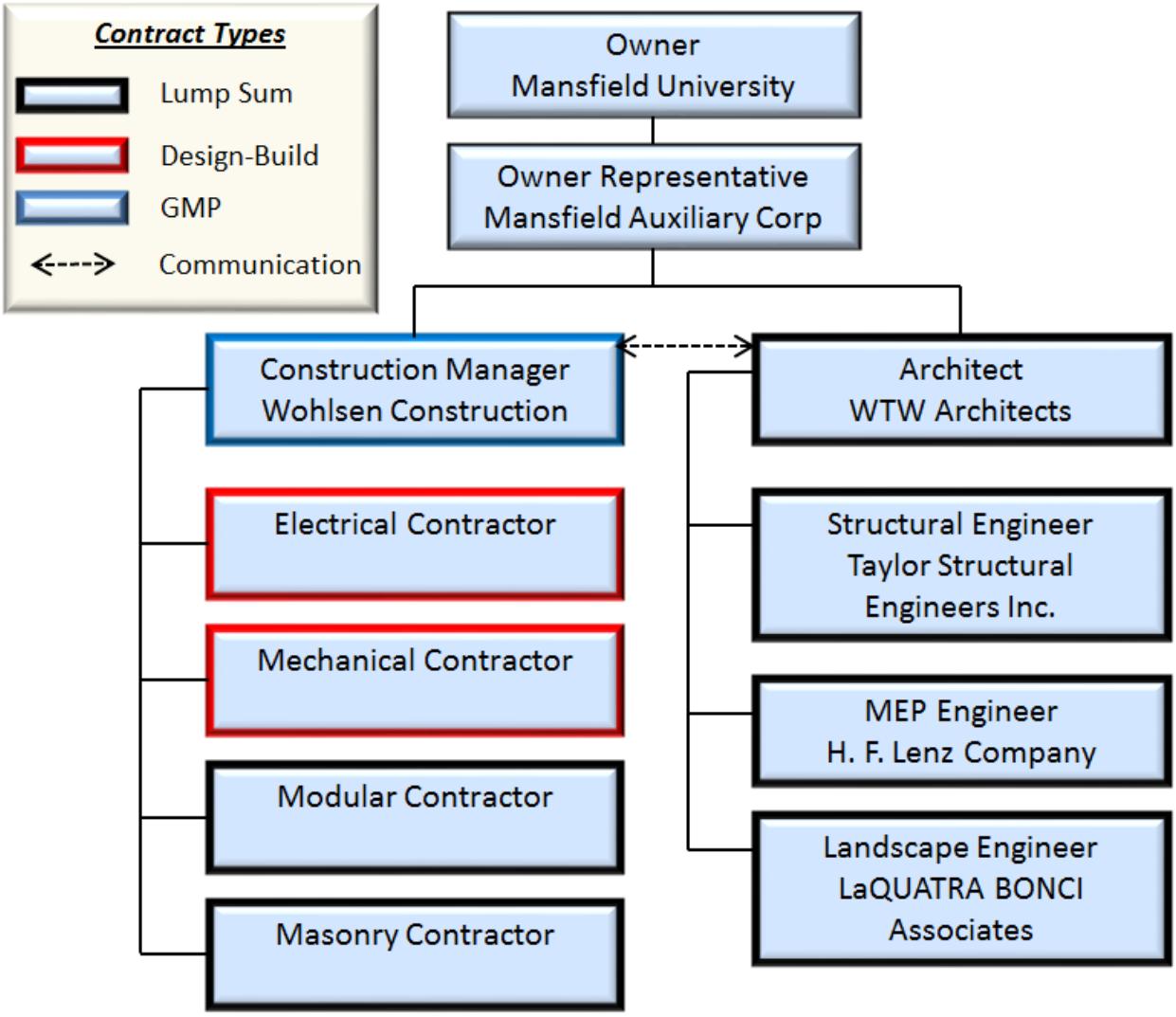


Figure 12 Project Organizational Chart

CONTRACT NARRATIVE

The Mansfield University Dormitory Buildings C & D will be constructed under a single contractor: Wohlsen Construction. The Wohlsen Construction was carefully chosen after the RFP process. Wohlsen's price initially was too high for the owner to get financing and the owner requested for the contractor to perform value engineering. Eventually the two sides came together resulting in a GPM contract at a price just over $39 Million. There is a savings sharing agreement that the CM will receive 20% of total savings. Liquidated damages are $65 per bed per a day. The substantial completion dates were set for both buildings. Building C is due 8/5/13 and Building D is due 10/17/13.

Wohlsen Construction is working as a CM at risk. All of the subcontractors have lump sum contracts with the Construction Manager except for the electrical and mechanical/plumbing contractors. They have design build contracts. Design build contracts are appropriate for this project because modular construction is being employed. The MEP contractors will need to supply the mains that are located in the corridors and connect them to each unit. There is a lot of coordination needed between the MEP contractors. Design build contracts will require the contractors redesign as needed. They will not be able to submit a change order to the owner for any redesigning.

STAFFING PLAN

ORGANIZATIONAL CHART

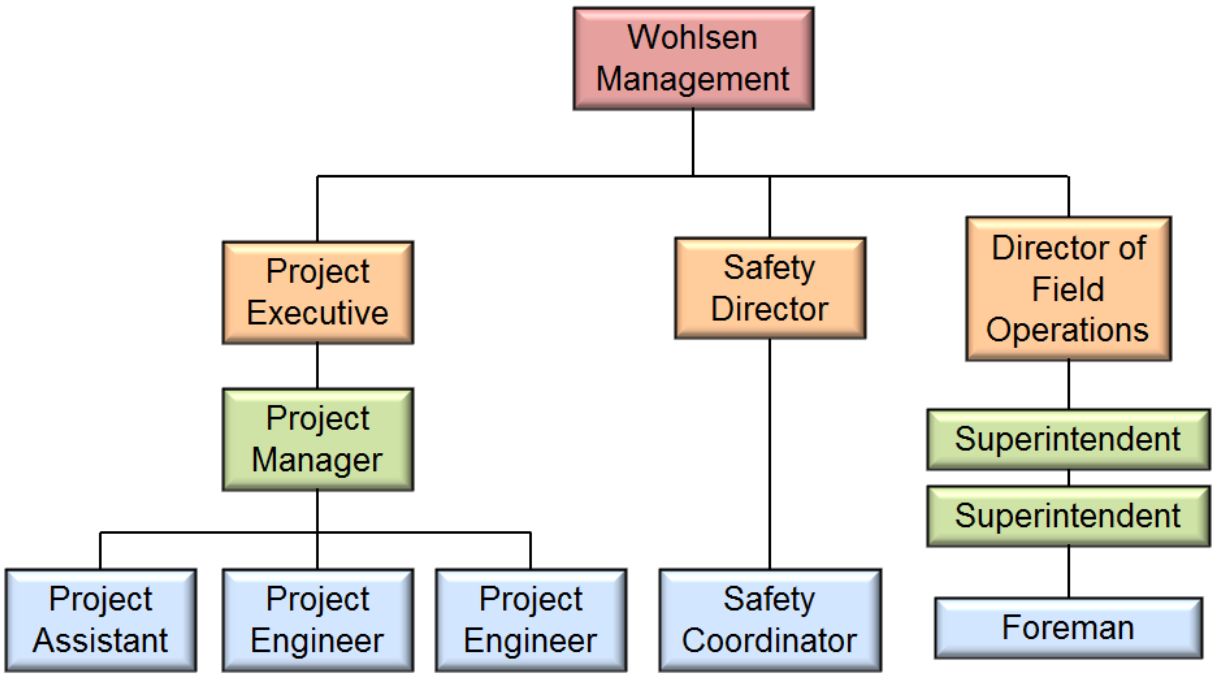


Figure 13 CM Organizational Chart

PROJECT MANAGEMENT NARRATIVE

On the Mansfield job, Wohlsen has project executive that oversees the project manager. The project executive has many projects that he is responsible for at one time, so he only is referred to on big project decisions. All of the executive level will relay the status of projects to the upper management. There is a project manager who is the main contact for the owner's representative. The project manager's key role is to safely keep the project under budget and on schedule. The project manager has a team underneath him consisting of two project engineers on site and a project assistant in the office to assist him all operations involved from preconstruction to closeout.

Also on site, there are two superintendents to manage daily operations. Their main focus is on quality control, delivery dates, and adapting to any field conditions so that the project finishes on time. The superintendents report to the field operations manager, who is similar to the project executive. The director of field operations is in charge of all of the field supervisors in the company. They get reports of how the job is going, but don't get deep into the details. There is one running foreman on site for added supervision and for any manual labor needed to keep the project safe. A safety coordinator will be on site regularly to make sure everyone is abiding by Wohlsen's safety plan. The safety coordinator will give safety orientation for anyone planning on working on site. They will send safety reports to the safety director.

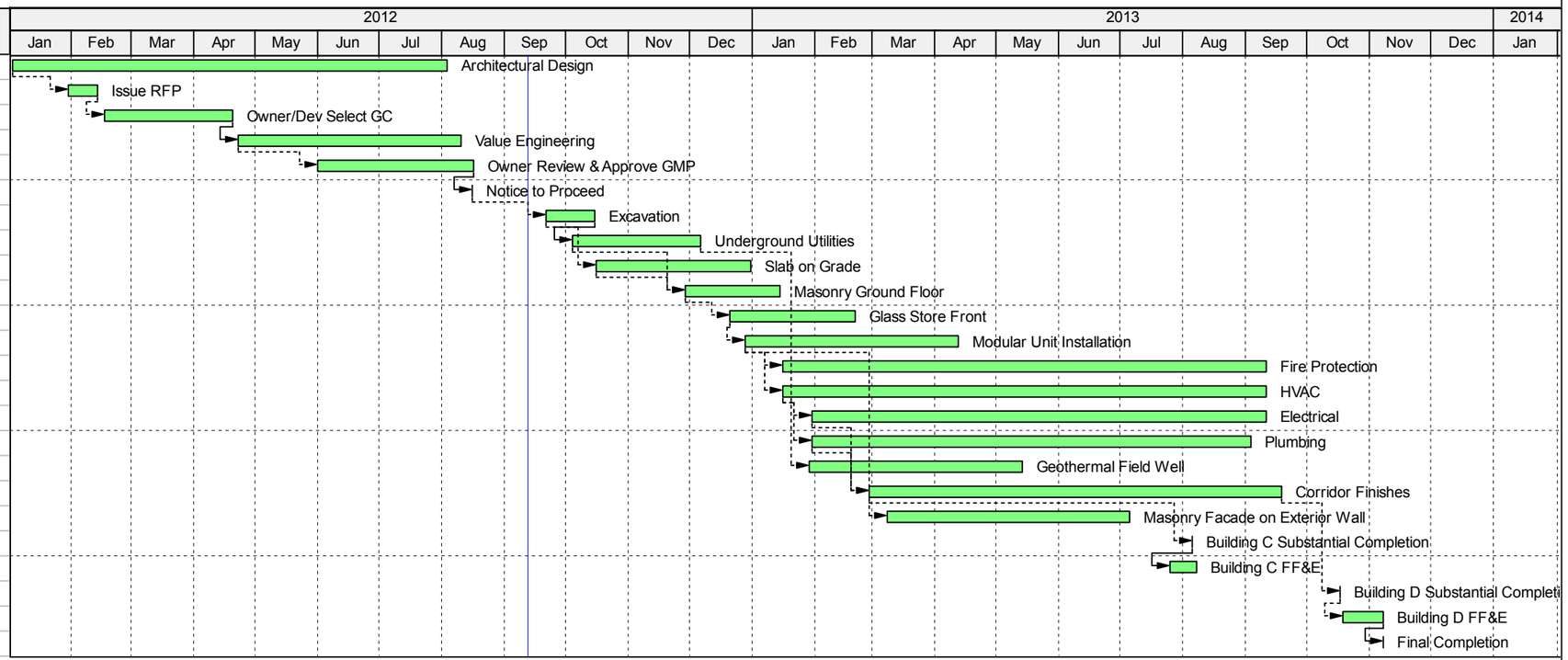
REFERENCES

- College Board, Online Website: https://bigfuture.collegeboard.org/college-university-search/mansfield-university-of-pennsylvania?searchType=bf_site&q=&bf_cat=bf_
- Mansfield's Department of Geography and Geology Website: http://geoggeol.mansfield.edu/what-can-i-study/natural-gas-production-services/
- Cheryl Clarke, Sun Gazzette's Online Website: http://www.sungazette.com/page/content.detail/id/572247/New-residence-hall-to-be-open-by-mid-January.html

APPENDIX A

PROJECT SCHEDULE

Activity ID	Activity Name	riginal ration	Start	Finish
01	Architectural Design	152	03-Jan-12	03-Aug-12
02	Issue RFP	11	30-Jan-12	13-Feb-12
03	Owner/Dev Select GC	46	17-Feb-12	20-Apr-12
04	Value Engineering	78	23-Apr-12	10-Aug-12
05	Owner Review & Approve GMP	54	01-Jun-12	16-Aug-12
06	Notice to Proceed	0	16-Aug-12	16-Aug-12
07	Excavation	17	21-Sep-12	15-Oct-12
08	Underground Utilities	45	04-Oct-12	06-Dec-12
09	Slab on Grade	53	16-Oct-12	31-Dec-12
10	Masonry Ground Floor	31	29-Nov-12	14-Jan-13
11	Glass Store Front	42	21-Dec-12	20-Feb-13
12	Modular Unit Installation	75	28-Dec-12	12-Apr-13
13	Fire Protection	167	16-Jan-13	10-Sep-13
14	HVAC	167	16-Jan-13	10-Sep-13
15	Electrical	157	30-Jan-13	10-Sep-13
16	Plumbing	152	30-Jan-13	03-Sep-13
17	Geothermal Field Well	75	29-Jan-13	13-May-13
18	Corridor Finishes	143	27-Feb-13	18-Sep-13
19	Masonry Facade on Exterior Wall	84	08-Mar-13	05-Jul-13
20	Building C Substantial Completion	0	05-Aug-13	05-Aug-13
21	Building C FF&E	10	25-Jul-13	07-Aug-13
22	Building D Substantial Completion	0	17-Oct-13	17-Oct-13
23	Building D FF&E	15	18-Oct-13	07-Nov-13
24	Final Completion	0	07-Nov-13	07-Nov-13



Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summary

TASK filter: All Activities

APPENDIX B

COST ESTIMATES

Square Foot Cost Estimate Report

Estimate Name: **Building D**

Building Type:	**College, Dormitory, 4-8 Story with Face Brick with Concrete Block Back-up / Steel Frame**
Location:	WELLSBORO, PA
Stories Count (L.F.):	**5.00**
Stories Height	**14.00**
Floor Area (S.F.):	**135,400.00**
LaborType	**Open Shop**
Basement Included:	Yes
Data Release:	**Year 2012 Quarter 3**
Cost Per Square Foot	**$186.92**
Total Building Cost	**$25,308,000**

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 SF	Cost
A Substructure		**2.7%**	**3.82**	**$517,500**
A1010	**Standard Foundations**		**1.44**	**$194,500**
	Strip footing, concrete, reinforced, load 14.8 KLF, soil bearing capacity 6 KSF, 12" deep x 32" wide			
	Spread footings, 3000 PSI concrete, load 400K, soil bearing capacity 6 KSF, 8' - 6" square x 27" deep			
A1030	**Slab on Grade**		**0.86**	**$117,000**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**0.61**	**$83,000**
	Excavate and fill, 10,000 SF, 8' deep, sand, gravel, or common earth, on site storage			
A2020	**Basement Walls**		**0.91**	**$123,000**
	Foundation wall, CIP, 12' wall height, pumped, .52 CY/LF, 24.29 PLF, 14" thick			
B Shell		**28.1%**	**39.31**	**$5,323,000**
B1010	**Floor Construction**		**25.18**	**$3,409,000**
	Cast-in-place concrete column, 16" square, tied, 400K load, 12' story height, 251 lbs/LF, 4000PSI			
	Steel column, W14, 300 KIPS, 10' unsupported height, 61 PLF			
	Steel column, W12, 400 KIPS, 10' unsupported height, 79 PLF			
	Steel column, W14, 500 KIPS, 10' unsupported height, 99 PLF			
	Steel column, W14, 800 KIPS, 10' unsupported height, 145 PLF			
	Steel column, W14, 900 KIPS, 10' unsupported height, 159 PLF			
	Steel column, W14, 1000 KIPS, 10' unsupported height, 176 PLF			
	Flat slab, concrete, with drop panels, 6" slab/2.5" panel, 12" column, 15'x15' bay, 75 PSF superimposed load, 153 P			
	Floor, composite metal deck, shear connectors, 5.5" slab, 35'x40' bay, 29.5" total depth, 75 PSF superimposed load,			
	Fireproofing, gypsum board, fire rated, 2 layer, 1" thick, 14" steel column, 3 hour rating, 22 PLF			
B1020	**Roof Construction**		**4.03**	**$545,500**
	Floor, composite slab on steel beam, 35'x40' bay, 4"slab, 29.5" total depth, 40 PSF superimposed load, 85 PSF total			
B2010	**Exterior Walls**		**6.97**	**$943,500**
	Brick wall, composite double wythe, standard face/CMU back-up, 8" thick, perlite core fill			
B2020	**Exterior Windows**		**2.06**	**$279,000**
	Windows, aluminum, sliding, standard glass, 5' x 3'			

		% of Total	Cost Per SF	Cost
B2030	**Exterior Doors**		**0.32**	**$43,500**
	Door, aluminum & glass, without transom, narrow stile, double door, hardware, 6'-0" x 7'-0" opening			
	Door, aluminum & glass, without transom, non-standard, hardware, 3'-0" x 7'-0" opening			
B3010	**Roof Coverings**		**0.76**	**$102,500**
	Roofing, single ply membrane, EPDM, 60 mils, loosely laid, stone ballast			
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			
	Roof edges, aluminum, duranodic, .050" thick, 6" face			
	Flashing, aluminum, no backing sides, .019"			
	Gravel stop, aluminum, extruded, 4", mill finish, .050" thick			
C Interiors		**24.2%**	**33.76**	**$4,571,000**
C1010	**Partitions**		**9.09**	**$1,230,500**
	Concrete block (CMU) partition, light weight, hollow, 8" thick, no finish			
C1020	**Interior Doors**		**5.81**	**$787,000**
	Door, single leaf, wood frame, 3'-0" x 7'-0" x 1-3/8", birch, solid core			
C1030	**Fittings**		**1.42**	**$192,000**
	Bathroom accessories, stainless steel, mirror, framed, with shelf, 72" x 24"			
C2010	**Stair Construction**		**3.22**	**$436,500**
	Stairs, steel, cement filled metal pan & picket rail, 20 risers, with landing			
C3010	**Wall Finishes**		**4.15**	**$562,000**
	2 coats paint on masonry with block filler			
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	**Floor Finishes**		**9.25**	**$1,253,000**
	Carpet, tufted, nylon, roll goods, 12' wide, 36 oz			
	Carpet, padding, add to above, minimum			
	Vinyl, composition tile, minimum			
	Vinyl, composition tile, maximum			
	Tile, ceramic natural clay			
C3030	**Ceiling Finishes**		**0.81**	**$110,000**
	Paint on plaster or drywall, roller work, primer + 1 coat			
	Acoustic ceilings, 3/4" fiberglass board, 24" x 48" tile, tee grid, suspended support			
D Services		**42.7%**	**59.69**	**$8,081,500**
D1010	**Elevators and Lifts**		**10.94**	**$1,481,000**
	Traction, geared passenger, 4000 lb, 6 floors, 12' story height, 2 car group, 200 FPM			
D2010	**Plumbing Fixtures**		**18.37**	**$2,487,500**
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Lavatory w/trim, wall hung, vitreous china, 18" x 15"			
	Kitchen sink w/trim, countertop, stainless steel, 19" x 18" single bowl			
	Laundry sink w/trim, stainless steel, countertop, 22" x 17" single compartment			
	Service sink w/trim, vitreous china, wall hung 22" x 20"			
	Bathtub, recessed, PE on CI, mat bottom, 5' long			
	Shower, stall, fiberglass 1 piece, three walls, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		**1.57**	**$213,000**
	Electric water heater, commercial, 100< F rise, 300 gal, 180 KW 738 GPH			
D2040	**Rain Water Drainage**		**0.17**	**$23,500**
	Roof drain, DWV PVC, 4" diam, diam, 10' high			
	Roof drain, DWV PVC, 4" diam, for each additional foot add			
D3010	**Energy Supply**		**3.80**	**$514,500**
	Commercial building heating system, fin tube radiation, forced hot water, 100,000 SF, 1mil CF, total 3 floors			

		% of Total	Cost Per SF	Cost
D3030	**Cooling Generating Systems**		**8.13**	**$1,101,000**
	Packaged chiller, air cooled, with fan coil unit, medical centers, 40,000 SF, 93.33 ton			
D4010	**Sprinklers**		**2.54**	**$344,000**
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 10,000 SF			
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 10,000 SF			
	Standard High Rise Accessory Package 8 story			
D4020	**Standpipes**		**0.54**	**$73,500**
	Dry standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor			
	Dry standpipe risers, class III, steel, black, sch 40, 6" diam pipe, additional floors			
	Fire pump, electric, with controller, 4" pump, 30 HP, 500 GPM			
D5010	**Electrical Service/Distribution**		**0.66**	**$89,000**
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 1200 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 1200 A			
	Switchgear installation, incl switchboard, panels & circuit breaker, 1200 A			
D5020	**Lighting and Branch Wiring**		**7.71**	**$1,044,000**
	Receptacles incl plate, box, conduit, wire, 20 per 1000 SF,2.4 W per SF, with transformer			
	Wall switches, 5.0 per 1000 SF			
	Miscellaneous power, to .5 watts			
	Central air conditioning power, 4 watts			
	Motor installation, three phase, 460 V, 15 HP motor size			
	Motor feeder systems, three phase, feed to 200 V 5 HP, 230 V 7.5 HP, 460 V 15 HP, 575 V 20 HP			
	Fluorescent fixtures recess mounted in ceiling, 0.8 watt per SF, 20 FC, 5 fixtures @32 watt per 1000 SF			
D5030	**Communications and Security**		**5.04**	**$682,500**
	Telephone wiring for offices & laboratories, 8 jacks/MSF			
	Communication and alarm systems, fire detection, addressable, 25 detectors, includes outlets, boxes, conduit and w			
	Fire alarm command center, addressable with voice, excl. wire & conduit			
	Communication and alarm systems, includes outlets, boxes, conduit and wire, intercom systems, 100 stations			
	Communication and alarm systems, includes outlets, boxes, conduit and wire, master TV antenna systems, 30 outle			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		**0.21**	**$28,000**
	Generator sets, w/battery, charger, muffler and transfer switch, gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 3			
	Generator sets, w/battery, charger, muffler and transfer switch, diesel engine with fuel tank, 30 kW			
E Equipment & Furnishings		**2.3%**	**3.17**	**$429,000**
E1090	**Other Equipment**		**0.00**	**$0**
E2020	**Moveable Furnishings**		**3.17**	**$429,000**
	Furnishings, dormitory furniture, dressing unit, built-in, deluxe			
F Special Construction		**0.0%**	**0.00**	**$0**
G Building Sitework		**0.0%**	**0.00**	**$0**
Sub Total		**100%**	**$139.75**	**$18,922,000**
Contractor's Overhead & Profit		**25.0%**	**$34.94**	**$4,730,500**
Architectural Fees		**7.0%**	**$12.23**	**$1,655,500**
User Fees		**0.0%**	**$0.00**	**$0**
Total Building Cost			**$186.92**	**$25,308,000**

Square Foot Cost Estimate Report

Estimate Name: **Building C**

Building Type:	**College, Dormitory, 4-8 Story with Face Brick with Concrete Block Back-up / Steel Frame**
Location:	WELLSBORO, PA
Stories Count (L.F.):	**5.00**
Stories Height	**14.00**
Floor Area (S.F.):	**79,500.00**
LaborType	**Open Shop**
Basement Included:	Yes
Data Release:	**Year 2012 Quarter 3**
Cost Per Square Foot	**$194.95**
Total Building Cost	**$15,499,000**

Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly

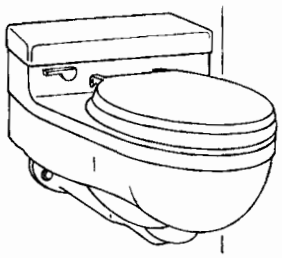
		% of Total	Cost Per SF	Cost
A Substructure		**3.2%**	**4.64**	**$368,500**
A1010	**Standard Foundations**		**1.85**	**$147,000**
	Strip footing, concrete, reinforced, load 14.8 KLF, soil bearing capacity 6 KSF, 12" deep x 32" wide			
	Spread footings, 3000 PSI concrete, load 400K, soil bearing capacity 6 KSF, 8' - 6" square x 27" deep			
A1030	**Slab on Grade**		**0.86**	**$68,500**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**0.61**	**$48,500**
	Excavate and fill, 10,000 SF, 8' deep, sand, gravel, or common earth, on site storage			
A2020	**Basement Walls**		**1.31**	**$104,500**
	Foundation wall, CIP, 12' wall height, pumped, .52 CY/LF, 24.29 PLF, 14" thick			
B Shell		**29.9%**	**43.64**	**$3,469,000**
B1010	**Floor Construction**		**25.42**	**$2,021,000**
	Cast-in-place concrete column, 16" square, tied, 400K load, 12' story height, 251 lbs/LF, 4000PSI			
	Steel column, W14, 300 KIPS, 10' unsupported height, 61 PLF			
	Steel column, W12, 400 KIPS, 10' unsupported height, 79 PLF			
	Steel column, W14, 500 KIPS, 10' unsupported height, 99 PLF			
	Steel column, W14, 800 KIPS, 10' unsupported height, 145 PLF			
	Steel column, W14, 900 KIPS, 10' unsupported height, 159 PLF			
	Steel column, W14, 1000 KIPS, 10' unsupported height, 176 PLF			
	Flat slab, concrete, with drop panels, 6" slab/2.5" panel, 12" column, 15'x15' bay, 75 PSF superimposed load, 153 P			
	Floor, composite metal deck, shear connectors, 5.5" slab, 35'x40' bay, 29.5" total depth, 75 PSF superimposed load,			
	Fireproofing, gypsum board, fire rated, 2 layer, 1" thick, 14" steel column, 3 hour rating, 22 PLF			
B1020	**Roof Construction**		**4.03**	**$320,500**
	Floor, composite slab on steel beam, 35'x40' bay, 4"slab, 29.5" total depth, 40 PSF superimposed load, 85 PSF total			
B2010	**Exterior Walls**		**10.06**	**$799,500**
	Brick wall, composite double wythe, standard face/CMU back-up, 8" thick, perlite core fill			
B2020	**Exterior Windows**		**2.97**	**$236,500**
	Windows, aluminum, sliding, standard glass, 5' x 3'			

		% of Total	Cost Per SF	Cost
B2030	**Exterior Doors**		**0.32**	**$25,500**
	Door, aluminum & glass, without transom, narrow stile, double door, hardware, 6'-0" x 7'-0" opening			
	Door, aluminum & glass, without transom, non-standard, hardware, 3'-0" x 7'-0" opening			
B3010	**Roof Coverings**		**0.83**	**$66,000**
	Roofing, single ply membrane, EPDM, 60 mils, loosely laid, stone ballast			
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			
	Roof edges, aluminum, duranodic, .050" thick, 6" face			
	Flashing, aluminum, no backing sides, .019"			
	Gravel stop, aluminum, extruded, 4", mill finish, .050" thick			
C Interiors		**23.3%**	**34.02**	**$2,704,500**
C1010	**Partitions**		**9.09**	**$722,500**
	Concrete block (CMU) partition, light weight, hollow, 8" thick, no finish			
C1020	**Interior Doors**		**5.81**	**$462,000**
	Door, single leaf, wood frame, 3'-0" x 7'-0" x 1-3/8", birch, solid core			
C1030	**Fittings**		**1.42**	**$113,000**
	Bathroom accessories, stainless steel, mirror, framed, with shelf, 72" x 24"			
C2010	**Stair Construction**		**3.22**	**$256,000**
	Stairs, steel, cement filled metal pan & picket rail, 20 risers, with landing			
C3010	**Wall Finishes**		**4.42**	**$351,000**
	2 coats paint on masonry with block filler			
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	**Floor Finishes**		**9.25**	**$735,500**
	Carpet, tufted, nylon, roll goods, 12' wide, 36 oz			
	Carpet, padding, add to above, minimum			
	Vinyl, composition tile, minimum			
	Vinyl, composition tile, maximum			
	Tile, ceramic natural clay			
C3030	**Ceiling Finishes**		**0.81**	**$64,500**
	Paint on plaster or drywall, roller work, primer + 1 coat			
	Acoustic ceilings, 3/4" fiberglass board, 24" x 48" tile, tee grid, suspended support			
D Services		**41.4%**	**60.30**	**$4,794,000**
D1010	**Elevators and Lifts**		**10.94**	**$869,500**
	Traction, geared passenger, 4000 lb, 6 floors, 12' story height, 2 car group, 200 FPM			
D2010	**Plumbing Fixtures**		**18.37**	**$1,460,500**
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Lavatory w/trim, wall hung, vitreous china, 18" x 15"			
	Kitchen sink w/trim, countertop, stainless steel, 19" x 18" single bowl			
	Laundry sink w/trim, stainless steel, countertop, 22" x 17" single compartment			
	Service sink w/trim, vitreous china, wall hung 22" x 20"			
	Bathtub, recessed, PE on CI, mat bottom, 5' long			
	Shower, stall, fiberglass 1 piece, three walls, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		**1.57**	**$125,000**
	Electric water heater, commercial, 100< F rise, 300 gal, 180 KW 738 GPH			
D2040	**Rain Water Drainage**		**0.30**	**$23,500**
	Roof drain, DWV PVC, 4" diam, diam, 10' high			
	Roof drain, DWV PVC, 4" diam, for each additional foot add			
D3010	**Energy Supply**		**3.80**	**$302,000**
	Commercial building heating system, fin tube radiation, forced hot water, 100,000 SF, 1mil CF, total 3 floors			

		% of Total	Cost Per SF	Cost
D3030	**Cooling Generating Systems**		**8.13**	**$646,500**
	Packaged chiller, air cooled, with fan coil unit, medical centers, 40,000 SF, 93.33 ton			
D4010	**Sprinklers**		**2.54**	**$202,000**
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 10,000 SF			
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 10,000 SF			
	Standard High Rise Accessory Package 8 story			
D4020	**Standpipes**		**0.55**	**$43,500**
	Dry standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor			
	Dry standpipe risers, class III, steel, black, sch 40, 6" diam pipe, additional floors			
	Fire pump, electric, with controller, 4" pump, 30 HP, 500 GPM			
D5010	**Electrical Service/Distribution**		**1.12**	**$89,000**
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 1200 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 1200 A			
	Switchgear installation, incl switchboard, panels & circuit breaker, 1200 A			
D5020	**Lighting and Branch Wiring**		**7.74**	**$615,500**
	Receptacles incl plate, box, conduit, wire, 20 per 1000 SF,2.4 W per SF, with transformer			
	Wall switches, 5.0 per 1000 SF			
	Miscellaneous power, to .5 watts			
	Central air conditioning power, 4 watts			
	Motor installation, three phase, 460 V, 15 HP motor size			
	Motor feeder systems, three phase, feed to 200 V 5 HP, 230 V 7.5 HP, 460 V 15 HP, 575 V 20 HP			
	Fluorescent fixtures recess mounted in ceiling, 0.8 watt per SF, 20 FC, 5 fixtures @32 watt per 1000 SF			
D5030	**Communications and Security**		**5.04**	**$400,500**
	Telephone wiring for offices & laboratories, 8 jacks/MSF			
	Communication and alarm systems, fire detection, addressable, 25 detectors, includes outlets, boxes, conduit and w			
	Fire alarm command center, addressable with voice, excl. wire & conduit			
	Communication and alarm systems, includes outlets, boxes, conduit and wire, intercom systems, 100 stations			
	Communication and alarm systems, includes outlets, boxes, conduit and wire, master TV antenna systems, 30 outle			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		**0.21**	**$16,500**
	Generator sets, w/battery, charger, muffler and transfer switch, gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 3			
	Generator sets, w/battery, charger, muffler and transfer switch, diesel engine with fuel tank, 30 kW			
E Equipment & Furnishings		**2.2%**	**3.17**	**$252,000**
E1090	**Other Equipment**		**0.00**	**$0**
E2020	**Moveable Furnishings**		**3.17**	**$252,000**
	Furnishings, dormitory furniture, dressing unit, built-in, deluxe			
F Special Construction		**0.0%**	**0.00**	**$0**
G Building Sitework		**0.0%**	**0.00**	**$0**
Sub Total		**100%**	**$145.76**	**$11,588,000**
Contractor's Overhead & Profit		**25.0%**	**$36.44**	**$2,897,000**
Architectural Fees		**7.0%**	**$12.75**	**$1,014,000**
User Fees		**0.0%**	**$0.00**	**$0**
Total Building Cost			**$194.95**	**$15,499,000**

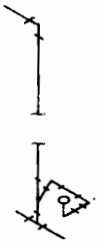
D2010 Plumbing Fixtures

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

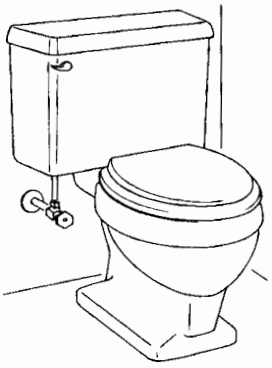


One Piece Wall Hung

Supply



Waste/Vent



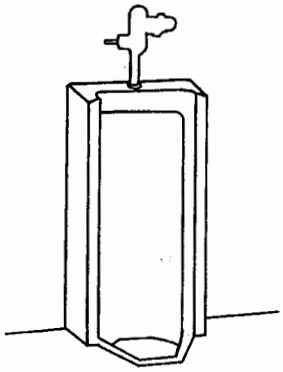
Floor Mount

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.	650	217	867
Pipe Steel galvanized, schedule 40, threaded, 2" diam.	4.000	L.F.	68.60	72	140.60
Pipe, CI soil, no hub, cplg 10' OC, hanger 5' OC, 4" diam.	2.000	L.F.	34.70	39.70	74.40
Pipe, coupling, standard coupling, CI soil, no hub, 4" diam.	2.000	Ea.	40	70	110
Copper tubing type L solder joint, hangar 10' O.C., 1/2" diam.	6.000	L.F.	26.22	47.40	73.62
Wrought copper 90° elbow for solder joints 1/2" diam.	2.000	Ea.	4.46	64	68.46
Wrought copper Tee for solder joints 1/2" diam.	1.000	Ea.	3.82	49	52.82
Supports/carrier, water closet, siphon jet, horiz, single, 4" waste	1.000	Ea.	830	120	950
TOTAL			1,657.80	679.10	2,336.90

D2010 110	Water Closet Systems		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
0	Water closet, vitreous china, elongated				
40	Tank type, wall hung				
50	Close coupled two piece	RD2010 -400	1,650	680	2,330
20	Floor mount, one piece		1,450	720	2,170
50	One piece low profile		995	720	1,715
00	Two piece close coupled		635	720	1,355
40	Bowl only with flush valve				
80	Wall hung		1,650	770	2,420
20	Floor mount		785	735	1,520
60	Floor mount, ADA compliant with 18" high bowl		780	755	1,535

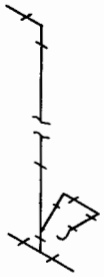
D2010 Plumbing Fixtures

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

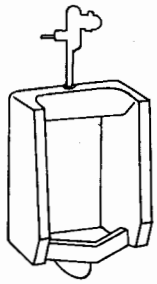


Stall Type

Supply



Waste/Vent



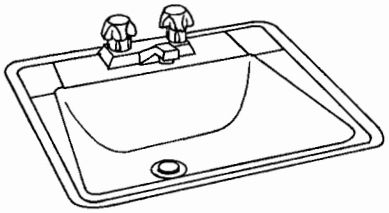
Wall Hung

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D2010 210 2000					
URINAL, VITREOUS CHINA, WALL HUNG					
Urinal, wall hung, vitreous china, incl. hanger	1.000	Ea.	315	385	700
Pipe, steel, galvanized, schedule 40, threaded, 1-1/2" diam.	5.000	L.F.	65	72	137
Copper tubing type DWV, solder joint, hangers 10' OC, 2" diam.	3.000	L.F.	60	43.65	103.65
Combination Y & 1/8 bend for CI soil pipe, no hub, 3" diam.	1.000	Ea.	16.50		16.50
Pipe, CI, no hub, cplg. 10' OC, hanger 5' OC, 3" diam.	4.000	L.F.	54.40	72	126.40
Pipe coupling standard, CI soil, no hub, 3" diam.	3.000	Ea.	34.20	61	95.20
Copper tubing type L, solder joint, hanger 10' OC 3/4" diam.	5.000	L.F.	32.75	42	74.75
Wrought copper 90° elbow for solder joints 3/4" diam.	1.000	Ea.	4.61	33.50	38.11
Wrought copper Tee for solder joints, 3/4" diam.	1.000	Ea.	8.80	53.50	62.30
TOTAL			591.26	762.65	1,353.91

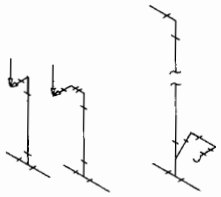
D2010 210	Urinal Systems	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
2000	Urinal, vitreous china, wall hung	590	765	1,355
2040	Stall type	1,225	910	2,135

D2010 Plumbing Fixtures

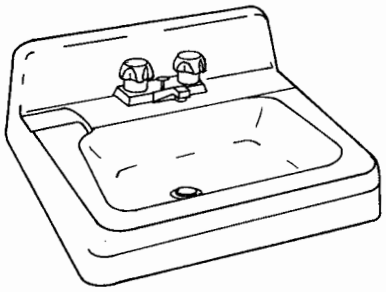
Systems are complete with trim and rough-in (supply, waste and vent) to connect to supply branches and waste mains.



Vanity Top



Supply Waste/Vent



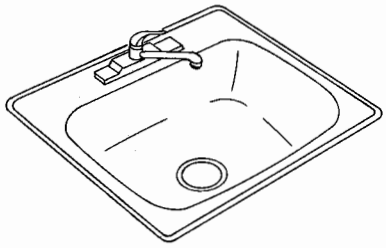
Wall Hung

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.	325	180	505
Pipe, steel, galvanized, schedule 40, threaded, 1-1/4" diam.	4.000	L.F.	44.60	51.80	96.40
Copper tubing type DWV, solder joint, hanger 10' OC 1-1/4" diam.	4.000	L.F.	48.60	42.60	91.20
Wrought copper DWV, Tee, sanitary, 1-1/4" diam.	1.000	Ea.	42.50	71	113.50
P trap w/cleanout, 20 ga., 1-1/4" diam.	1.000	Ea.	143	35.50	178.50
Copper tubing type L, solder joint, hanger 10' OC 1/2" diam.	10.000	L.F.	43.70	79	122.70
Wrought copper 90° elbow for solder joints 1/2" diam.	2.000	Ea.	4.46	64	68.46
Wrought copper Tee for solder joints, 1/2" diam.	2.000	Ea.	7.64	98	105.64
Stop, chrome, angle supply, 1/2" diam.	2.000	Ea.	18.50	58	76.50
TOTAL			678	679.90	1,357.90

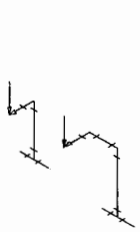
D2010 310	Lavatory Systems		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
1560	Lavatory w/trim, vanity top, PE on CI, 20" x 18", Vanity top by others.		680	680	1,360
1600	19" x 16" oval		530	680	1,210
1640	18" round	RD2010 -400	605	680	1,285
1680	Cultured marble, 19" x 17"		585	680	1,265
1720	25" x 19"		620	680	1,300
1760	Stainless, self-rimming, 25" x 22"		750	680	1,430
1800	17" x 22"		740	680	1,420
1840	Steel enameled, 20" x 17"		560	700	1,260
1880	19" round		530	700	1,230
1920	Vitreous china, 20" x 16"		640	715	1,355
1960	19" x 16"		640	715	1,355
2000	22" x 13"		645	715	1,360
2040	Wall hung, PE on CI, 18" x 15"		870	750	1,620
2080	19" x 17"		870	750	1,620
2120	20" x 18"		840	750	1,590
2160	Vitreous china, 18" x 15"		715	770	1,485
2200	19" x 17"		660	770	1,430
2240	24" x 20"		935	770	1,705
2300	20" x 27", handicap		970	830	1,800

D2010 Plumbing Fixtures

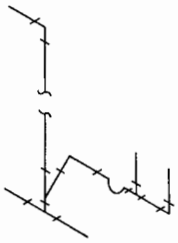
Systems are complete with trim and rough-in (supply, waste and vent) to connect to supply branches and waste mains.



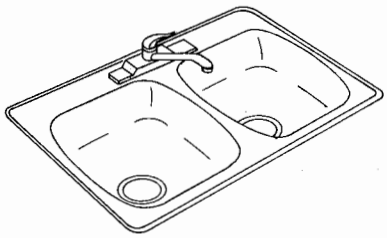
Countertop Single Bowl



Supply



Waste/Vent



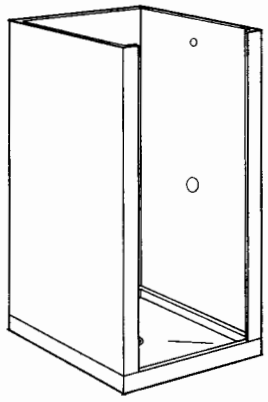
Countertop Double Bowl

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D2010 410 1720					
KITCHEN SINK W/TRIM, COUNTERTOP, P.E. ON C.I., 24" X 21", SINGLE BOWL					
Kitchen sink, counter top, PE on CI, 1 bowl, 24" x 21" OD	1.000	Ea.	283	206	489
Pipe, steel, galvanized, schedule 40, threaded, 1-1/4" diam.	4.000	L.F.	44.60	51.80	96.40
Copper tubing, type DWV, solder, hangers 10' OC 1-1/2" diam.	6.000	L.F.	90.30	71.10	161.40
Wrought copper, DWV, Tee, sanitary, 1-1/2" diam.	1.000	Ea.	53	80	133
P trap, standard, copper, 1-1/2" diam.	1.000	Ea.	139	37.50	176.50
Copper tubing, type L, solder joints, hangers 10' OC 1/2" diam.	10.000	L.F.	43.70	79	122.70
Wrought copper 90° elbow for solder joints 1/2" diam.	2.000	Ea.	4.46	64	68.46
Wrought copper Tee for solder joints, 1/2" diam.	2.000	Ea.	7.64	98	105.64
Stop, angle supply, chrome, 1/2" CTS	2.000	Ea.	18.50	58	76.50
TOTAL			684.20	745.40	1,429.60

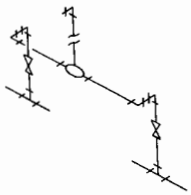
D2010 410	Kitchen Sink Systems	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
1720	Kitchen sink w/trim, countertop, PE on CI, 24"x21", single bowl	685	745	1,430
1760	30" x 21" single bowl	950	745	1,695
1800	32" x 21" double bowl	735	805	1,540
1840	42" x 21" double bowl	1,575	815	2,390
1880	Stainless steel, 19" x 18" single bowl	1,025	745	1,770
1920	25" x 22" single bowl	1,100	745	1,845
1960	33" x 22" double bowl	1,450	805	2,255
2000	43" x 22" double bowl	1,650	815	2,465
2040	44" x 22" triple bowl	1,900	850	2,750
2080	44" x 24" corner double bowl	1,325	815	2,140
2120	Steel, enameled, 24" x 21" single bowl	860	745	1,605
2160	32" x 21" double bowl	870	805	1,675
2240	Raised deck, PE on CI, 32" x 21", dual level, double bowl	810	1,025	1,835
2280	42" x 21" dual level, triple bowl	1,575	1,100	2,675

D2010 Plumbing Fixtures

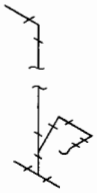
Systems are complete with trim and rough-in (supply, waste and vent) for connection to supply branches and waste mains.



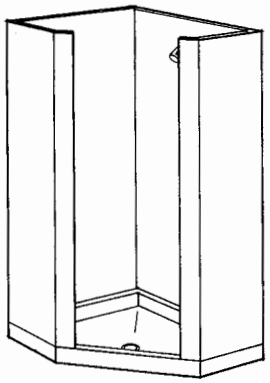
Three Wall



Supply



Waste/Vent



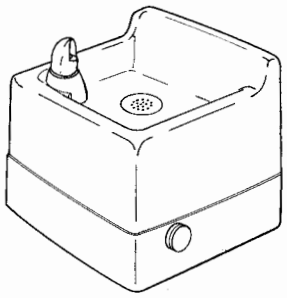
Corner Angle

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D2010 710 1560					
SHOWER, STALL, BAKED ENAMEL, MOLDED STONE RECEPTOR, 30″ SQUARE					
Shower stall, enameled steel, molded stone receptor, 30″ square	1.000	Ea.	815	222	1,037
Copper tubing type DWV, solder joints, hangers 10′ OC, 2″ diam.	6.000	L.F.	90.30	71.10	161.40
Wrought copper DWV, Tee, sanitary, 2″ diam.	1.000	Ea.	53	80	133
Trap, standard, copper, 2″ diam.	1.000	Ea.	139	37.50	176.50
Copper tubing type L, solder joint, hanger 10′ OC 1/2″ diam.	16.000	L.F.	69.92	126.40	196.32
Wrought copper 90° elbow for solder joints 1/2″ diam.	3.000	Ea.	6.69	96	102.69
Wrought copper Tee for solder joints, 1/2″ diam.	2.000	Ea.	7.64	98	105.64
Stop and waste, straightway, bronze, solder joint 1/2″ diam.	2.000	Ea.	14.20	53	67.20
TOTAL			1,195.75	784	1,979.75

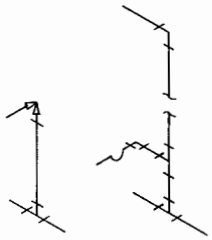
D2010 710	Shower Systems		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
1560	Shower, stall, baked enamel, molded stone receptor, 30″ square		1,200	785	1,985
1600	32″ square		1,200	795	1,995
1640	Terrazzo receptor, 32″ square	RD2010 -400	1,575	795	2,370
1680	36″ square		1,650	800	2,450
1720	36″ corner angle		1,775	800	2,575
1800	Fiberglass one piece, three walls, 32″ square		975	770	1,745
1840	36″ square		995	770	1,765
1880	Polypropylene, molded stone receptor, 30″ square		930	1,125	2,055
1920	32″ square		945	1,125	2,070
1960	Built-in head, arm, bypass, stops and handles		117	296	413
2050	Shower, stainless steel panels, handicap				
2100	w/fixed and handheld head, control valves, grab bar, and seat		5,310	3,520	8,850
2500	Shower, group with six heads, thermostatic mix valves & balancing valve		5,300	865	6,165
2520	Five heads		4,400	785	5,185

D2010 Plumbing Fixtures

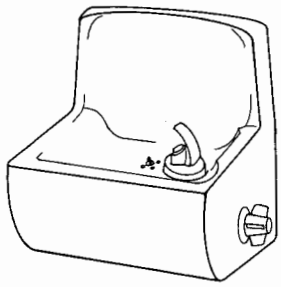
Systems are complete with trim and rough-in (supply, waste and vent) to connect to supply branches and waste mains.



Wall Mounted, No Back



Supply Waste/Vent

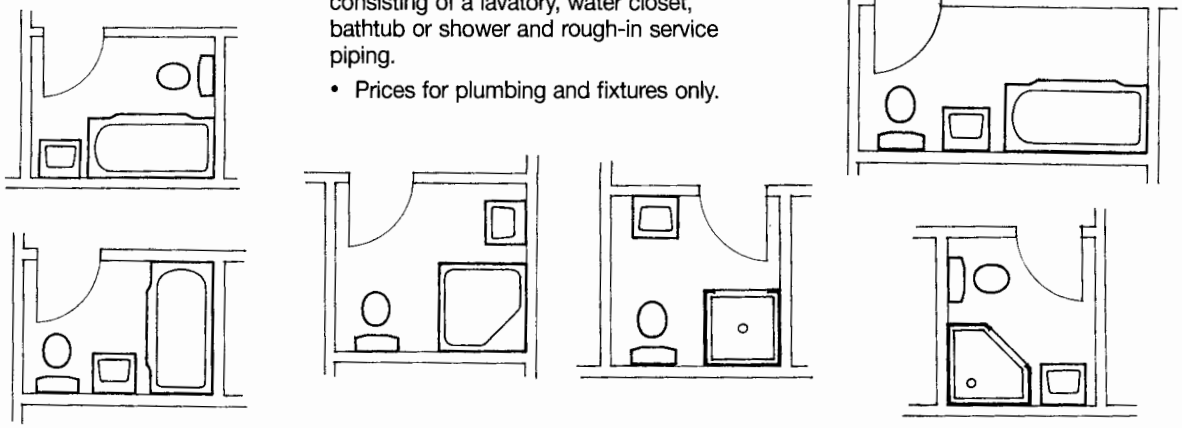


Wall Mounted, Low Back

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D2010 810 1800					
DRINKING FOUNTAIN, ONE BUBBLER, WALL MOUNTED					
NON RECESSED, BRONZE, NO BACK					
Drinking fountain, wall mount, bronze, 1 bubbler	1.000	Ea.	1,025	160	1,185
Copper tubing, type L, solder joint, hanger 10' OC 3/8" diam	5.000	L.F.	20.10	38	58.10
Stop, supply, straight, chrome, 3/8" diam	1.000	Ea.	6.75	26.50	33.25
Wrought copper 90° elbow for solder joints 3/8" diam	1.000	Ea.	6.70	29	35.70
Wrought copper Tee for solder joints, 3/8" diam	1.000	Ea.	11.30	45.50	56.80
Copper tubing, type DWV, solder joint, hanger 10' OC 1-1/4" diam.	4.000	L.F.	48.60	42.60	91.20
P trap, standard, copper drainage, 1-1/4" diam.	1.000	Ea.	143	35.50	178.50
Wrought copper, DWV, Tee, sanitary, 1-1/4" diam.	1.000	Ea.	42.50	71	113.50
TOTAL			1,303.95	448.10	1,752.05

D2010 810	Drinking Fountain Systems	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
1740	Drinking fountain, one bubbler, wall mounted			
1760	Non recessed			
1800	Bronze, no back RD2010 -400	1,300	450	1,750
1840	Cast iron, enameled, low back	1,150	450	1,600
1880	Fiberglass, 12" back	2,200	450	2,650
1920	Stainless steel, no back	1,275	450	1,725
1960	Semi-recessed, poly marble	1,300	450	1,750
2040	Stainless steel	1,375	450	1,825
2080	Vitreous china	1,200	450	1,650
2120	Full recessed, poly marble	1,950	450	2,400
2200	Stainless steel	1,750	450	2,200
2240	Floor mounted, pedestal type, aluminum	2,675	610	3,285
2320	Bronze	2,350	610	2,960
2360	Stainless steel	3,200	610	3,810

D2010 Plumbing Fixtures



Three Fixture Bathroom Systems consisting of a lavatory, water closet, bathtub or shower and rough-in service piping.

- Prices for plumbing and fixtures only.

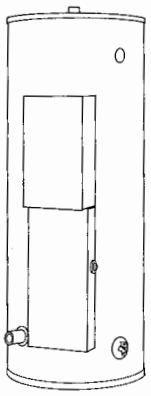
*Common wall is with an adjacent bathroom.

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D2010 924 1170					
BATHROOM, LAVATORY, WATER CLOSET & BATHTUB					
ONE WALL PLUMBING, STAND ALONE					
Wtr closet, 2 pc close cpld vit china flr mntd w/seat supply & stop	1.000	Ea.	265	217	482
Water closet, rough-in waste & vent	1.000	Set	335	380	715
Lavatory w/ftngs, wall hung, white, PE on CI, 20" x 18"	1.000	Ea.	380	144	524
Lavatory, rough-in waste & vent	1.000	Set	460	695	1,155
Bathtub, white PE on CI, w/ftgs, mat bottom, recessed, 5' long	1.000	Ea.	1,100	262	1,362
Baths, rough-in waste and vent	1.000	Set	387	499.50	886.50
TOTAL			2,927	2,197.50	5,124.50

D2010 924	Three Fixture Bathroom, One Wall Plumbing	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
1150	Bathroom, three fixture, one wall plumbing			
1160	Lavatory, water closet & bathtub			
1170	Stand alone	2,925	2,200	5,125
1180	Share common plumbing wall *	2,525	1,575	4,100

D2010 926	Three Fixture Bathroom, Two Wall Plumbing	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
2130	Bathroom, three fixture, two wall plumbing			
2140	Lavatory, water closet & bathtub			
2160	Stand alone	2,950	2,225	5,175
2180	Long plumbing wall common *	2,650	1,775	4,425
3610	Lavatory, bathtub & water closet			
3620	Stand alone	3,250	2,525	5,775
3640	Long plumbing wall common *	3,000	2,300	5,300
4660	Water closet, corner bathtub & lavatory			
4680	Stand alone	4,300	2,250	6,550
4700	Long plumbing wall common *	3,875	1,700	5,575
6100	Water closet, stall shower & lavatory			
6120	Stand alone	3,075	2,525	5,600
6140	Long plumbing wall common *	2,875	2,325	5,200
7060	Lavatory, corner stall shower & water closet			
7080	Stand alone	3,375	2,225	5,600
7100	Short plumbing wall common *	2,725	1,500	4,225

D2020 Domestic Water Distribution

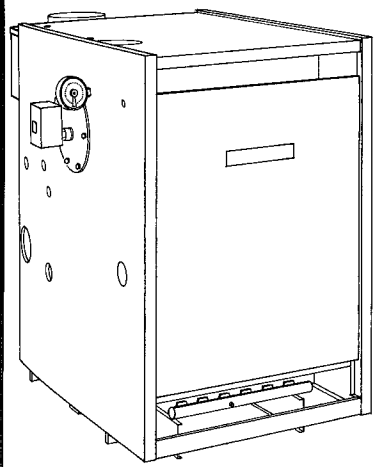


Systems below include piping and fittings within 10' of heater. Electric water heaters do not require venting.

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D2020 240 1820					
ELECTRIC WATER HEATER, COMMERCIAL, 100° F RISE					
50 GALLON TANK, 9 KW, 37 GPH					
Water heater, commercial, electric, 50 Gal, 9 KW, 37 GPH	1.000	Ea.	3,600	355	3,955
Copper tubing, type L, solder joint, hanger 10' OC, 3/4" diam	34.000	L.F.	222.70	285.60	508.30
Wrought copper 90° elbow for solder joints 3/4" diam	5.000	Ea.	23.05	167.50	190.55
Wrought copper Tee for solder joints, 3/4" diam	2.000	Ea.	17.60	107	124.60
Wrought copper union for soldered joints, 3/4" diam	2.000	Ea.	64	71	135
Valve, gate, bronze, 125 lb, NRS, soldered 3/4" diam	2.000	Ea.	89	64	153
Relief valve, bronze, press & temp, self-close, 3/4" IPS	1.000	Ea.	146	23	169
Wrought copper adapter, copper tubing to male, 3/4" IPS	1.000	Ea.	7.85	37.50	45.35
TOTAL			4,170.20	1,110.60	5,280.80

D2020 240	Electric Water Heaters - Commercial Systems	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
1800	Electric water heater, commercial, 100°F rise			
1820	50 gallon tank, 9 KW 37 GPH RD2020 -100	4,175	1,100	5,275
1860	80 gal, 12 KW 49 GPH	6,000	1,375	7,375
1900	36 KW 147 GPH	8,100	1,475	9,575
1940	120 gal, 36 KW 147 GPH	8,675	1,600	10,275
1980	150 gal, 120 KW 490 GPH	25,400	1,725	27,125
2020	200 gal, 120 KW 490 GPH	26,700	1,775	28,475
2060	250 gal, 150 KW 615 GPH	30,200	2,050	32,250
2100	300 gal, 180 KW 738 GPH	36,600	2,175	38,775
2140	350 gal, 30 KW 123 GPH	24,500	2,350	26,850
2180	180 KW 738 GPH	33,700	2,350	36,050
2220	500 gal, 30 KW 123 GPH	31,700	2,750	34,450
2260	240 KW 984 GPH	51,000	2,750	53,750
2300	700 gal, 30 KW 123 GPH	26,000	3,150	29,150
2340	300 KW 1230 GPH	37,900	3,150	41,050
2380	1000 gal, 60 KW 245 GPH	32,700	4,375	37,075
2420	480 KW 1970 GPH	51,000	4,375	55,375
2460	1500 gal, 60 KW 245 GPH	67,500	5,400	72,900
2500	480 KW 1970 GPH	91,500	5,400	96,900

)3020 Heat Generating Systems



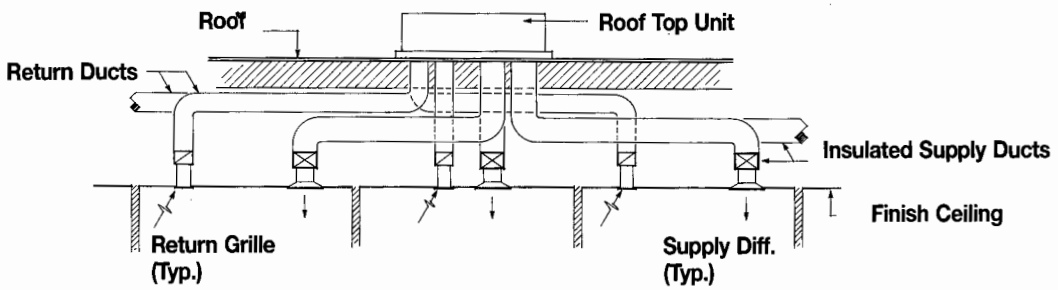
Boiler Selection: The maximum allowable working pressures are limited by ASME "Code for Heating Boilers" to 15 PSI for steam and 160 PSI for hot water heating boilers, with a maximum temperature limitation of 250°F. Hot water boilers are generally rated for a working pressure of 30 PSI. High pressure 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.		4,200	1,350	5,550
0620	30 K.W., 103 M.B.H.		5,000	1,475	6,475
0640	60 K.W., 205 M.B.H.	RD3020 -010	6,125	1,600	7,725
0660	120 K.W., 410 M.B.H.		6,875	1,950	8,825
0680	210 K.W., 716 M.B.H.	RD3020 -020	8,050	2,925	10,975
0700	510 K.W., 1,739 M.B.H.		19,500	5,475	24,975
0720	720 K.W., 2,452 M.B.H.		23,600	6,175	29,775
0740	1,200 K.W., 4,095 M.B.H.		30,500	7,075	37,575
0760	2,100 K.W., 7,167 M.B.H.		58,500	8,900	67,400
0780	3,600 K.W., 12,283 M.B.H.		89,500	15,000	104,500
0820	Steam, 6 K.W., 20.5 M.B.H.		4,000	1,475	5,475
0840	24 K.W., 81.8 M.B.H.		4,975	1,600	6,575
0860	60 K.W., 205 M.B.H.		6,875	1,750	8,625
0880	150 K.W., 512 M.B.H.		9,900	2,700	12,600
0900	510 K.W., 1,740 M.B.H.		25,100	6,675	31,775
0920	1,080 K.W., 3,685 M.B.H.		35,100	9,625	44,725
0940	2,340 K.W., 7,984 M.B.H.		72,000	15,000	87,000
0980	Gas, cast iron, hot water, 80 M.B.H.		2,050	1,675	3,725
1000	100 M.B.H.		2,625	1,825	4,450
1020	163 M.B.H.		3,200	2,450	5,650
1040	280 M.B.H.		4,725	2,725	7,450
1060	544 M.B.H.		9,400	4,850	14,250
1080	1,088 M.B.H.		14,200	6,150	20,350
1100	2,000 M.B.H.		20,500	9,625	30,125
1120	2,856 M.B.H.		24,600	12,300	36,900
1140	4,720 M.B.H.		77,000	17,000	94,000
1160	6,970 M.B.H.		93,000	27,700	120,700
1180	For steam systems under 2,856 M.B.H., add 8%				
1520	Oil, cast iron, hot water, 109 M.B.H.		2,250	2,050	4,300
1540	173 M.B.H.		2,850	2,450	5,300
1560	236 M.B.H.		3,675	2,900	6,575
1580	1,084 M.B.H.		10,300	6,550	16,850
1600	1,600 M.B.H.		13,300	9,400	22,700
1620	2,480 M.B.H.		20,400	12,000	32,400
1640	3,550 M.B.H.		26,300	14,400	40,700
1660	Steam systems same price as hot water				

D3050 Terminal & Package Units



System Description: Rooftop units are multizone with up to 12 zones, and include electric cooling, gas heat, thermostats, filters, supply and return fans complete. Duct systems are low velocity, galvanized steel supply and return with insulated supplies.

Multizone units cost more per ton of cooling than single zone. However, they offer flexibility where load conditions are varied due to heat generating areas or exposure to radiational heating. For example, perimeter offices on the "sunny side" may require cooling at the same time "shady side" or central offices may require heating. It is possible to accomplish similar results using duct heaters in branches of the single zone unit. However, heater location could be a problem and total system operating energy efficiency could be lower.

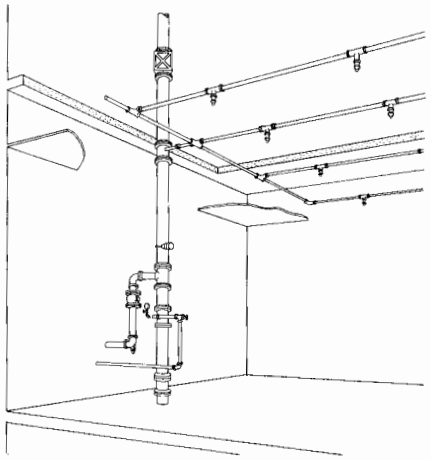
System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D3050 155 1280					
ROOFTOP, MULTIZONE, AIR CONDITIONER					
APARTMENT CORRIDORS, 3,000 S.F., 5.50 TON					
Rooftop multizone unit, standard controls, curb	1.000	Ea.	27,500	1,782	29,282
Ductwork package for rooftop multizone units	1.000	System	2,062.50	12,375	14,437.50
TOTAL			29,562.50	14,157	43,719.50
COST PER S.F.			9.85	4.72	14.57

Note A: Small single zone unit recommended.

D3050 155	Rooftop Multizone Unit Systems		COST PER S.F. MAT.	COST PER S.F. INST.	COST PER S.F. TOTAL
1240	Rooftop, multizone, air conditioner				
1260	Apartment corridors, 1,500 S.F., 2.75 ton. See Note A.				
1280	3,000 S.F., 5.50 ton	RD3030 -010	9.87	4.73	14.60
1440	25,000 S.F., 45.80 ton		6.55	4.55	11.10
1520	Banks or libraries, 1,500 S.F., 6.25 ton		22.50	10.75	33.25
1640	15,000 S.F., 62.50 ton		11.05	10.30	21.35
1720	25,000 S.F., 104.00 ton		9.85	10.25	20.10
1800	Bars and taverns, 1,500 S.F., 16.62 ton		48.50	15.45	63.95
1840	3,000 S.F., 33.24 ton		40	14.90	54.90
1880	10,000 S.F., 110.83 ton		24	14.85	38.85
2080	Bowling alleys, 1,500 S.F., 8.50 ton		30.50	14.60	45.10
2160	10,000 S.F., 56.70 ton		20	14.10	34.10
2240	20,000 S.F., 113.00 ton		13.40	13.90	27.30
2640	Drug stores, 1,500 S.F., 10.00 ton		36	17.15	53.15
2680	3,000 S.F., 20.00 ton		25	16.55	41.55
2760	15,000 S.F., 100.00 ton		15.80	16.40	32.20
3760	Offices, 1,500 S.F., 4.75 ton, See Note A.				
3880	15,000 S.F., 47.50 ton		11.30	7.90	19.20
3960	25,000 S.F., 79.16 ton		8.35	7.80	16.15
4000	Restaurants, 1,500 S.F., 7.50 ton		27	12.85	39.85
4080	10,000 S.F., 50.00 ton		17.80	12.45	30.25
4160	20,000 S.F., 100.00 ton		11.85	12.30	24.15
4240	Schools and colleges, 1,500 S.F., 5.75 ton		20.50	9.85	30.35
4360	15,000 S.F., 57.50 ton		10.15	9.45	19.60
4441	25,000 S.F., 95.83 ton		9.55	9.45	19

D40 Fire Protection

D4010 Sprinklers



Wet Pipe System. A system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by heat from a fire.

All areas are assumed to be open.

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D4010 410 0580					
WET PIPE SPRINKLER, STEEL, BLACK, SCH. 40 PIPE					
LIGHT HAZARD, ONE FLOOR, 2000 S.F.					
Valve, gate, iron body, 125 lb., OS&Y, flanged, 4" diam.	1.000	Ea.	465	288.75	753.75
Valve, swing check, bronze, 125 lb, regrinding disc, 2-1/2" pipe size	1.000	Ea.	472.50	57.75	530.25
Valve, angle, bronze, 150 lb., rising stem, threaded, 2" diam.	1.000	Ea.	446.25	43.50	489.75
*Alarm valve, 2-1/2" pipe size	1.000	Ea.	1,068.75	285	1,353.75
Alarm, water motor, complete with gong	1.000	Ea.	266.25	119.25	385.50
Valve, swing check, w/balldrip CI with brass trim 4" pipe size	1.000	Ea.	222.75	285	507.75
Pipe, steel, black, schedule 40, 4" diam.	10.000	L.F.	130.13	239.70	369.83
*Flow control valve, trim & gauges, 4" pipe size	1.000	Set	3,731.25	648.75	4,380
Fire alarm horn, electric	1.000	Ea.	48.38	66.75	115.13
Pipe, steel, black, schedule 40, threaded, cplg & hngr 10' OC, 2-1/2" diam.	20.000	L.F.	285	345	630
Pipe, steel, black, schedule 40, threaded, cplg & hngr 10' OC, 2" diam.	12.500	L.F.	118.13	168.75	286.88
Pipe, steel, black, schedule 40, threaded, cplg & hngr 10' OC, 1-1/4" diam.	37.500	L.F.	233.44	364.22	597.66
Pipe steel, black, schedule 40, threaded cplg & hngr 10' OC, 1" diam.	112.000	L.F.	567	1,016.40	1,583.40
Pipe Tee, malleable iron black, 150 lb. threaded, 4" pipe size	2.000	Ea.	360	432	792
Pipe Tee, malleable iron black, 150 lb. threaded, 2-1/2" pipe size	2.000	Ea.	101.25	192	293.25
Pipe Tee, malleable iron black, 150 lb. threaded, 2" pipe size	1.000	Ea.	23.25	78.75	102
Pipe Tee, malleable iron black, 150 lb. threaded, 1-1/4" pipe size	5.000	Ea.	55.31	309.38	364.69
Pipe Tee, malleable iron black, 150 lb. threaded, 1" pipe size	4.000	Ea.	27.30	240	267.30
Pipe 90° elbow, malleable iron black, 150 lb. threaded, 1" pipe size	6.000	Ea.	38.03	220.50	258.53
Sprinkler head, standard spray, brass 135°-286°F 1/2" NPT, 3/8" orifice	12.000	Ea.	160.20	474	634.20
Valve, gate, bronze, NRS, class 150, threaded, 1" pipe size	1.000	Ea.	66.38	25.13	91.50
*Standpipe connection, wall, single, flush w/plug & chain 2-1/2"x2-1/2"	1.000	Ea.	101.25	171.75	273
TOTAL			8,987.80	6,072.33	15,060.13
COST PER S.F.			4.49	3.04	7.53

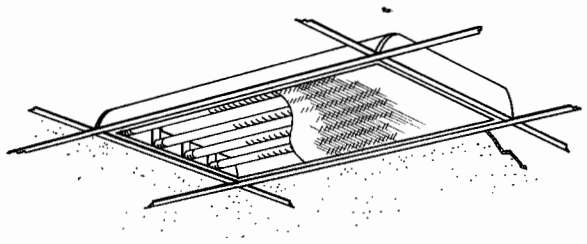
*Not included in systems under 2000 S.F.

D4010 410	Wet Pipe Sprinkler Systems		COST PER S.F. MAT.	COST PER S.F. INST.	COST PER S.F. TOTAL
0520	Wet pipe sprinkler systems, steel, black, sch. 40 pipe				
0530	Light hazard, one floor, 500 S.F.		2.57	2.90	5.47
0560	1000 S.F.	RD4010 -100	5.05	3.03	8.08
0580	2000 S.F.		4.50	3.04	7.54
0600	5000 S.F.	RD4020 -300	2.23	2.15	4.38
0620	10,000 S.F.		1.55	1.83	3.38
0640	50,000 S.F.		1.17	1.63	2.80
0660	Each additional floor, 500 S.F.		1.34	2.47	3.81

D4010 Sprinklers

D4010 410	Wet Pipe Sprinkler Systems	COST PER S.F.		
		MAT.	INST.	TOTAL
0680	1000 S.F.	1.31	2.32	3.63
0700	2000 S.F.	1.21	2.08	3.29
0720	5000 S.F.	.94	1.79	2.73
0740	10,000 S.F.	.93	1.66	2.59
0760	50,000 S.F.	.77	1.29	2.06
1000	Ordinary hazard, one floor, 500 S.F.	2.83	3.11	5.94
1020	1000 S.F.	4.99	2.99	7.98
1040	2000 S.F.	4.59	3.18	7.77
1060	5000 S.F.	2.46	2.31	4.77
1080	10,000 S.F.	1.92	2.39	4.31
1100	50,000 S.F.	1.50	2.25	3.75
1140	Each additional floor, 500 S.F.	1.69	2.79	4.48
1160	1000 S.F.	1.25	2.30	3.55
1180	2000 S.F.	1.34	2.30	3.64
1200	5000 S.F.	1.35	2.19	3.54
1220	10,000 S.F.	1.31	2.23	3.54
1240	50,000 S.F.	1.15	1.97	3.12
1500	Extra hazard, one floor, 500 S.F.	9.55	4.81	14.36
1520	1000 S.F.	6.05	4.20	10.25
1540	2000 S.F.	4.95	4.29	9.24
1560	5000 S.F.	3.33	3.75	7.08
1580	10,000 S.F.	2.80	3.52	6.32
1600	50,000 S.F.	2.99	3.42	6.41
1660	Each additional floor, 500 S.F.	2.08	3.45	5.53
1680	1000 S.F.	2.02	3.29	5.31
1700	2000 S.F.	1.81	3.31	5.12
1720	5000 S.F.	1.58	2.94	4.52
1740	10,000 S.F.	1.72	2.68	4.40
1760	50,000 S.F.	1.73	2.57	4.30
2020	Grooved steel, black sch. 40 pipe, light hazard, one floor, 2000 S.F.	4.23	2.56	6.79
2060	10,000 S.F.	1.68	1.63	3.31
2100	Each additional floor, 2000 S.F.	.98	1.68	2.66
2150	10,000 S.F.	.68	1.39	2.07
2200	Ordinary hazard, one floor, 2000 S.F.	4.28	2.73	7.01
2250	10,000 S.F.	1.48	2.01	3.49
2300	Each additional floor, 2000 S.F.	1.03	1.85	2.88
2350	10,000 S.F.	.87	1.85	2.72
2400	Extra hazard, one floor, 2000 S.F.	4.57	3.51	8.08
2450	10,000 S.F.	1.97	2.60	4.57
2500	Each additional floor, 2000 S.F.	1.47	2.71	4.18
2550	10,000 S.F.	1.26	2.31	3.57
3050	Grooved steel black sch. 10 pipe, light hazard, one floor, 2000 S.F.	4.19	2.54	6.73
3100	10,000 S.F.	1.28	1.54	2.82
3150	Each additional floor, 2000 S.F.	.94	1.65	2.59
3200	10,000 S.F.	.66	1.37	2.03
3250	Ordinary hazard, one floor, 2000 S.F.	4.24	2.71	6.95
3300	10,000 S.F.	1.45	1.98	3.43
3350	Each additional floor, 2000 S.F.	.99	1.83	2.82
3400	10,000 S.F.	.84	1.82	2.66
3450	Extra hazard, one floor, 2000 S.F.	4.55	3.49	8.04
3500	10,000 S.F.	1.87	2.55	4.42
3550	Each additional floor, 2000 S.F.	1.45	2.69	4.14
3600	10,000 S.F.	1.19	2.28	3.47
4050	Copper tubing, type M, light hazard, one floor, 2000 S.F.	5.35	2.54	7.89
4100	10,000 S.F.	2.25	1.54	3.79
4150	Each additional floor, 2000 S.F.	2.10	1.69	3.79
4200	10,000 S.F.	1.63	1.38	3.01
4250	Ordinary hazard, one floor, 2000 S.F.	5.55	2.86	8.41

D5020 Lighting and Branch Wiring



Type C. Recessed, mounted on grid ceiling suspension system, 2′ x 4′, four 40 watt lamps, acrylic prismatic diffusers.

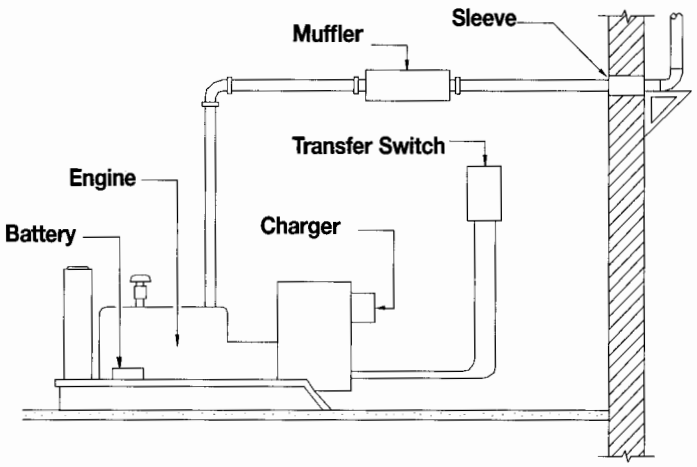
5.3 watts per S.F. for 100 footcandles.

3 watts per S.F. for 57 footcandles.

System Components	QUANTITY	UNIT	COST PER S.F. MAT.	INST.	TOTAL
SYSTEM D5020 210 0200					
FLUORESCENT FIXTURES RECESS MOUNTED IN CEILING					
1 WATT PER S.F., 20 FC, 5 FIXTURES PER 1000 S.F.					
Steel intermediate conduit, (IMC) 1/2" diam.	.128	L.F.	.24	.76	1
Wire, 600 volt, type THW, copper, solid, #12	.003	C.L.F.	.04	.16	.20
Fluorescent fixture, recessed, 2'x 4', four 40W, w/ lens, for grid ceiling	.005	Ea.	.37	.64	1.01
Steel outlet box 4" square	.005	Ea.	.10	.15	.25
Fixture whip, Greenfield w/#12 THHN wire	.005	Ea.	.04	.04	.08
TOTAL			.79	1.75	2.54

D5020 210	Fluorescent Fixtures (by Wattage)		COST PER S.F. MAT.	INST.	TOTAL
0190	Fluorescent fixtures recess mounted in ceiling				
0195	T12, standard 40 watt lamps				
0200	1 watt per S.F., 20 FC, 5 fixtures @40 watts per 1000 S.F.	RD5020 -200	.79	1.75	2.54
0240	2 watt per S.F., 40 FC, 10 fixtures @40 watt per 1000 S.F.		1.59	3.43	5.02
0280	3 watt per S.F., 60 FC, 15 fixtures @40 watt per 1000 S.F		2.37	5.20	7.57
0320	4 watt per S.F., 80 FC, 20 fixtures @40 watt per 1000 S.F.		3.15	6.90	10.05
0400	5 watt per S.F., 100 FC, 25 fixtures @40 watt per 1000 S.F.		3.95	8.65	12.60
0450	T8, energy saver 32 watt lamps				
0500	0.8 watt per S.F., 20 FC, 5 fixtures @32 watt per 1000 S.F.		.85	1.75	2.60
0520	1.6 watt per S.F., 40 FC, 10 fixtures @32 watt per 1000 S.F.		1.71	3.43	5.14
0540	2.4 watt per S.F., 60 FC, 15 fixtures @ 32 watt per 1000 S.F		2.56	5.20	7.76
0560	3.2 watt per S.F., 80 FC, 20 fixtures @32 watt per 1000 S.F.		3.40	6.90	10.30
0580	4 watt per S.F., 100 FC, 25 fixtures @32 watt per 1000 S.F.		4.26	8.65	12.91

D5090 Other Electrical Systems



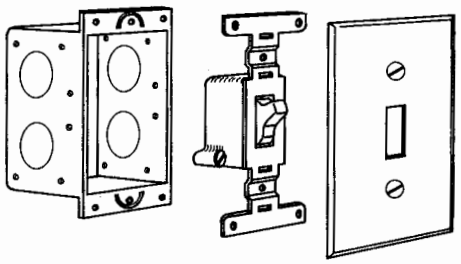
Description: System below tabulates the installed cost for generators by kW. Included in costs are battery, charger, muffler, and transfer switch.

No conduit, wire, or terminations included.

System Components	QUANTITY	UNIT	COST PER kW MAT.	INST.	TOTAL
SYSTEM D5090 210 0200					
GENERATOR SET, INCL. BATTERY, CHARGER, MUFFLER & TRANSFER SWITCH					
GAS/GASOLINE OPER., 3 PHASE, 4 WIRE, 277/480V, 7.5 kW					
Generator set, gas or gasoline operated, 3 ph 4 W, 277/480 V, 7.5 kW	.133	Ea.	1,163.33	259.47	1,422.80
TOTAL			1,163.33	259.47	1,422.80

D5090 210	Generators (by kW)		COST PER kW MAT.	INST.	TOTAL
0190	Generator sets, include battery, charger, muffler & transfer switch				
0200	Gas/gasoline operated, 3 phase, 4 wire, 277/480 volt, 7.5 kW		1,175	260	1,435
0240	11.5 kW	RD5010 -110	1,075	197	1,272
0280	20 kW		730	129	859
0320	35 kW		495	84	579
0360	80 kW		355	51	406
0400	100 kW		310	49.50	359.50
0440	125 kW		510	46	556
0480	185 kW		455	35	490
0560	Diesel engine with fuel tank, 30 kW		770	97.50	867.50
0600	50 kW		550	77.50	627.50
0720	125 kW		335	45	380
0760	150 kW		320	41.50	361.50
0800	175 kW		297	36.50	333.50
0840	200 kW		268	34	302
0880	250 kW		252	28	280
0920	300 kW		228	24.50	252.50
0960	350 kW		220	23	243
1000	400 kW		239	21.50	260.50
1040	500 kW		240	18	258
1200	750 kW		263	11.30	274.30
1400	1000 kW		244	12	256

D5020 Lighting and Branch Wiring



Description: Table D5020 130 includes the cost for switch, plate, box, conduit in slab or EMT exposed and copper wire. Add 20% for exposed conduit.

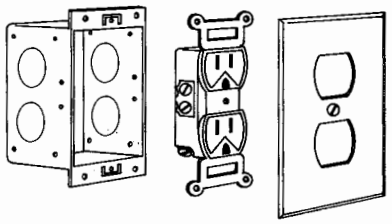
No power required for switches.

Federal energy guidelines recommend the maximum lighting area controlled per switch shall not exceed 1000 S.F. and that areas over 500 S.F. shall be so controlled that total illumination can be reduced by at least 50%.

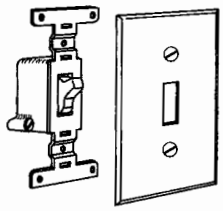
System Components	QUANTITY	UNIT	COST PER S.F. MAT.	INST.	TOTAL
SYSTEM D5020 130 0360					
WALL SWITCHES, 5.0 PER 1000 S.F.					
Steel, intermediate conduit (IMC), 1/2" diameter	88.000	L.F.	.17	.52	.69
Wire, 600V type THWN-THHN, copper solid #12	1.710	C.L.F.	.02	.09	.11
Toggle switch, single pole, 15 amp	5.000	Ea.	.03	.07	.10
Wall plate, 1 gang, brown plastic	5.000	Ea.		.04	.04
Steel outlet box 4" plaster rings	5.000	Ea.	.01	.15	.16
Plaster rings	5.000	Ea.	.02	.05	.07
TOTAL			.25	.92	1.17

D5020 130	Wall Switch by Sq. Ft.	COST PER S.F. MAT.	INST.	TOTAL
0200	Wall switches, 1.0 per 1000 S.F.	.06	.21	.27
0240	1.2 per 1000 S.F.	.06	.25	.31
0280	2.0 per 1000 S.F.	.10	.34	.44
0320	2.5 per 1000 S.F.	.11	.43	.54
0360	5.0 per 1000 S.F.	.25	.92	1.17
0400	10.0 per 1000 S.F.	.52	1.86	2.38

D5020 Lighting and Branch Wiring



Duplex Receptacle

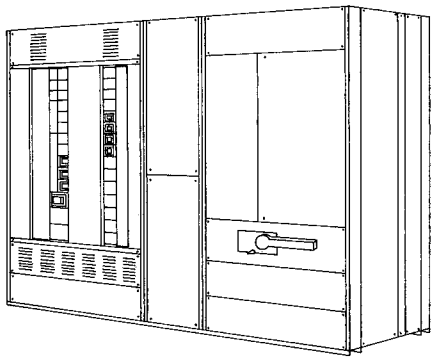


Wall Switch

System Components	QUANTITY	UNIT	COST PER EACH MAT.	INST.	TOTAL
SYSTEM D5020 125 0520					
RECEPTACLES AND WALL SWITCHES, RECEPTICLE DUPLEX 120 V GROUNDED, 15 A					
Electric metallic tubing conduit, (EMT), 3/4" diam	22.000	L.F.	24.20	100.76	124.96
Wire, 600 volt, type THWN-THHN, copper, solid #12	.630	C.L.F.	8.28	34.02	42.30
Steel outlet box 4" square	1.000	Ea.	2.73	30	32.73
Steel outlet box, 4" square, plaster rings	1.000	Ea.	3.70	9.30	13
Receptacle, duplex, 120 volt grounded, 15 amp	1.000	Ea.	1.51	14.90	16.41
Wall plate, 1 gang, brown plastic	1.000	Ea.	.43	7.45	7.88
TOTAL			40.85	196.43	237.28

D5020 125	Receptacles & Switches by Each	COST PER EACH MAT.	INST.	TOTAL
0460	Receptacles & Switches, with box, plate, 3/4" EMT conduit & wire			
0520	Receptacle duplex 120 V grounded, 15 A	41	196	237
0560	20 A	51	204	255
0600	Receptacle duplex ground fault interrupting, 15 A	79	204	283
0640	20 A	81.50	204	285.50
0680	Toggle switch single, 15 A	45	196	241
0720	20 A	47.50	204	251.50
0760	3 way switch, 15 A	48	208	256
0800	20 A	49	215	264
0840	4 way switch, 15 A	68	221	289
0880	20 A	84	236	320

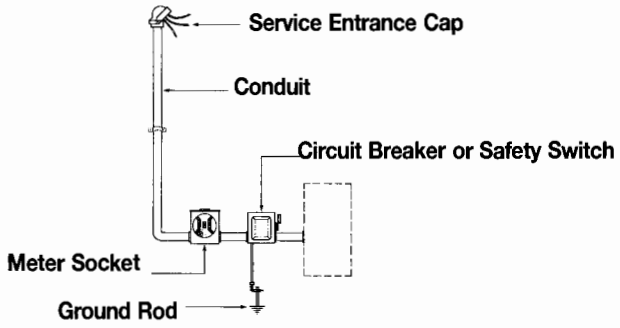
D5010 Electrical Service/Distribution



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.	2,475	2,125	4,600
Switchboard, alum. bus bars, 120/208V, 4 wire, 600V	1.000	Ea.	4,425	1,200	5,625
Distribution sect., alum. bus bar, 120/208 or 277/480 V, 4 wire, 600A	1.000	Ea.	2,525	1,200	3,725
Feeder section circuit breakers, KA frame, 70 to 225 A	3.000	Ea.	4,200	558	4,758
TOTAL			13,625	5,083	18,708

D5010 240	Switchgear		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
0200	Switchgear inst., incl. swbd., panels & circ bkr, 400 A, 120/208volt		4,500	3,750	8,250
0240	600 A		13,600	5,075	18,675
0280	800 A	RD5010 -110	17,400	7,200	24,600
0320	1200 A		20,900	11,000	31,900
0360	1600 A		28,300	15,500	43,800
0400	2000 A		35,800	19,700	55,500
0410	Add 20% for 277/480 volt				

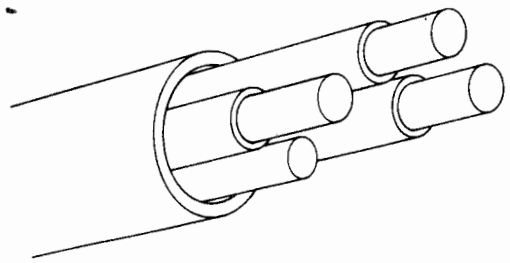
D5010 Electrical Service/Distribution



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.	655	213	868
Meter socket, single position, 4 terminal, 100 A	1.000	Ea.	48.50	186	234.50
Rigid galvanized steel conduit, 3/4″, including fittings	20.000	L.F.	59.40	149	208.40
Wire, 600V type XHHW, copper stranded #6	.900	C.L.F.	91.80	82.35	174.15
Service entrance cap 3/4″ diameter	1.000	Ea.	12.25	46	58.25
Conduit LB fitting with cover, 3/4″ diameter	1.000	Ea.	15.75	46	61.75
Ground rod, copper clad, 8′ long, 3/4″ diameter	1.000	Ea.	35.50	112	147.50
Ground rod clamp, bronze, 3/4″ diameter	1.000	Ea.	8.35	18.65	27
Ground wire, bare armored, #6-1 conductor	.200	C.L.F.	31.60	66	97.60
TOTAL			958.15	919	1,877.15

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		960	920	1,880
0240	100 A		1,150	1,100	2,250
0280	200 A		1,875	1,700	3,575
0320	400 A	RD5010 -110	4,425	3,125	7,550
0360	600 A		8,275	4,225	12,500
0400	800 A		10,200	5,100	15,300
0440	1000 A		12,400	5,850	18,250
0480	1200 A		15,800	6,000	21,800
0520	1600 A		27,800	8,600	36,400
0560	2000 A		30,600	9,800	40,400
0570	Add 25% for 277/480 volt				
0580					
0610	1 phase, 3 wire, 120/240 volts, 100 A		535	1,000	1,535
0620	200 A		1,100	1,475	2,575

)5010 Electrical Service/Distribution

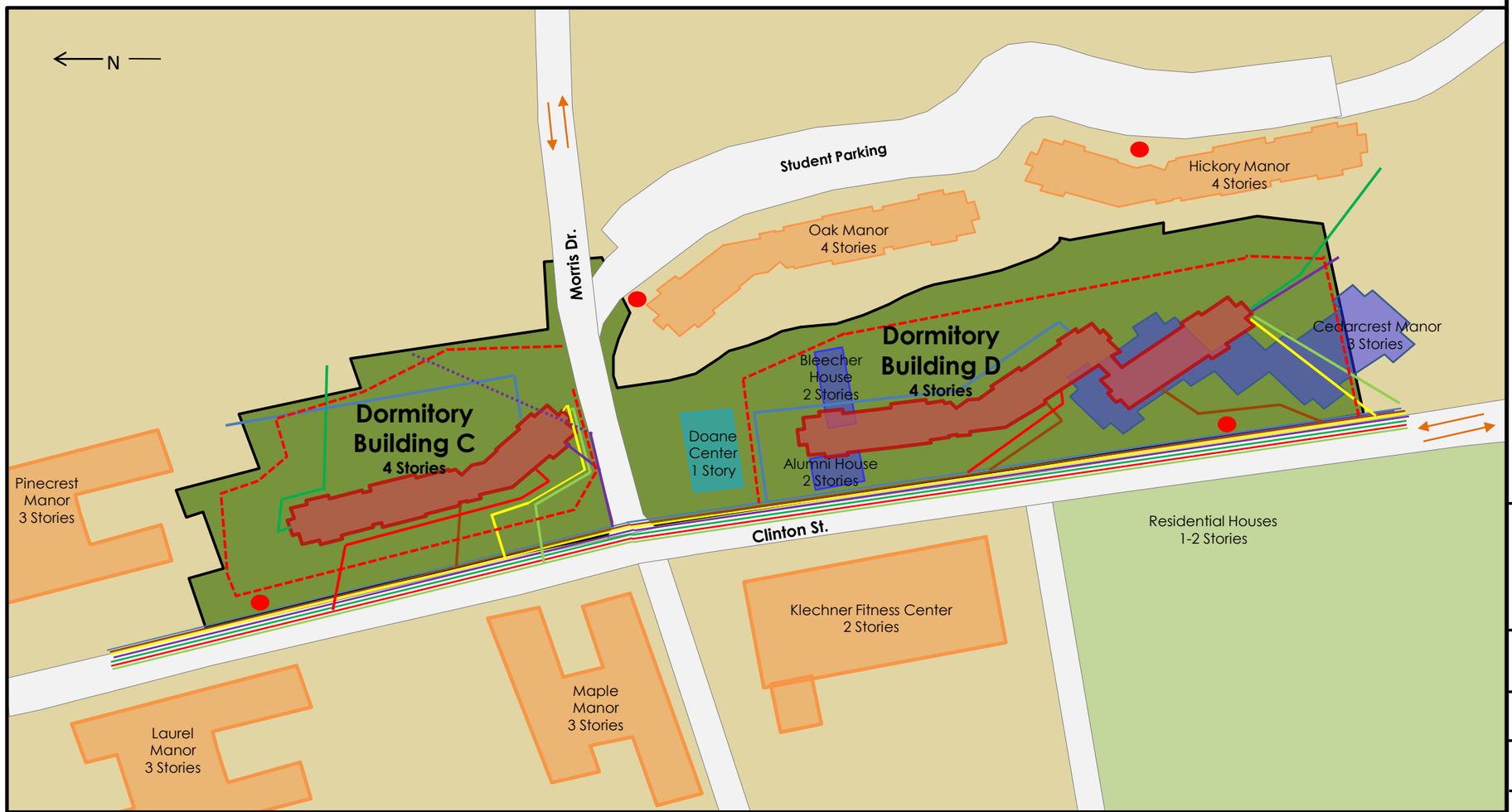


System Components	QUANTITY	UNIT	COST PER L.F. MAT.	INST.	TOTAL
SYSTEM D5010 230 0200					
FEEDERS, INCLUDING STEEL CONDUIT & WIRE, 60 A					
Rigid galvanized steel conduit, 3/4", including fittings	1.000	L.F.	2.97	7.45	10.42
Wire 600 volt, type XHHW copper stranded #6	.040	C.L.F.	4.08	3.66	7.74
TOTAL			7.05	11.11	18.16

D5010 230	Feeder Installation		COST PER L.F. MAT.	INST.	TOTAL
0200	Feeder installation 600 V, including RGS conduit and XHHW wire, 60 A		7.05	11.10	18.15
0240	100 A		10.35	14.70	25.05
0280	200 A	RD5010 -140	23.50	23	46.50
0320	400 A		46.50	45.50	92
0360	600 A		101	74.50	175.50
0400	800 A		150	89	239
0440	1000 A		164	114	278
0480	1200 A		226	117	343
0520	1600 A		300	178	478
0560	2000 A		330	228	558
1200	Branch installation 600 V, including EMT conduit and THW wire, 15 A		1.27	5.65	6.92
1240	20 A		1.27	5.65	6.92
1280	30 A		1.98	6.95	8.93
1320	50 A		3.16	8.05	11.21
1360	65 A		3.91	8.55	12.46
1400	85 A		6.30	10.05	16.35
1440	100 A		7.95	10.65	18.60
1480	130 A		10.35	12	22.35
1520	150 A		12.95	13.80	26.75
1560	200 A		17.05	15.50	32.55

APPENDIX C

EXISTING SITE PLAN



Symbols

- Site Fence
- Fire Hydrant
- Site Perimeter
- Traffic Direction
- Existing Building
- Demolished
- Existing to Remain
- Onsite Building Footprint
- Sanitary
- Telecom
- Electric
- Gas
- Strom
- Water
- Steam
- Existing Steam to be Removed

Dormitories Mansfield University

Mike Mahoney
Construction Management

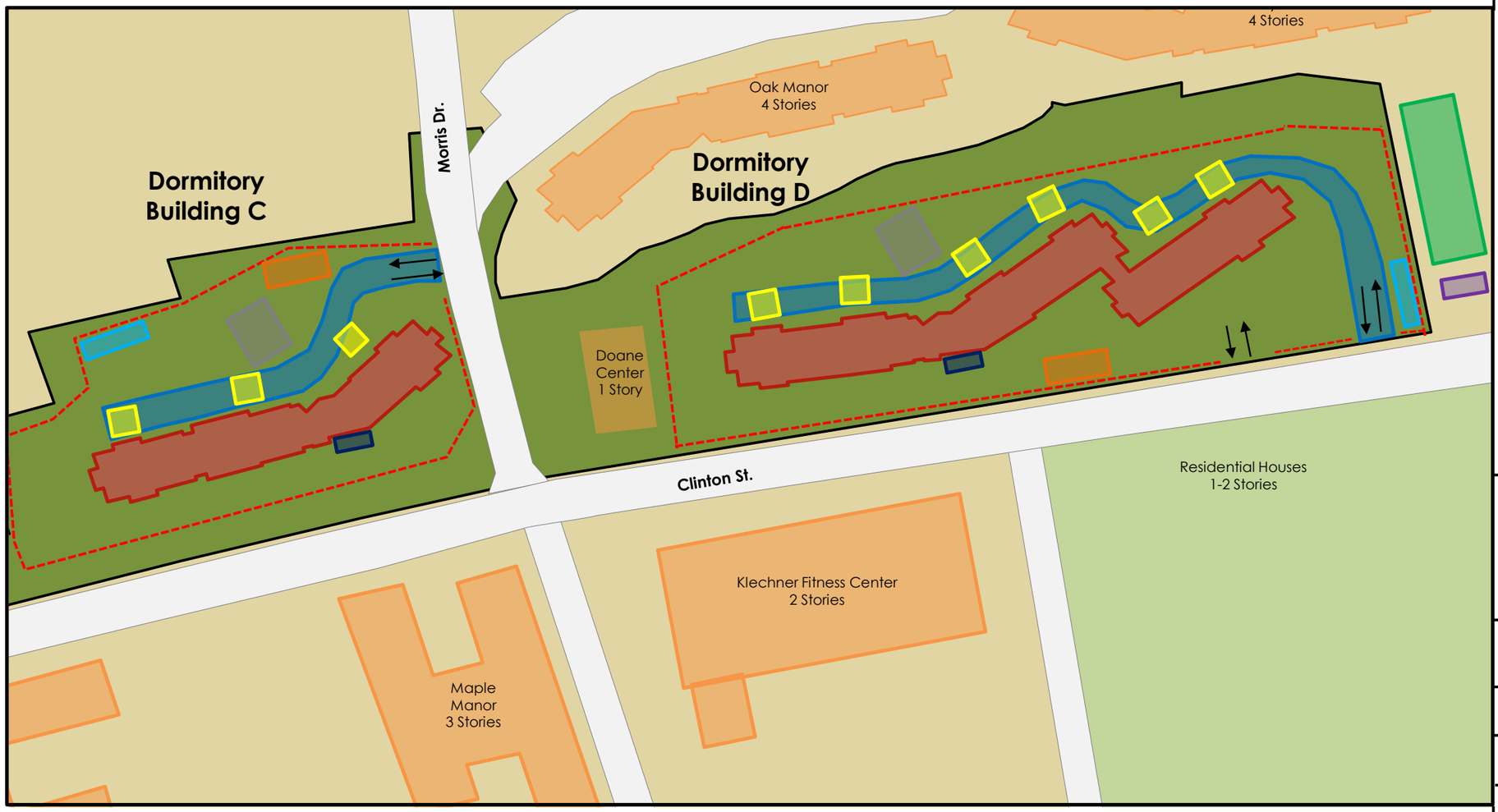
Technical Report 1

Existing Conditions

Appendix C

APPENDIX D

SUPERSTRUCTURE SITE LAYOUT



Symbols

- Building Footprint
- Dumpsters + Recycling
- Crane Pads
- Temporary Bathrooms
- Material Hoists
- Access Road - Modular
- CM Trailer
- Steel Layout Area
- Storage Units
- Site Entrance

Dormitories Mansfield University

Mike Mahoney
Construction Management

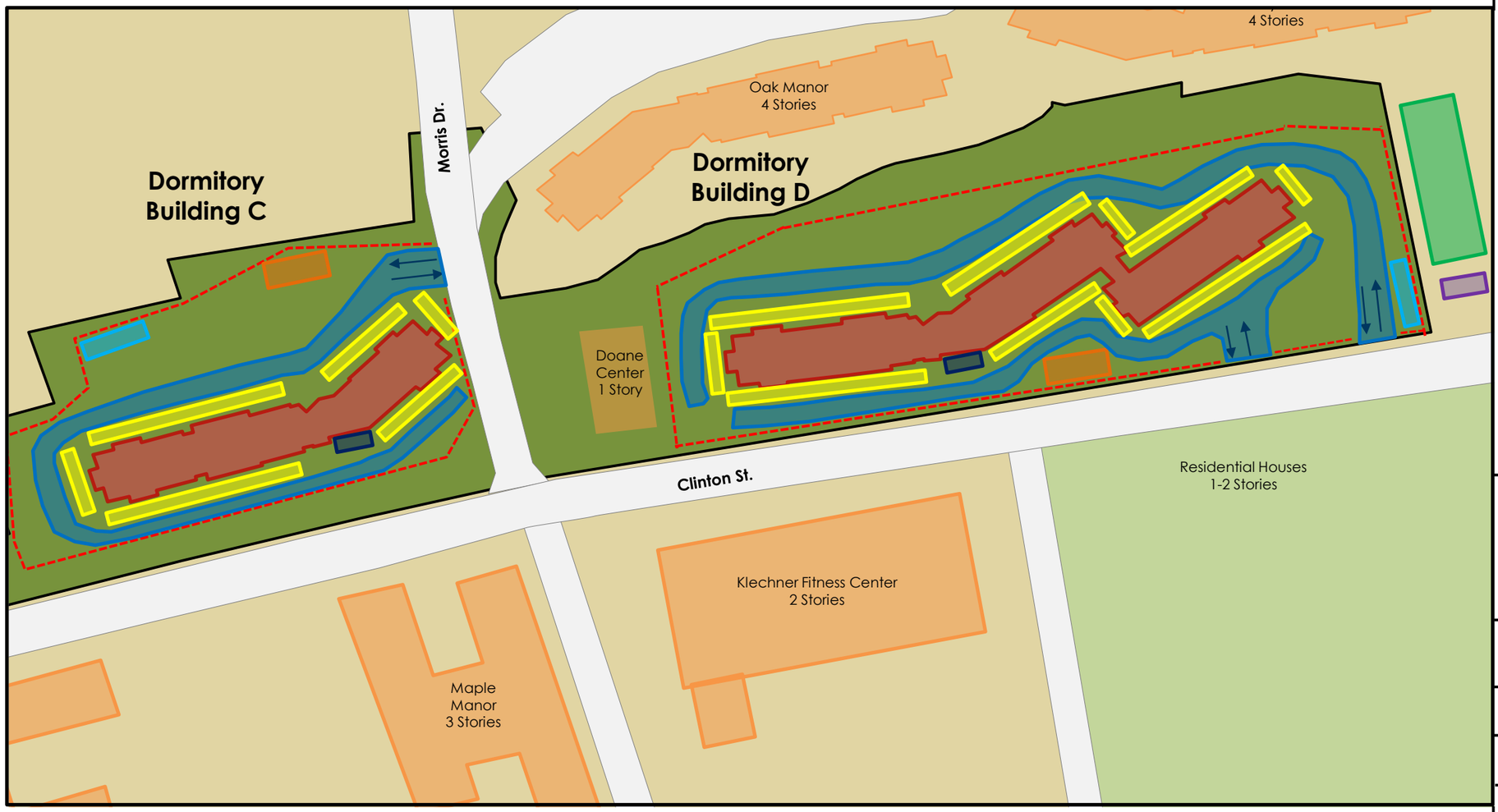
Technical Report 1

Superstructure

Appendix D

APPENDIX E

BUILDING ENCLOSURE SITE LAYOUT



Symbols

- Building Footprint
- Dumpsters + Recycling
- Scaffolding
- Temporary Bathrooms
- Material Hoists
- Access Road - Masonry
- CM Trailer
- Storage Units
- Site Entrance

Dormitories
Mansfield University

Mike Mahoney
Construction Management

Technical Report 1

Enclosure

Appendix E