## **DORMITORY BUILDINGS C & D**

MANSFIELD UNIVERSITY, MANSFIELD PA



TECHNICAL REPORT NO. 2

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## **EXECUTIVE SUMMARY**

In tech report number 2, there are five main sections of investigation. There is a detailed schedule analysis, where a trade by trade schedule was created for the entire project. There is a detailed structural estimate, where a cost estimate of a typical bay was created. There is a detailed general conditions estimate, where the cost was estimated for all of the general conditions during the project. There is a Building Information Modeling (BIM) uses evaluation, where all of the uses of BIM were briefly researched and the most significant uses were examined in detail. Finally, there is a constructability challenges section, where three main constructability issues were inspected and then solutions were recommended.

The detailed schedule was broken into two buildings and then phases in each building. The schedule showed seven main phases of construction: 2 structural steel core and 5 modular construction phases. The schedule of Building C is tighter than Building D, because it is expected to open for the first day of classes in the fall 2013 semester. A typical floor by floor schedule was broken down for a steel core phase and a modular construction phase.

The detailed structural estimate used *RS MEANS Costworks* to provide unit prices. The structural cost for a typical modular unit was calculated first. The modular units were built with dimensional lumber. The units had to be designed with the strength to be transported by tractor trailer and lifted into place by a crane. The roof was constructed using pre-engineered wood trusses, 24 inches apart. The foundation has a concrete footer with masonry block walls. A 4 inch slab on grade was poured with 4 foot by 4 foot spread footings underneath the structural steel columns. The columns were attached to wide flange beams that support the modular units above. The detailed cost estimate for the modular construction is \$4,275,039.20.

The general condition estimate used the staffing plan from technical report one to produce the staffing costs, and *RS MEANS* was used to find the unit prices. With a Project Manager and two Superintendents costing almost 66% of the total staffing cost, the staffing costs were about a quarter of the total general conditions costs. Insurance, bond and permit costs were 36% of the general conditions. Temporary Utilities were 8.6% of the general conditions cost. The total general conditions cost was estimated to be \$3,030,000.

BIM was used on the project to detect field conflicts. Before construction, the subcontractors bought into 3D modeling along with clash detection to virtually design the MEP systems. Some other uses of BIM were evaluated for the owner: evaluating the phasing plan, identifying concerns between architectural and modular designs, maintenance technician support and site logistics are a few.

The Mansfield University dormitories were designed with some construction challenges. The three challenges investigated in this report are: (1) modular construction, (2) design-build subcontractor coordination, and (3) daily university operations. These issues place specific restrictions on the construction process. Because it is very early in construction on the project, not all of these challenges have occurred yet, but there is a plan in place for when they arise.

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## DETAILED PROJECT SCHEDULE

\*See Appendix A for Detailed Project Schedule

## OVERVIEW

The project schedule for these dormitories is extremely important for the Mansfield University. For every day late, the University loses \$65 per a bed. They have set Building C's completion date to the beginning of the fall semester 2013. The construction manager, Wohlsen Construction, was given the notice to proceed on August 16, 2012. Building C is due to be completed by September 5, 2013 and Building D is due by October 17, 2013. The project will span approximately 15 months.

## PHASING

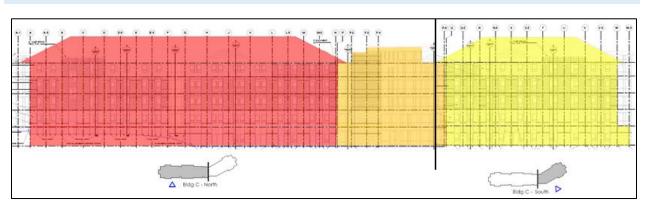


Figure 1 Building C Phasing Plan

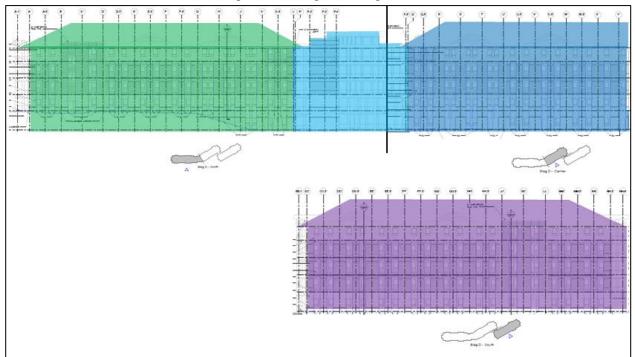


Figure 2 Building D Phasing Plan

The 200 activities in the detailed schedule are split into two categories, one for each dormitory building. There are 2 structural steel "core" phases and 5 modular construction phases. The phases can be seen in the Figures 1 and 2 above. The basement floor is made of CMU block and will be built before any of the units can be set and is part of the exterior construction section. The core spaces of each building also will be completed before the modular units are set. The core spaces are orange on Building C and light blue on Building D. The modular phases will begin with the red (phase1) and then move on accordingly: yellow (2), green (3), blue (4) and finally purple (5). The Final section of the schedule highlights the end of construction activities that are required for substantial completion.

## EXCAVATION, GRADING AND FOUNDATION

Excavation, grading and foundation construction will require 201 days in Building C and 211 days in Building D. The excavation also involves digging all of the geothermal wells. Once the geothermal wells are complete, the rough grading can start. During the winter months, there is a gap in work due to the harsh weather combined with the frozen ground conditions.

## CORE CONSTRUCTION

The core construction will take 186 days for Building C and 163 days for Building D. The core construction is broken down into the floor by floor construction for Building C. The schedule would look similar floor by floor for Building D. The MEP's receive about 60 days per a floor and will be working on all four floors concurrently. The MEP's need to have the manpower required to work on all four floors at the same time; all of the other trades can work with one crew.

## MODULAR CONSTRUCTION

For the two modular phases in Building C, the construction will take 155 days. In Building D, the schedule becomes tighter allowing 156 days for three phases. The MEP's are scheduled for less time in the modular construction, because the modular units are made with all of the room MEP connections pre-installed. All the MEP's need to do is connect each room's feed to the mains in the hallways.

## DETAILED STRUCTURAL ESTIMATE

\*See Appendix B for Detailed Structural System Takeoff

### OVERVIEW

*RS MEANS Costworks* was used to attain cost per unit prices. A typical modular bay was used to take off. The section is shown in Figures 3 and 4. A typical modular unit is 9' wide by 55' long. The structural estimate was broken down into three sections: modular, roof, and foundation.

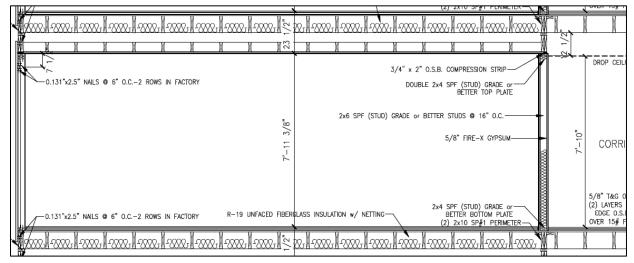


**Figure 3 Modular Section** Plan from Sheet A1.2C – Architectural Plans -WTW Architects

**Figure 4 Modular Section** Elevation from Sheet A2.1C – Architectural Plans -WTW Architects

## MODULAR ESTIMATE

The modular units are constructed with structural dimensional lumber. Figure 5 on the shows a section through the unit. The units are made with double 2x4 wood stud walls. A double 2x10 perimeter frame is attached to the top and bottom of each unit. 2x10 floor joists and 2x6 ceiling joists spaced 16 inches on center provide additional strength. Pneumatic nailing was assumed to be used because the modular contractor created the units in their factory.



## Figure 5 Typical Section - Half of a Modular Unit

Section from Sheet 407A – Shop Drawings – Simplex Industries

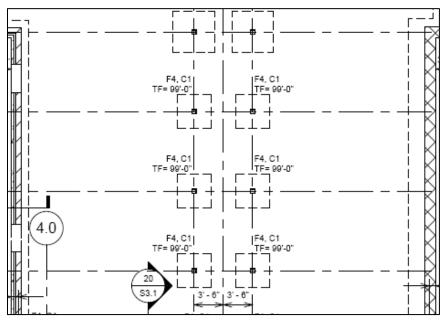
	Cost / Unit	Units	Cost
Walls			
2x4 Studs	\$11.38 LF	209 LF	\$2,378.42
Openings add	\$3.80 LF	12 LF	\$45.60
Window, Studs and Header	\$39.75 EA	4 EA	\$159.00
2x10 Blocking around perimeter	\$3.32 LF	517 LF	\$1,716.44
Floor Joist			
2x10	\$2.05 LF	432 LF	\$885.60
Flooring			
3/4" Tongue and Groove OSB	\$1.81 SF FLR	507 SF FLR	\$917.67
1/4" Noise Isolation Underlayment	\$2.60 SF FLR	507 SF FLR	\$1,318.20
3/4" Butt Edge OSB	\$1.81 SF FLR	507 SF FLR	\$917.67
1/2" FIBERROCK	\$2.99 SF FLR	507 SF FLR	\$1,515.93
5/8" T & G OSB	\$1.45 SF FLR	507 SF FLR	\$735.15
Exterior Panel			
1/2" Zip Board with 1" Foam Insul.	\$4.76 SF	167 SF	794.92
Ceiling Joists			
2x6	\$1.26 LF	306 LF	385.56
Total Structural Costs Per a Modular Unit			

Table 1Structural Cost per a Modular Unit

The total structural cost of one modular unit is \$11,770.16. There are 4 floors of modular units in one bay. In each bay, the modular structure cost was \$47,080.64.

## FOUNDATION

The foundation system has three components: cast-in-place concrete footers, masonry block basement walls and structural steel support for the modular units above. The concrete footers are 3 feet under grade. The concrete slab on grade is 4 inches thick except for the spread footings. Figure 6 shows there are 4 foot square 1 foot thick spread footings underneath the columns to support the axial force. The cost of the foundation per each bay is outlined in Table 2. The estimated cost of the foundation is \$5,941.52.



### Figure 6 Spread Footings

Plan from Sheet S1.0C - Architectural Plans -WTW Architects

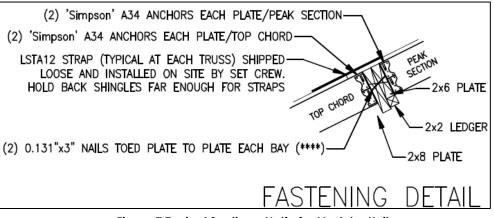
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Foundation Structural Cost

	Cost / Unit		Units		Cost
Concrete	-				
4" Slab on Grade	\$117.00	CY	7	CY	\$819.00
Concrete Footers	\$110.00	CY	2	CY	\$220.00
#5Rebar	\$1,065.50	Ton	0.038	Tons	\$40.49
#4 Rebar	\$1,106.50	Ton	0.233	Tons	\$257.81
AnchorBolts	\$7.17	EA	16.66	EA	\$119.45
Masonry					
8" Bond Beam, Grout Included	12.07	LF	18	LF	\$217.26
14"Thick8x16CMU	\$15.30	SF	45	SF	\$688.50
8"Thick 8x16 CMU	\$9.30	SF	180	SF	\$1,674.00
Steel					
HSS 6x6x3/8 Column	\$360.00	EA	2	EA	\$720.00
1-1/4" x 14" x 14" Column B. Plate	\$1.89	lb	140	lbs	\$264.60
W 14x61 Steel Beams	\$0.33	lb	2440	lbs	\$805.20
Wood					
Double 2.8 Sill	\$6.40	LF	18	LF	\$115.20
Foundation Costs per Modular Section			\$5,941.52		

## ROOFING

The roof was constructed with pre-engineered roof trusses spaced 24 inches apart. The trusses are constructed off site in three pieces. The three pieces are connected with anchors and plates shown in Figure 7. There is zip sheathing with pre-applied moisture resistance. Table 3 shows the total estimated cost of one bay section of the roofing is \$4,748.64.



**Figure 7 Typical Section - Half of a Modular Unit** Detail from Sheet 407A – Shop Drawings – Simplex Industries

Table 3		
Roofing Structural Cost		

	Cost / Unit	Units	Cost
Roofing			
Shingles	\$1.28 SF	749 SF	\$958.72
1/2" Zip Sheathing	\$1.13 SF	749 SF	\$846.37
Pre-engineered Roof Truss 59'Span	\$3.85 SF	539 SF	\$2,075.15
1-1/2"x16" LVLRoof Beams	\$3.34 SF	260 SF	\$868.40
Roofing Cost per Modular Section			\$4,748.64

## CONCLUSION

The total cost of one bay is \$57,770.80. There are 74 modular bays in both buildings. Table 4 shows that the estimated total cost of the modular structure is \$4,275,039.20. This estimated cost does not include the steel structured core of both buildings. A source of error could be using *RS MEANS Costworks*. Their database calculates numbers from the traditional construction approaches. The modular contractor uses an assembly line technique in constructing their units. The productivity of the labor has been shown to increase when using an assembly line.

	Table 4	
Total Cost	of Modular Structu	ıre
r Modular Section	No. of Sections	Tota

Cost per Modular Section	No. of Sections	Total Cost
\$57,770.80	74	\$4,275,039.20

## **GENERAL CONDITIONS ESTIMATE**

\*See Appendix C for Detailed General Conditions Estimate

## GENERAL CONDITIONS NARRATIVE

*RS* Means was used to find the unit prices for the general conditions estimate. The *RS* Means pages can be found at the end of Appendix C. The total cost of the general conditions was estimated at \$3,030,000. With a project cost of approximately \$39 million, the general conditions are approximately 7.8% of the total cost.

### STAFFING COSTS

The jobsite personnel for the construction manager were estimated at \$830,500. That is 27.4% of the general conditions cost. The breakdown is shown in Table 5.

Staff	Cost
1 - Project Executive (20%)	\$58,200.00
1 - Project Manager (100%)	\$196,500.00
2 - Project Engineers (80%)	\$124,800.00
1 - Project Assistant (50%)	\$36,800.00
1 - Safety Coordinator (13%)	\$9,200.00
2 - Superintendents (100%)	\$366,000.00
1 - Working Foreman (100%)	\$39,000.00
Total	\$830,500.00



One Project Engineer is expected to be on the project for 100% of the duration. The other Project Engineer will only be only on the project until all of the modular units are set. That is estimated to be 60% of the way through the project. Once the project gets to that point, the submittal process should be completed and RFI's should be settling down. Most of the staffing cost is the two full-time Superintendents. Their cost is 44% of the total staffing cost. Add the Project Manager to the Superintendents, the top onsite supervision costs are 66% of the total staffing costs.

## STARTUP COSTS

Insurance, bonds, and permits were estimated to cost \$1,102,500. These figures were found by using percentages of the total project cost found in RS Means. All of these costs are at the very beginning of the project. It is 36.4% of the total general conditions cost.

	Initial Costs	:	
	Cost per Unit	Construction Cost	Cost
Insurance	0.40% job	\$35,000,000.00 job	\$140,000.00
Performance Bond	1.50% job	\$35,000,000.00 job	\$525,000.00
Permits	1.25% job	\$35,000,000.00 job	\$437,500.00
Total			\$1,102,500.00

Table	6
Initial Co	osts

### UTILITIES

Temporary utilities were estimated to cost \$260,139 over the 15 month project. That is 8.6% of the total. Temporary power, lighting, water, and heating in the winter are all necessary on the jobsite. The unit that was used to measure the utilities was hundreds of floor square feet. These numbers were for 12 months, not 15 months. I assumed that the RS Means data will work for this project, because not all of the site will be using power and water at the same time. The cost of utilities at the beginning will be extremely small compared to the cost at the end of the project.

	Cost per Unit	No. of Units	Cost
Temporary Heat, 12 hrs./day	\$46.00 csf flr	2150 csf flr	\$98,900.00
Lighting, wiring, outlets	\$22.00 csf flr	2150 csf flr	\$47,300.00
Power for Lighting	\$1.01 csf flr	2150 csf flr	\$2,171.50
Temporary Power	\$51.50 csf flr	2150 csf flr	\$110,725.00
Temporary Water	\$69.50 month	15 months	\$1,042.50
Total			\$260,139.00

Table 7Temporary Utilities

## OTHER

Finally, all of the other materials needed for adequate site logistics were calculated. The cleanup costs after the project are completed was estimated to cost \$210,000. All of the other costs including the jobsite trailer were estimated at \$626,925. The one major cost that could be taken out of the general conditions estimate is the crane. The 100 ton crawler crane used for setting the modular units should be part of the modular subcontractor's contract to better the construction cost to general conditions ratio. The total cost of the crane and mobilization is \$273,300. That is 9% of the general conditions cost. By taking that out of the general conditions cost, the general conditions shrinks to less than 7% of the total project cost.

	Cost pe	r Unit	No. of Un	its	Cost
Office Trailer 32' x 8'	\$203.00	month	15	months	\$3,045.00
Air Conditioning	\$45.50	month	4	months	\$182.00
Storage Boxes, 20' x 8'	\$79.00	month	90	months	\$7,110.00
Office Equipment	\$220.00	month	15	months	\$3,300.00
Office Supplies	\$82.50	month	15	months	\$1,237.50
Telephone/Internet Service	\$89.00	month	15	months	\$1,335.00
100-ton Crawler Crane	\$3,625.00	day	75	day	\$271,875.00
Scaffolding	\$217.00	csf	904	csf	\$196,168.00
Crane Mobilization	\$1,425.00	ea	1	ea	\$1,425.00
Gravel Road	\$14.45	sy	2595	sy	\$37,497.75
Winter Trap Protection	\$2.55	sf	904	sf	\$2,305.20
Temporary Fencing	\$9.25	lf	2740	lf	\$25,345.00
Cleanup After Job Completion	0.60%	job	\$35,000,000.00	job	\$210,000.00
Gator, Gas Powered	\$5,600.00	ea	1	ea	\$5,600.00
Construction Truck	\$500.00	month	30	months	\$15,000.00
Sanitation	\$500.00	month	15	months	\$7,500.00
Recycling/Waste	\$2,400.00	month	15	months	\$36,000.00
Site Safety Materials	\$800.00	month	15	months	\$12,000.00

Table 8Other General Condition Costs

## BUILDING INFORMATION MODELING USE EVALUATION

## BIM USES FOR THE CONSTRUCTION MANAGER

BIM was used for 3D clash detection for the MEP's on this project. The architect created the Revit model that was used. BIM was not a requirement on the project, but because the MEP's are design-build, they decided that it would be an efficient way to start the coordination early. The mechanical contractor designed the duct work in the hallways and core first. They also inserted the mechanical units in the attic area. Then the electrical contractor designed their feeders, panel boards, electrical fixtures and lighting. Finally the plumbing and fire protection was added to the model to provide full MEP 3D coordination model. Running clash detection will eliminate MEP system conflicts allowing the tradesmen work more productively. The BIM manger of the 3D clash detection is the construction management company's project manager and two project engineers.

The modular units are created with low ceiling heights. The modular units have to be shipped to the site, so they must be able to fit under bridges and in tunnels. The maximum height of the unit is 11 feet. That means if the ceilings are 8 feet above finished floor, there is about a foot of space for the MEP systems. This is just another reason for more coordination.

## POTENTIAL BIM USES

Priority	Goal Description	Potential BIM Uses
3	Reduce Field Conflicts	3D Coordination (const)
3	Evaluate Phasing Plan	4D Modeling
2	Identify Concerns Between Modular and Architectural Design	3D Coordination (design), Design Reviews
2	Maintenance Technician Support	Building Maintenance Scheduling
2	Site Logistics Plan	Site Utilization Planning, 4D Modeling
1	Accurate Record Set	Record Modeling
1	Cost Evaluation	Cost Estimation

 Table 9

 Owner Goals, From BIM Execution Planning Guide

There are many other uses of BIM besides clash detection. After evaluating the BIM uses to find the owner's goals, Table 9 was created to show the main goals of the owner. Priority level goes from 3 (highest priority) to 1 (lowest). Other than reducing field conflicts, evaluating the phasing plan was of high priority. As previously stated there are 2 core phases and 5 modular phases. The efficiency of the phasing is extremely important to finishing the project on time. There is a design goal, constructability goal and operation goal with a medium priority. There are two main designers, and coordination between the architect and modular unit designer is important. Much like Penn State, Mansfield should use BIM features to attach easily accessible information with each mechanical and electrical unit. The site logistics will be used to ensure the site is safe and productive during the construction process. The low priority goals are having an accurate record model and cost evaluation.

Table 10BIM Use Matrix, From BIM Execution Planning Guide

Plan		Design		Construct		Operate
Programming		Design Authoring		Construction System Design	х	Building Maintenance Scheduling
Site Analysis	Х	Design Reviews	Х	Site Utilization Planning		Building System Analysis
	Х	3D Coordination	Х	3D Coordination		Asset Management
		Engineering Analysis		Digital Fabrication		Space Management
		Sustainability Evaluation		3D Control and Planning		Disaster Planning
		Code Validation		Record Modeling	Х	Record Modeling
Phase Planning	Х	Phase Planning	Х	Phase Planning		Phase Planning
Cost Estimation	Х	Cost Estimation		Cost Estimation		Cost Estimation
Existing Conditions Modeling		Existing Conditions Modeling		Existing Conditions Modeling		Existing Conditions Modeling

## BIM EXECUTION PLANNING PROCESS

\*See Appendix D for Level 1 BIM Planning Process

## COST ESTIMATION

Cost estimation is the process in which BIM can be used to assist in the generation of accurate quantity take-offs and cost estimates.

Role Players:	Owner	High
	Construction Manager	High
	Architect	Medium

Cost estimation was needed in the design phase. The owner needed the construction manager to provide some value engineering. The CM could have used BIM to quickly estimate price changes.

## DESIGN REVIEWS

Design review is the process in which stakeholders view a 3D model and provide their feedbacks to validate multiple design aspects.

Role Players:	Owner	High
	Architect	High
	Modular Designer	High
	MEP Design-Builders	Low

Coordination between the architect and the modular designer was very important. The owner also needed to know what was being designed would fulfill the building's purpose.

## PHASING PLAN

Phasing planning is the process in which a 4D model (3D models with the added dimension of time) is utilized to effectively plan the phased occupancy in a renovation, retrofit, addition, or to show the construction sequence and space requirements on a building site.

Role Players:	Construction Manager	High
	All Subcontractors	High

By providing a 4D model of the different phases of the project, the construction manager would make sure that the subcontractors are aware of the construction process. Also collaboration with between the subcontractors will allow the process to move without any speed bumps.

### SITE UTILIZATION PLANNING

Site utilization planning is the process in which BIM is used to graphically represent both permanent and temporary facilities on site during multiple phases of the construction process.

Role Players:	Construction Manager	High
	All Subcontractors	Medium
	Owner	Low

The construction manager will generate site usage plans for temporary and permanent facilities. By providing these plans for the subcontractors, they will know where things are moving on site and the space they require as the construction progresses. This knowledge automatically makes everyone onsite safer.

### BUILDING MAINTENANCE SCHEDULING

Building maintenance scheduling is the process in which the functionality of the building structure and equipment serving the building are maintained over the operational life of a facility.

Role Players:

Owner Construction Manager All Subcontractors High High Medium

The university will want to plan maintenance activities proactively and track maintenance history. The subcontractors will have to provide the information that the maintenance personnel needs for maintenance repairs.

### **RECORD MODEL**

Record Modeling is the process used to depict an accurate representation of the physical conditions, environment, and assets of a facility.

Role Players:	Owner	High
	Construction Manager	High

## CONSTRUCTABILITY CHALLENGES

The Mansfield University dormitories were designed with some construction challenges. The top three challenges this project faces are: (1) modular construction, (2) design-build subcontractor coordination, and (3) daily university operations. These issues place restrictions on the construction process. Because it is very early in construction on the project, not all of these challenges have been dealt with yet, but there is a plan on how to handle them when they arrive.

## MODULAR CONSTRUCTION

Modular construction was used on these dormitory buildings to shorten the project schedule and increase quality. There are limitations to modular construction, though; one has been noted in the BIM section. The space above the ceiling is limited. 3D coordination was used to solve that limitation. There are a few other issues that still need to be addressed.

## FAMILIARITY

Mansfield University is located in north central Pennsylvania. The closest big city is New York City and it takes over four hours to drive there. Modular construction is most popular in large cities where there is very little site for storage. Modular construction companies tend to have their offices close to these large cities. Most of the subcontractors are local contractors that rarely have the opportunity to work on a modular construction project. There could be expected details from the modular contractor that the other subcontractors are unfamiliar with. The key to this challenge is communication.

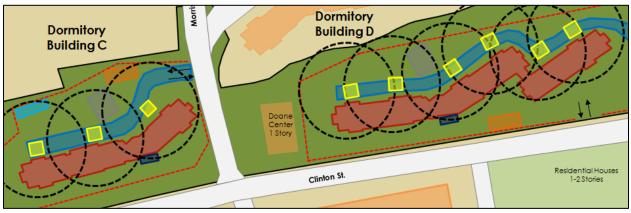
The construction management company has previously built a modular elementary school. The construction company decided to use the same project manager from the elementary project on this dormitory project. The project manager learned many things from the previous job and the most important thing was coordination. There should be no confusion.

The CM has a weekly meeting with the owner and architect to review construction progress and discuss any issues. The CM also has weekly subcontractor meetings, where foremen from every contractor onsite meet to coordinate. The schedule will be reviewed at these meetings to make sure that everyone is hitting their dates. If there is confusion about the construction, communication during these meetings will help to resolve it. The mentality that is preached by the project management team is "everyone should be willing to compromise and the entire site should come to together to fix any issues." Subcontractor buy-in to this mentality will help the project move past issues faster.

The modular subcontractor will take most of the coordination off of the rest of the subcontractors. They are responsible for making all of the connections between the units. Also before the units leave the site, they check that every connection is in the right location to connect to each other when assembled. All of this work by the modular contractor will allow for easier integration of the other subcontractors.

## CRANE

To set the modular units, a 100 ton crawler crane will be used. Site logistics had to be planned for this sized crane. Eight crane pads were created at specific locations so the crane can reach every spot on the building. The swing radius of the crane is over 100 feet. Safety must be the main concern, while the crane setting the modular units. The delivery of the units must be figured into the site logistics also. There will be a gravel path created so the oversize loaded truck can make its way to the crane.



**Figure 8 Site Plan** Modular Site Logistics



Figure 9 Modular Unit Setting Picture Courtesy of Texas Construction.com

## DESIGN-BUILD SUBCONTRACTORS

The mechanical/plumbing, electrical and fire protection subcontractors have a designbuild contract with the construction manager. They are in charge of designing their company's part of construction. The modular contractor has all of the MEP's in the rooms, so all these contractors must do is connect each room to the mains in the hallways and each main to the right pieces of equipment. It sounds simple, but there was a lot of coordination done before the modular units were set into place.

## BIM

As previously noted, BIM 3D coordination was used to design the remaining MEP's. After all of the subcontractors bought in to the 3D coordination, the HVAC system was designed first, then electrical, then plumbing and finally fire protection. The space between the ceilings and the floor above were so small that BIM all of the subcontractors saw the value in creating the model. Each contractor created their systems in Revit, and then clash detection was used. The contractors would change their systems accordingly, and the clash detection would be run through the model again. Once there were no clashes, the model was finished and the final design was complete.

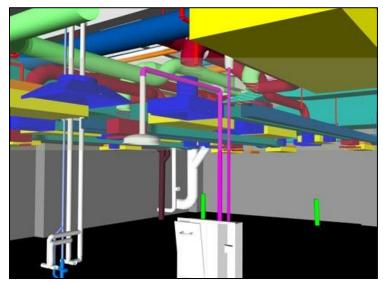


Figure 10 Clash Detection Picture Courtesy of Allied Fire Protection

The BIM model allowed each subcontractor to see exactly where their work should be placed. Problems were avoided and the project should move faster. Because all of the MEP subcontractors saw the value in 3D coordination, the result will be a smoother and quicker construction process.

## DAILY UNIVERSITY OPERATIONS

There were guidelines set by the university that the construction manager had to follow during the construction process. All of these guidelines make sure that normal university operations would not be altered by the construction. There are two different sets of people that are considered: students and university employees.

## STUDENTS

While the students are taking classes, they provide many challenges for construction manager. The first and most important concern for the students is their safety. The 8 foot tall site fence will provide a barrier between pedestrian areas and construction areas. Also, a covering is placed on the fence. The university wanted a barrier from seeing the construction site from the outside. There are gates at both sites that will be locked whenever there is no construction going on. Security cameras will be used to monitor both sites after construction hours. The last thing the university needs is a student to hurt themselves on the construction site while no one is working.

Keeping existing sidewalks open is also important for the university. Building D's site is in between two dorms and the fitness center. A new sidewalk path was created to direct these students around the site to the fitness center. Also right next to Building D's site is an existing building called the Doane Center. The Doane Center has a door that exits toward the site fence. The sidewalk that provided a path to the door was demolished during site grading and a temporary one was provided, Figure 11. At no point in time will sidewalk be used for storage or parking for any construction activities. This will be explained at the site orientation that every construction worker must complete in order to work onsite.

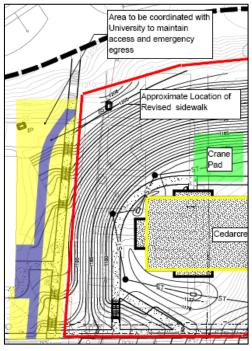


Figure 11 Doane Center Access

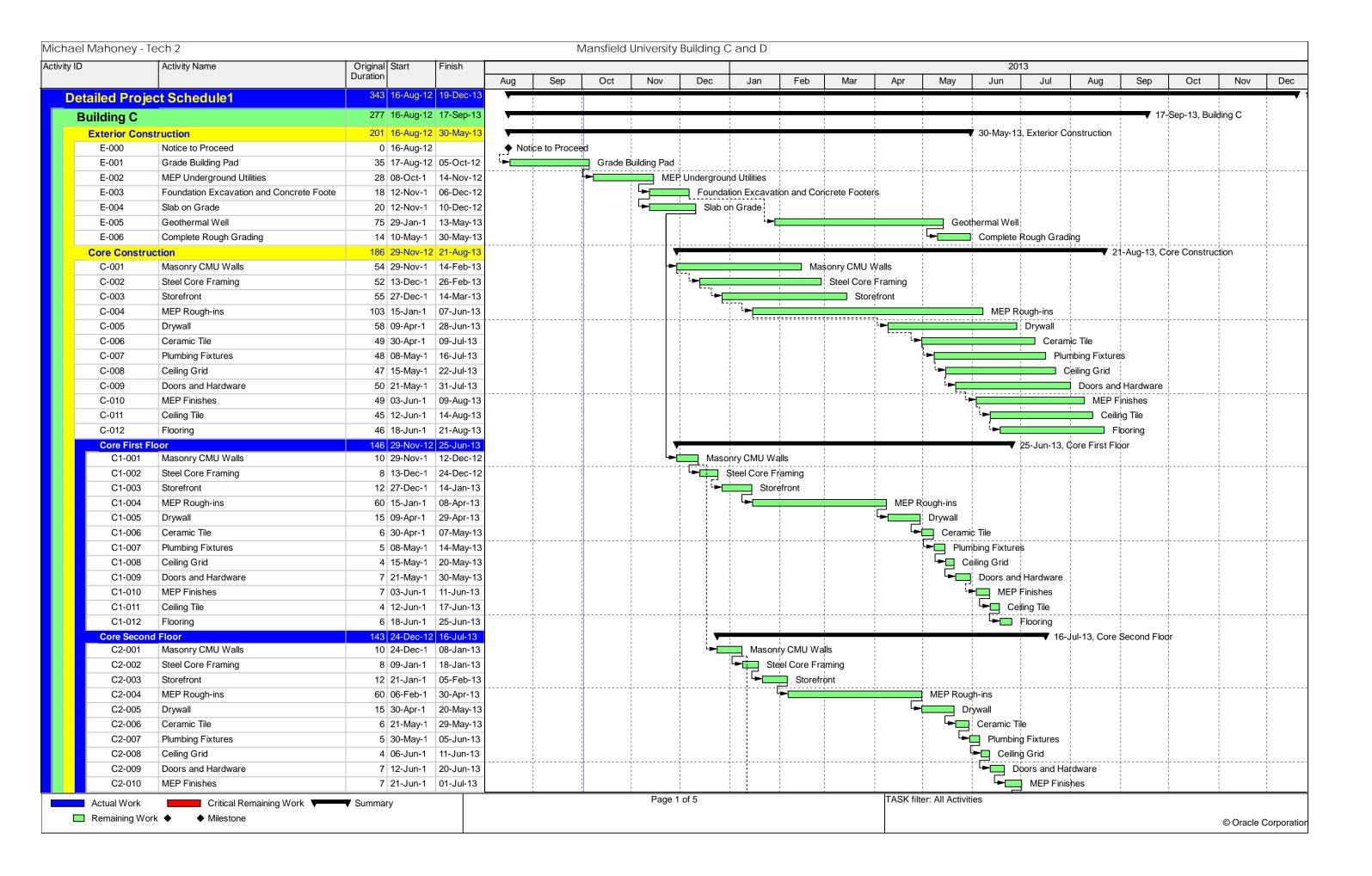
## UNIVERSITY OPERATIONS

University teachers and maintenance must be able to do their job. This means that parking is available for them. Construction workers will only be allowed to park in the designated construction parking areas. There are two lots that are provided for workers. Also, no streets may be blocked due to construction deliveries or services. Gates are kept clear so there is no construction traffic backed up onto the road. The delivery of the modular units will be scheduled so that, as one truck leaves, the next one is arriving. There is not enough space onsite to park multiple delivery trucks. The modular subcontractor must keep their deliveries to this strict schedule.

When shutting down any services for other buildings, the university must be notified two weeks in advance. They need to give their employees and students notification in advance. There will be tie-ins to the electric and water that will affect the two dorms east of Building D. Those tie-ins will be scheduled once the main equipment is installed but will still be two weeks in advance. Once the date is set, the subcontractors will be obligated to tie in at that time.

## APPENDIX A

## DETAILED PROJECT SCHEDULE



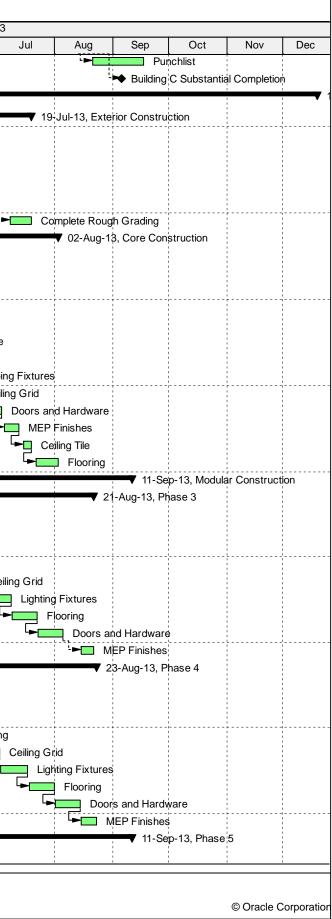
ity ID		Activity Name	Original	Start	Finish											
			Duration			Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
	C2-011	Ceiling Tile		02-Jul-13*		_									1	
	C2-012	Flooring		09-Jul-13*			, , ,		1	1					I	
	Core Third Fl				09-Aug-13		, , ,		, , ,	1   						-+
	C3-001	Masonry CMU Walls			31-Jan-13	_	 		1	1			CMU Walls		1	
	C3-002	Steel Core Framing			12-Feb-13				1	1			el Core Frami	ng	1	
	C3-003	Storefront			28-Feb-13		   			1 1 1			Storefront		1	
	C3-004	MEP Rough-ins			23-May-13	_	   									MEP Rou
	C3-005	Drywall		24-May-1					i   							
	C3-006	Ceramic Tile			24-Jun-13	_	!   			1					1	¦ <b>⊢</b>
	C3-007	Plumbing Fixtures			01-Jul-13		   			i i i					1	[
	C3-008	Ceiling Grid		02-Jul-13*			   		1	1					4	
	C3-009	Doors and Hardware		09-Jul-13*			-   			1					I.	
	C3-010	MEP Finishes		18-Jul-13*			   		   	     		     	   		, , ,	
	C3-011	Ceiling Tile	4	29-Jul-13*	01-Aug-13		 			1 1 1					1	
	C3-012	Flooring		-	09-Aug-13		1 1 1 1		1	1 1 1					1	
	Core Fourth C4-001	Floor Masonry CMU Walls			21-Aug-13 14-Feb-13	_					L		asonry CMU V	/alle		-
	C4-001 C4-002	Steel Core Framing			26-Feb-13	_					-		Steel Core		1	
	C4-002 C4-003	Storefront			14-Mar-13		     		, ,	, , ,	'       		Steel Core		;	
		MEP Rough-ins			07-Jun-13	_	   		1	1	1			non	. <u> </u>	
	C4-004					-			1	1	1					
	C4-005				28-Jun-13	-	 		1	1 1 1					1	
	C4-006	Ceramic Tile		01-Jul-13*											1	
	C4-007	Plumbing Fixtures		10-Jul-13*					; ;						¦	
	C4-008	Ceiling Grid		17-Jul-13*		-									, 1	
	C4-009	Doors and Hardware		23-Jul-13*		_	   			i i i					1	
	C4-010	MEP Finishes		-	09-Aug-13				1	1	1				4	
	C4-011	Ceiling Tile		-	14-Aug-13	-									1	
	C4-012	Flooring		-	21-Aug-13				¦ 						<u>.</u>	
	Nodular Const	ruction			06-Aug-13		   		1		1		1			
	Phase 1 M-1001	Set Modular Units		28-Dec-12	01-Jul-13 22-Feb-13								Set Modular	Inito		-
	M-1001 M-1002	MEP Rough-ins		11-Jan-1	01-Apr-13	-				i E		;		MEP Rou	hh inn	
-	M-1002	Drywall		15-Feb-1	24-Apr-13	-				1			1		Drywall	
					08-May-13											
	M-1004	Painting Ceiling Grid			17-May-13	-	1 								Paintin	ng eiling Grid
_	M-1005	-			20-May-13										1	ighting F
_	M-1006	Lighting Fixtures				-	, 1 1									-
	M-1007	Flooring			29-May-13	-										Floorin
_	M-1008 M-1009	Doors and Hardware MEP Finishes		19-Apr-1 29-Apr-1	06-Jun-13 01-Jul-13				; 				 			Do
	Phase 1 Fi				21-May-13		1 1 1 1		1	-	1	1		-		21-May-1
		Set Modular Units			11-Jan-13	-	1 1 1 1		1		Set N	/odular Uni	l6		<b>▼</b> ∠	. I - Way- I
	M1-002	MEP Rough-ins	26	11-Jan-1	15-Feb-13		   			1			¦∶ EP Rough-ins		, (	
	M1-003	-			11-Mar-13								Drywa		1	
		Painting		11-Mar-1	22-Mar-13		, ,		;				· · · · · · · · · · · · · · · · · · ·	ainting	; i !	
		Ceiling Grid			01-Apr-13									Ceiling Gr	id	
		Lighting Fixtures		02-Apr-1	10-Apr-13				1					-	ig Fixtures	
		Flooring		11-Apr-1;	18-Apr-13		   									
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Jul	Aug	Sep	Oct	Nov	Dec
Ceiling	1 1				
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	V 09-Aug	-13, Core T	nira Floor		
ramic Tile					
Plumbing	Fixtures				
Ceiling					
	ors and Hard MEP Finishe				
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	21	-Aug-13, Co	ore Fourth Fl	oor	
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Ceram	hc Tile hbing Fixture	s			
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	Doors and				
	MEP F				
		boring			
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01-Jul-13,	Phase 1				
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Hardwar	ę				
MEP Finis					
e 1 First I	Floor				
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ty ID		Activity Name	Original	Start	Finish											
			Duration			Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Мау	Jun
		Doors and Hardware	6	19-Apr-1	26-Apr-13			, , ,	, , , ,					· •		1
	M1-009	MEP Finishes		29-Apr-1	21-May-13									L.	- <b>M</b>	IEP Finish
	·	cond Floor			11-Jun-13				1			l I	1		1	11
		Set Modular Units			25-Jan-13						▕┝──	Set Modula				
	M2-002	MEP Rough-ins	26	28-Jan-1	04-Mar-13	i i			1			<b>ا</b> ر ا	MEP Ro	1		
	M2-003	Drywall	17	05-Mar-1	27-Mar-13			1	1 1 1			1		Drywall		
	M2-004	Painting	10	28-Mar-1	10-Apr-13									Paint		
	M2-005	Ceiling Grid	7	11-Apr-1;	19-Apr-13										eiling Grid	
	M2-006	Lighting Fixtures	7	22-Apr-1	30-Apr-13										📕 Lighting Fi	xtures
	M2-007	Flooring	6	01-May-1	08-May-13				1					-	Floorin	ģ
	M2-008	Doors and Hardware	6	09-May-1	16-May-13			1		1						ors and
	M2-009	MEP Finishes	17	17-May-1	11-Jun-13											
	Phase 1 Th	ird Floor		-	25-Jun-13							-		_		-
		Set Modular Units	10	28-Jan-1	08-Feb-13				1			Set N	odular Units	6		
	M3-002	MEP Rough-ins	26	11-Feb-1	18-Mar-13								M	EP Rough-ir	าร่	
	M3-003		17	19-Mar-1	10-Apr-13									Dryw		
	M3-004			11-Apr-1;	· ·					{ !				· · · F · · · · · · · ·	Painting	+
		Ceiling Grid		25-Apr-1	03-May-13				1						Ceiling G	irid
		Lighting Fixtures		06-May-1	14-May-13				i 1 1	1						1
	M3-007			15-May-1	22-May-13			1		1						
		Doors and Hardware		23-May-1	-			1	1	i i i						Door
		MEP Finishes			25-Jun-13											
	Phase 1 Fo				25-Jul-13				1							
	·	Set Modular Units			22-Feb-13								Set Modula	r Í Inits		
		MEP Rough-ins							1	1				MEP Ro		
	M4-002 M4-003	-		02-Apr-1	24-Apr-13							-	j C		Drywall	
	M4-003	•											 		- +	
				25-Apr-1	08-May-13	-									Painting	T
		Ceiling Grid		09-May-1	-				1						Cei	
		Lighting Fixtures		10-May-1	-	- i									· _ ·	ghting F
	M4-007			21-May-1	-				- - 						· – – ·	Floori
		Doors and Hardware			06-Jun-13			   	 				4			
		MEP Finishes			01-Jul-13			1	1	1						
	ase 2				06-Aug-13											1
		Set Modular Units			31-Jan-13					, , ,		Set Mod	ular Units			
		MEP Rough-ins		06-Feb-1	02-Apr-13								ſ	MEP Ro		
		Drywall		03-Apr-1	30-Apr-13				; 	; ;	; {		۲ ۱	F	Drywall	
		Painting		01-May-1										4	P	ainting
		Ceiling Grid		22-May-1	04-Jun-13			1	1							Cei
		Lighting Fixtures		05-Jun-1	18-Jun-13											<b>&gt;</b>
		Flooring		20-Jun-1	03-Jul-13			1	1							-
		Doors and Hardware			16-Jul-13						¦ 				¥	¦ 
		MEP Finishes			06-Aug-13			1	1	1	1					
Faca	de				8 28-Jun-13								-			
F-0	0001	Exterior Masonry Veneer Phase 1			02-May-13			1	1 1 1	i i i	1				Exterior N	lasonry
F-C	0002	Exterior Masonry Veneer Phase 2			28-Jun-13										·►	
Final					17-Sep-13				- - 							
F-1	1001	Commissioning	20	17-Jul-13*	13-Aug-13								}			
	al Work	Critical Remaining Work	Summar	n.					Page 3	of 5	·	1		TASK fi	lter: All Activit	ties

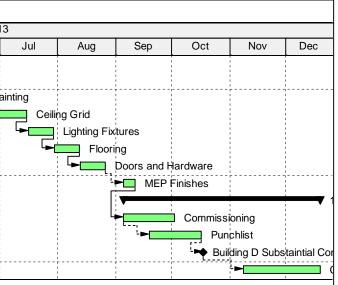
	A	Com	Ort	Neur	Dee
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3-Jun-13,					
Phase 1					
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			Sep-13, Fina		   
•	Comr	nissioning			
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ID	Activity Name	Original Duration	Start	Finish		-									
F-1002	Punchlist		21-Aug-1	17-Sep-13	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
F-1003	Building C Substantial Completion	0	217/091	05-Sep-13											
Building D		-	21-Sep-12	19-Dec-13		-	1				1		1	i 1	
			· · ·	19-Jul-13		-									
Exterior Con E-1001	Grade Building Pad			11-Oct-12			Crode	Duilding Do	J				, ,	+	- +
E-1001 E-1002	MEP Underground Utilities		21-Sep-12 12-Oct-1	15-Nov-12				Building Pat		und Utilities					
E-1002 E-1003	Foundation Excavation and Concrete Foote		12-0ct-1 19-0ct-1	13-Nov-12	_	,     			•	ndation Excav	ation and	Concrete For	tore		
E-1003 E-1004	Slab on Grade		19-001-1 14-Dec-1	13-Dec-12 24-Dec-12	_		-			Slab on Grac	1				
E-1004 E-1005	Geothermal Well		01-Feb-1	03-May-13	_				-					Geother	rmal V
E-1005 E-1006	Complete Rough Grading			19-Jul-13		, , ,	, , , , ,							Geother	
Core Constr				02-Aug-13		1 1 1									
Core Constr C-1001	Masonry CMU Walls			02-Aug-13					▼	Masor	ry CMU W				
C-1001 C-1002	Steel Core Framing		07-Jan-1	18-Jan-13		   					el Core Fr	1			
C-1002 C-1003	Storefront		31-Jan-1	20-Feb-13							1	Storefront			
C-1003	MEP Rough-ins		14-Feb-1	10-Apr-13										Rough-ins	
C-1004 C-1005	Drywall		11-Apr-1;	15-May-13	-	   						1			ywall
C-1005	Ceramic Tile		16-May-1	29-May-13											Ce
C-1000	Painting		16-May-1	05-Jun-13		1 1 1									
C-1007	Plumbing Fixtures		30-May-1	12-Jun-13	-	1 1 1									╤╛╵
C-1009	Ceiling Grid		06-Jun-1	12-Jun-13											
C-1010	Doors and Hardware		20-Jun-1	03-Jul-13		   									
C-1011	MEP Finishes			12-Jul-13									1		
C-1012	Ceiling Tile			19-Jul-13		, , ,							- - 		
C-1012	Flooring			02-Aug-13		   									
Modular Con				11-Sep-13						,					- +
Phase 3				21-Aug-13		     									
M-3001	Set Modular Units		01-Feb-1	26-Feb-13								Set Modula	r Units		
M-3002	MEP Rough-ins	43	27-Feb-1	26-Apr-13	-						-	,	1	MEP Roug	,h-ins
M-3003	Drywall	15	22-Apr-1	10-May-13		-   								Dryw	i i
M-3004	Painting	15	13-May-1	03-Jun-13		   	/						/   		F
M-3005	Ceiling Grid	15	03-Jun-1	21-Jun-13										[	+
M-3006	Lighting Fixtures	10	24-Jun-1	08-Jul-13		, , , ,							1		
M-3007	Flooring	10	09-Jul-13*	22-Jul-13											
M-3008	Doors and Hardware	10	23-Jul-13*	05-Aug-13									1		
M-3009	MEP Finishes	5	15-Aug-1	21-Aug-13		'     									
Phase 4		126	27-Feb-13	23-Aug-13			1					V	1	1	
M-4001	Set Modular Units	18	27-Feb-1	22-Mar-13	-						<b>له</b> ا	s s	et Modular I	1	-
M-4002	MEP Rough-ins		25-Mar-1	03-May-13	-	, 1 1							I <del>-</del>	🚊 MEP Ro	
M-4003	Drywall		03-May-1	23-May-13		   					   		<u> </u>		Drywa
M-4004	Painting	14	23-May-1	12-Jun-13										L <b>-</b>	_
M-4005	Ceiling Grid		12-Jun-1	02-Jul-13		   									L -
M-4006	Lighting Fixtures			17-Jul-13											-
M-4007	Flooring			31-Jul-13		1 1									
M-4008	Doors and Hardware		01-Aug-1	-		   					   		     	     	
M-4009	MEP Finishes			23-Aug-13			1			1					
Phase 5				11-Sep-13		   							1	1	
M-5001	Set Modular Units	15	25-Mar-1	12-Apr-13		1 1 1					1		Set N	Vodular Unit	S
Actual Work	Critical Remaining Work	-						Page 4	of 5				TASK fill	ter: All Activ	ities



Micha	el Mahoney - T	ech 2					Ν	lansfield	University	Building	C and D						
Activity I	ID	Activity Name	Original		Finish											20	013
			Duration			Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	T
	M-5002	MEP Rough-ins	20	15-Apr-1	10-May-13				•						MEP	Rough-ins	-
	M-5003	Drywall	14	13-May-1	31-May-13				1     				1     			Drywall	
	M-5004	Painting	15	03-Jun-1	21-Jun-13				 1 1	1	1		1 1 1		L		Paintir
	M-5005	Ceiling Grid	15	24-Jun-1	15-Jul-13											►	<u> </u>
	M-5006	Lighting Fixtures	10	16-Jul-13*	29-Jul-13				1					- - -			4
	M-5007	Flooring	10	30-Jul-13*	12-Aug-13	-											
	M-5008	Doors and Hardware	10	13-Aug-1	26-Aug-13	-			1 1 1								
	M-5009	MEP Finishes	5	05-Sep-1	11-Sep-13												
	Final		75	05-Sep-13	19-Dec-13												
	A1860	Commissioning	20	05-Sep-1	02-Oct-13												
	A1870	Punchlist	20	19-Sep-1	16-Oct-13												
	A1880	Building D Substaintial Completion	0		17-Oct-13												
	A1890	Close Out	29	08-Nov-1	19-Dec-13					 ! !			1 1 1	-,	- <del>-</del>	· · · · · · · · · · · · · · · · · · ·	

Actual Work Critical Remaining Work Summary	Page 5 of 5	TASK filter: All Activities
Remaining Work   Milestone		



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## APPENDIX B

## DETAILED STRUCTURAL ESTIMATE

	Cost / Unit	Units	Cost
Walls			
2x4 Studs	\$11.38 LF	209 LF	\$2,378.42
Openings add	\$3.80 LF	12 LF	\$45.60
Window, Studs and Header	\$39.75 EA	4 EA	\$159.00
2x10 Blocking around perimeter	\$3.32 LF	517 LF	\$1,716.44
Floor Joist			
2x10	\$2.05 LF	432 LF	\$885.60
Flooring			
3/4" Tongue and Groove OSB	\$1.81 SF FLR	s 507 SF FLR	\$917.67
1/4" Noise Isolation Underlayment	\$2.60 SF FLR	s 507 SF FLR	\$1,318.20
3/4" Butt Edge OSB	\$1.81 SF FLR	s 507 SF FLR	\$917.67
1/2" FIBERROCK	\$2.99 SF FLR	s 507 SF FLR	\$1,515.93
5/8'' T & G OSB	\$1.45 SF FLR	s 507 SF FLR	\$735.15
Exterior Panel			
1/2" Zip Board with 1" Foam Insul.	\$4.76 SF	167 SF	794.92
Ceiling Joists			
2x6	\$1.26 LF	306 LF	385.56
Total Structural Costs Per a Modular	Unit		\$11,770.16

## Structural Cost Per a Modular Unit

## Roofing

	Cost / Ur	nit L	Inits	Cost
Roofing				
Shingles	\$1.28 SF	74	9 SF	\$958.72
1/2" Zip Sheathing	\$1.13 SF	74	9 SF	\$846.37
Pre-engineered Roof Truss 59' Span	\$3.85 SF	53	9 SF	\$2,075.15
1-1/2"x16" LVL Roof Beams	\$3.34 SF	26	O SF	\$868.40
Roofing Cost per Modular Section				\$4,748.64

## Foundation

	Cost / U	nit	Un	its	Cost
Concrete					
4" Slab on Grade	\$117.00	CY	7	CY	\$819.00
Concrete Footers	\$110.00	CY	2	CY	\$220.00
#5 Rebar	\$1,065.50	Ton	0.038	Tons	\$40.49
#4 Rebar	\$1,106.50	Ton	0.233	Tons	\$257.81
Anchor Bolts	\$7.17	ΕA	16.66	EA	\$119.45
Masonry					
8" Bond Beam, Grout Included	12.07	LF	18	LF	\$217.26
14" Thick 8x16 CMU	\$15.30	SF	45	SF	\$688.50
8" Thick 8x16 CMU	\$9.30	SF	180	SF	\$1,674.00
Steel					
HSS 6x6x3/8 Column	\$360.00	ΕA	2	ΕA	\$720.00
1-1/4" x 14" x 14" Column B. Plate	\$1.89	lb	140	lbs	\$264.60
W 14x61 Steel Beams	\$0.33	lb	2440	lbs	\$805.20
Wood					
Double 2.8 Sill	\$6.40	LF	18	LF	\$115.20
Foundation Costs per Modular Sect	ion				\$5,941.52

## Structural Cost per a Modular Section

	Cost Per Floor	No. of Floors	Total Cost
Cost of Modular Unit	\$11,770.16	4 Floors	\$47,080.64
Cost of Roofing	\$4,748.64	1 Floors	\$4,748.64
Cost of Foundation	\$5,941.52	1 Floors	\$5,941.52
Structural Cost per a N	Nodular Section		\$57,770.80

## Total Modular Structural Cost of Both Buildings

Cost per Modular Section	No. of Sections	Total Cost
\$57,770.80	74	\$4,275,039.20

## APPENDIX C

## GENERAL CONDITIONS ESTIMATE

	· · · · · · · · · · · · · · · · · · ·		
	Cost per Unit	Units	Cost
01 31 13.20			
Project Executive	\$4,850.00 week	12 week	\$58,200.00
Project Manager	\$3,275.00 week	60 week	\$196,500.00
Project Engineer	\$1,300.00 week	96 week	\$124,800.00
Project Assistant	\$1,150.00 week	32 week	\$36,800.00
Safety Coordinator	\$1,150.00 week	8 week	\$9,200.00
Superintendent	\$3,050.00 week	120 week	\$366,000.00
Forman	\$650.00 week	60 week	\$39,000.00
01 31 13.30	\$030.00 WEEK	00 Week	\$37,000.00
Insurance	0.40% ich	\$25,000,000,00 ich	¢140.000.00
01 31 13.90	0.40% job	\$35,000,000.00 job	\$140,000.00
Performance Bond	1 E0% ich	\$25,000,000,00 ich	¢E2E 000 00
	1.50% job	\$35,000,000.00 job	\$525,000.00
01 41 26.50 Permits	1.25% iob	\$25,000,000,00 ich	¢ 427 E00 00
	1.25% job	\$35,000,000.00 job	\$437,500.00
01 51 13.80 Temporary Heat, 12 hrs/day	\$46.00 csf flr	2150 csf flr	\$98,900.00
Lighting, wiring, outlets	\$40.00 Csi fir	2150 CSI III 2150 CSI flr	\$98,900.00 \$47,300.00
Power for Lighting	\$1.01 csf flr	2150 Csf flr	\$47,300.00
Temporary Power	\$1.01 Csi iii \$51.50 csf flr	2150 Csf flr	\$110,725.00
Temporary Water	\$69.50 month	15 months	\$1,042.50
01 52 13.20	\$09.30 1101111	15 11011018	\$1,042.50
Office Trailer 32' x 8'	\$203.00 month	15 months	\$3,045.00
Air Conditioning	\$45.50 month	4 months	\$3,043.00
Storage Boxes, 20' x 8'	\$79.00 month	90 months	\$7,110.00
01 52 13.40	\$77.00 1101111	70 months	\$7,110.00
Office Equipment	\$220.00 month	15 months	\$3,300.00
Office Supplies	\$82.50 month	15 months	\$1,237.50
Telephone/Internet Service	\$89.00 month	15 months	\$1,335.00
01 54 19.50	\$67.66 Hieritin		\$1,000.00
100-ton Crawler Crane	\$ 3,625.00 day	75 day	\$271,875.00
01 54 23.70	\$ 0,020.00 day	10 003	\$271,070.00
Scaffolding	\$ 217.00 csf	904 csf	\$196,168.00
01 54 36.50	÷ 217.00 001	761 831	\$176,166.66
Crane Mobilization	\$ 1,425.00 ea	1 ea	\$1,425.00
01 55 23.50			+ . ,
Gravel Road	\$ 14.45 sy	2595 sy	\$37,497.75
01 56 13.90			
Winter Trap Protection	\$ 2.55 sf	904 sf	\$2,305.20
01 56 26.50			
Temporary Fencing	\$ 9.25 lf	2740 lf	\$25,345.00
01 74 13.20			
Cleanup After Job Completion	0.60% job	\$35,000,000.00 job	\$210,000.00
01 93 08.50			
Gator, Gas Powered	\$ 5,600.00 ea	1 ea	\$5,600.00
Construction Truck	\$ 500.00 month	30 months	\$15,000.00
Others			\$0.00
Sanitation	\$ 500.00 month	15 months	\$7,500.00
Recycling/Waste	\$ 2,400.00 month	15 months	\$36,000.00
Site Safety Materials	\$ 800.00 month	15 months	\$12,000.00
			\$3,030,064.45

01	21 Allowances										
	21 57 - Overtime Allowance		1	р	· ·						Total
01 21	57.50 Overtime		Crew	Daily Output	Labor- Hours	Unit	Material	2012 B Labor	are Costs Equipment	Total	Incl 0&
0010 0020	OVERTIME for early completion of projects or where labor shortages exist, add to usual labor, up to	R012909-90				Costs		100%			
	11 61 - Cost Indexes										
01 21	61.20 Historical Cost Indexes										
0010	HISTORICAL COST INDEXES (See Reference Section)		<u> </u>	1							
	21 63 - Taxes				et 1						
01 21	1 63.10 Taxes										
0010	TAXES	R012909-80									
0020	Sales tax, State, average					%	5.07%			Network 21	
0050	Maximum	R012909-85					9.25%				
0200	Social Security, on first \$110,100 of wages							7.65%			
0300	Unemployment, combined Federal and State, minimum							.80%			
0350	Average							7.80%			
	Aaximum					¥		14.36%			

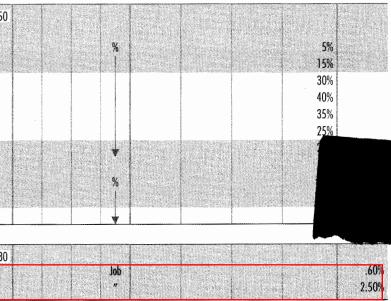
## **Project Management and Coordination**

## Rate Geographic Herley

0010	FIELD PERSONNEL					
0020	Clerk, average		Week	420	420	650
0100	Field engineer, minimum			995	995	
0120	Average			1,300	1,300	2,000
0140	Maximum			1,475	1,475	1 .
0160	General purpose laborer, average			1,375		2,125
0180	Project manager, minimum			1,850		2,850
0200	Average			2,125	2,125	
0220	Maximum			2,425	Man Torrest, of the first of the second state	3,750
0240	Superintendent, minimum			1,800		2,775
0260	Average			1,975		3,050
0280	Maximum			2,250	2,250	3,475
0290	Timekeeper, average		*	1,150	1,150	1,775
01 31	13.30 Insurance					
0010	INSURANCE	R013113-40				
0020	Builders risk, standard, minimum		Job			.2
0050	Moximum	R013113-60				.6.
0200	All-risk type, minimum					.2
0250	Maximum		·····			.6
0400	Contractor's equipment floater, minimum		Value			.5
0450	Maximum		//			1.5
0800	Workers' compensation & employer's liability, average					
0850	by trade, carpentry, general		Payroll	14.96%		
0900	Clerical			.49%		
0950	Concrete			12.70%		
1000	Electrical			5.58%		
1050	Excavation	<ul> <li>A set of the product of the second state of the secon</li></ul>		9.01%		
1100	Glozing			12.57%		
1150	Insulation			11.85%		
1200	Lathing			7.82%		
1250	Mosonry			12.10%		

# 01 31 Project Management and Coordination 01 31 13 – Project Coordination

04 24	1 13.30 Insurance		Crew	Daily Output	Labor- Hours	Unit	Materia	2012 Ba Labor	re Costs Equipment	Total	Total Incl O&
1300	Painting & decorating			Vulpu	CIUUII	Payroll		10.70%	LUCIPIII		
1350	Pile driving					Tuyton		16.76%			
1400	Plastering							10.78%			
1400	Plumbing			27 UPDE EST				6.91%			
1500	Roofing				1.001.004.41.44			28.83%		A 14 M sugar	
1550	Sheet metal work (HVAC)		e prime and		i a li a um u mayo			8.47%			N 001 10 10 10 10 10 10 10 10 10 10 10 10
1600	Steel erection, structural		an a su a					36.86%			
1650	Tile work, interior ceramic							8.01%			
1700	Waterproofing, brush or hand caulking							6.41%			
1800	Wrecking							30.43%			
2000	Range of 35 trades in 50 states, excl. wrecking, min.							1.80%			
2100	Average		901290290391913919 90129293939391913939 9012929393939391913939	d ddar ffyr yn yn		HIGH HERE THE PARTY COLUMN TO MARKED		13.70%			
2200	Maximum			* *				124.10%		SA ESA MAN	
_								124.10/0			<u> </u>
en namen avere	1 13.40 Main Office Expense								ar in the state		
)010	MAIN OFFICE EXPENSE Average for General Contractors	R013113-50									
020	As a percentage of their annual volume					N 11-1				200/	
0030	Annual volume to \$300,000, minimum					% Vol.				20%	
)040	Maximum									30%	
060	To \$500,000, minimum			*			ore Law Deel and			17% 22%	
0070	Maximum		stagend the other se							8	
0800	To \$1,000,000, minimum		PD-0000-044 mile							16% 19%	
)090 1110	Maximum		CUCCONANAJINA CUCCONANAJINA	-			turi a contribution	u musuli bib princi animini si s no fi lo la fazzari e si		19%	
)110	To \$3,000,000, minimum									Eminer Friet, hus well and the fight	
0120										16%	
0130 0140	To \$5,000,000, minimum Maximum				1					8% 10%	
20201020100202	1 13.50 General Contractor's Mark-Up			n und and sink a	(uilliðlðincsma)						
0010	GENERAL CONTRACTOR'S MARK-UP on Change Orders										
						07					10%
0200	Extra work, by subcontractors, add					%					10%
0250	By General Contractor, add										15% 5%
)400	Omitted work, by subcontractors, deduct all but										7.5
0450	By General Contractor, deduct all but										
0600 0650	Overtime work, by subcontractors, odd		111141								15% 10%
	By General Contractor, add					*					107(
CONTRACT D	1 13.70 Overhead		AND A COLOR			March 19					
)010	OVERHEAD As a percent of installing contractors direct costs	R013113-50									
)040	Includes an allowance for home affice expenses, FICA,										
060	Risk & public liability insur. and unemploy.; minimum			[]		%				5%	
080	Average			Page 1						15%	
)100	Maximum		al training and the second secon	ad ad control of						30%	
0120	With profit allowance, by size of project; under \$50,000	)	N BIR RESERVENCE							40%	
0140	\$50,000 to \$100,000		-	- Alle dans out of the	MULTING IN THIS					35%	And and a second se
0160	\$100,000 to \$500,000	interiora a concernent attendentita utrata a		added as here are used		กรที่ประเศษาย์ เป็นเราะ		NAMES AND ADDRESS OF A DESCRIPTION		2 <u>5%</u>	e riseries
0180	\$500,000 to \$1,000,000					Ŵ					
)200	Mark-up on general contractors total incl. O&P for										
)220	Handling subcontract; minimum					%					
)240	Average										
0260	Maximum					¥					
)1 31	1 13.90 Performance Bond										
010	PERFORMANCE BOND	R013113-80									
Endlighter	For buildings, minimum					dol					.6
0020				A CONTRACTOR OF A CONTRACTOR OFTA CONTRACTOR OFTA CONT	Statutu galant	FROM THE REAL PROPERTY OF THE	THE PERSON DEPARTMENT	A STARLEY AND A ST		STREET FRAME PROFESSION	CONTRACTOR OF A



# 01 32 Construction Progress Documentation 01 32 13 – Scheduling of work

01 30	2 13.50 Scheduling	Crew	Daily Output	Labor- Hours	Unit	Material	2012 E Labor	Sare Costs Equipment	Total	Total Incl O&P
0010	SCHEDULING						LUVVI	Ederburgu		
0020	Critical path, as % of architectural fee, minimum		Į.		%					.50%
0100	Maximum				"					1%
0300	Computer-update, micro, no plots, minimum				Ea.				455	500
0400	Including plots, maximum				"				1,450	1,600
0600	Rule of thumb, CPM scheduling, small job (\$10 Million)		14. Allen (16. colored)		Job					.05%
0650	Large job (\$50 Million +)									.03%
0700	Including cost control, small job	יייינע איז איז אין איז אין איז אין איז איז אין איז		5.0325-3444	-15-11-0-0-00	การ.การสารสารสาร			an a	.08%
0750	Large job				*					.04%
01	32 33 - Photographic Documentatio	n –								
01 39	2 33.50 Photographs									
0010	PHOTOGRAPHS						ידי ביד גינע אינע אינע אינע אינע אינע אינע אינע א			
0020	8" x 10", 4 shots, 2 prints ea., std. mounting				Set	475			475	520
0100	Hinged linen mounts					530			530	580
0200	8" x 10", 4 shots, 2 prints each, in color					415			415	460
0300	For I.D. slugs, add to all above	40 10			A F MARLAND LINDS VID	5.30			5.30	5.85
0500	Aerial photos, initial fly-over, 6 shots, 1 print ea., 8" x 10"					845			845	925
0550	11" x 14" prints			A MAA M Ange mangeman	Canada canada andar	1,025			1,025	1,125
0600	16" x 20" prints					1,200	a. 100 a December 101 (100). 20030	1.1747-1240-01-01-01-01-01-01-01-01-01-01-01-01-01	1,200	1,325
0700	For full color prints, add					40%				40%
0750	Add for traffic control area				7	305			305	335
0900	For over 30 miles from airport, add per				Mile	5.45			5.45	6
1000	Vertical photography, 4 to 6 shots with	가 있는 것이 있 같은 것이 있는 것 같은 것이 있는 것 같은 것이 있는 것이 없는 것이 있는 것이 없는 것이 있는 것이 없는 것이 있는 것이 없는 것이 있는 것이 없는 것이 있다. 것이 없는 것이 없는 것이 없는 것이 없는 것이 없는 것이 없는 것이 있 것이 없는 것이 없다. 것이 없는 것이 있 것이 없는 것이 없는 것이 없는 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없는 것이 없 있 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없는 것이 있 않은 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없이 없이 없이 없다. 것이 없는 것이 있 것이 없는 것이 없는 것이 없는 것이 없는 것이 없는 것이 없다. 것이 없는 것이 없는 것이 없이 않이								
1010	different scales, 1 print each				Set	1,125			1,125	1,225
1500	Time lapse equipment, camera and projector, buy					845			845	930
1550	Rent per month		Audior of the second		Ŵ	305			305	335
1700	Cameraman and film, including processing, B.&W.	ריינייט אין	and the second second		Day	1,375		H. Shiki keli si kecimper ngaras cinina	1,375	1,525
1720	Color				"	1,375			1,375	1,525

# 11 Regulatory Requirements 26 – Permit Requirements

<b>01</b> 41 26.50 Permits		
0010 PERMITS		
0020 Rule of thumb, most cities, minimum	doL	.50%
0100 Maximum	"	2%

# 01 45 Quality Control 01 45 93 – Testing and Inspecting Services

01	45	23.5	0 1	es	ting

0010 0015	TESTING and Inspecting Services For concrete building costing \$1,000,000, minimum	Project		4,725	5,200
0020	Maximum			38,000	41,800
0050	Steel building, minimum			4,725	5,200
0070	Maximum		in a fa f	14,800	16,300
0100	For building costing, \$10,000,000, minimum	a para daga daga Panga		30,100	33,100
0150	Maximum			48,200	53,000
0200	Asphalt testing, compressive strength Marshall stability, set af 3	Εσ.		145	165
0220	Density, set of 3			86	. 95
0250	Extraction, individual tests on sample			136	150

# 01 45 Quality Control 01 45 23 – Testing and Inspecting Services

0300	5 23.50 Testing Penetration
0350	Mix design, 5 specimens
0360	Additional specimen
0400	Specific gravity
0400	Swell test
0420	
0430	Water effect and cohesion, set of 6
	Water effect and plastic flow
0600	Concrete testing, aggregates, abrasion, ASTM C 131
0650	Absorption, ASTM C 127
0800	Petrographic analysis, ASTM C 295
0900	Specific gravity, ASTM C 127
1000	Sieve analysis, washed, ASTM C 136
1050	Unwashed
1200	Sulfate soundness
1300	Weight per cubic foot
1500	Cement, physical tests, ASTM C 150
1600	Chemical tests, ASTM C 150
1800	Compressive test, cylinder, delivered to lab, ASTM C 39
1900	Picked up by lab, minimum
1950	Average
2000	Maximum
2200	Compressive strength, cores (not incl. drilling), ASTM C 42
2250	Core drilling, 4" diameter (plus technician)
2260	Technician for core drilling
2300	Patching core holes
2400	Drying shrinkage at 28 days
2500	Flexural test beams, ASTM C 78
2600	Mix design, one batch mix
2650	Added trial batches
2800	Modulus of elasticity, ASTM C 469
2900	Tensile test, cylinders, ASTM C 496
3000	Water-Cement ratio curve, 3 batches
3100	4 batches
3300	Masonry testing, absorption, per 5 brick, ASTM C 67
3350	Chemical resistance, per 2 brick
3400	
3420	Compressive strength, per 5 brick, ASTM C 67
3440	Efflorescence, per 5 brick, ASTM C 67
3470	Imperviousness, per 5 brick
3500	Modulus of rupture, per 5 brick
3550	Moisture, block only
4100	Mortar, compressive strength, set of 3
이 바이고 아이에 바랍니다.	Reinforcing steel, bend test
4200	Tensile test, up to #8 bar
4220	#9 to #11 bar
4240	#14 bar and larger
4400	Soil testing, Atterberg limits, liquid and plastic limits
4510	Hydrometer analysis
4530	Specific gravity, ASTM D 354
4600	Sieve analysis, washed, ASTM D 422
4700	Unwashed, ASTM D 422
4710	Consolidation test (ASTM D2435), minimum
4715	Maximum
4720	Density and classification of undisturbed sample

Ea. 11 182 201 36 41 41 42 36 41 41 42 64 70 182 200 64 70 136 150	and a second second	Сгеж	Daily Output	Labor- Hours	Unit	Material	2012 B Labor	are Costs Equipment	Tota!	Totái Incl O&P
36       44         41       44         64       70         132       200         64       77         136       150         42       46         775       850         59       65         59       65         114       125         200       320         320       350         245       270         12       13         14       15         18       20         21       13         14       15         15       16         12       13         14       15         15       20         160       21         161       23         17       30         22       24         23       25         162       22         163       20         164       80         259       259         259       259         259       259         250       259         163       200         164 <td></td> <td></td> <td></td> <td></td> <td>Ea.</td> <td></td> <td></td> <td></td> <td>41</td> <td>4</td>					Ea.				41	4
41       44         64       77         182       200         136       150         42       44         775       850         59       65         59       65         59       65         114       125         320       320         320       320         320       320         320       320         320       320         320       320         320       320         34       40         320       320         320       320         34       40         320       320         34       40         320       320         34       40         320       320         331       14         15       18         45       50         164       180         35       50         164       180         45       50         164       180         45       50         164       180	NEL M								the state of the s	
64       77         82       200         64       77         136       150         42       64         775       850         50       55         59       65         114       125         320       320         321       336         40       320         320       320         321       13         14       15         15       14         16       23         22       245         270       32         14       15         15       18         20       23         14       15         15       14         16       23         17       30         27       30         27       30         28       259         29       255         29       255         164       150         164       160         170       132         164       160         170       132         180 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>Annual of the second</td> <td></td> <td>Webnander William</td> <td>1</td> <td></td>						Annual of the second		Webnander William	1	
1       182       200         44       70         136       150         42       46         775       850         59       65         59       65         134       125         135       200         136       126         137       850         59       65         134       125         135       200         136       200         137       850         138       200         201       14         135       200         136       200         137       300         203       350         214       14         135       18         141       15         152       14         153       100         144       101         155       68         164       101         164       101         164       101         164       101         165       102         166       102         167				And the second states						
64       77         136       150         42       46         775       850         59       65         59       65         114       12         36       40         203       300         320       300         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         321       33         321       32         43       45         50       55         68       75         68       75         68       75         32       35 <tr< td=""><td></td><td></td><td></td><td>o rom parts</td><td></td><td>Malandan Age 1 Mal</td><td></td><td></td><td>Į.</td><td></td></tr<>				o rom parts		Malandan Age 1 Mal			Į.	
136       150         42       44         775       850         59       65         59       65         59       65         36       40         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         320       320         321       14         15       18         27       30         36       40         27       30         36       40         27       30         36       40         27       30         37       32         38       20         39       65         29       25         20       32         30       35         312       36         36       205         37       50         38 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>70</td>										70
775       850         50       55         59       65         114       125         320       350         2245       270         12       13         14       15         18       20         277       36         28       270         12       13         14       15         18       20         27       30         38       40         100       23         114       15         18       20         27       30         38       40         100       23         114       15         12       32         101       23         121       32         132       141         132       141         133       141         134       155         141       155         141       155         142       141         155       68         141       155         150       55									and the state of t	150
50         55           59         65           114         125           36         40           320         320           320         320           320         320           320         320           245         270           12         13           14         15           18         20           27         30           36         40           27         30           36         40           27         30           36         40           27         30           36         40           27         30           37         55           50         55           51         120           32         32           320         35           320         35           320         35           32         35           33         25           341         155           386         95           32         35           32         35 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>46</td></t<>										46
59       65         36       40         320       350         245       270         12       13         14       15         18       20         27       30         27       30         36       40         27       30         36       40         27       30         36       40         27       30         36       40         27       30         36       40         27       30         36       40         27       30         36       40         27       30         36       40         27       30         36       40         27       24         236       250         59       65         259       285         101       14         155       166         36       205         45       50         164       205         37       25         32       35<									standing of the second s	
59       65         36       40         320       350         245       270         12       13         14       15         12       13         14       15         27       30         27       30         27       30         27       30         27       30         28       250         Hr.       45         20       22         24       236         236       260         59       255         60       59         28       260         29       22         24       238         236       260         59       255         61       120         120       132         120       132         120       132         120       132         120       132         120       132         120       132         120       132         120       132         120       14	i - man gan gan an		9 VA Ma 2017 - F 198		of and in the				5	
114       125         320       330         245       270         12       13         14       15         12       33         14       15         12       30         245       270         12       13         14       15         15       36         40       27         30       36         40       23         25       36         41       23         25       25         26       59         27       30         36       40         164       23         25       259         259       255         259       255         210       132         121       14         155       50         164       180         45       50         50       55         68       75         68       75         32       32         32       35         32       35         32       <	N D'ABAAN PRO	Miking georem of a				A COMPANY - MANA		A TABLE - COMPLEX	-	
36         40           320         350           245         270           12         13           14         15           18         20           27         30           36         40           14         15           18         20           27         30           36         23           16         23           17         30           36         25           18         20           27         30           36         25           18         20           23         25           19         22           11         45           120         132           121         132           122         24           236         260           45         50           45         50           45         50           45         50           141         155           186         25           187         96           186         32           3					ad in the second	Mana Af Should be a			¢.	
320       350         245       270         12       13         14       15         18       20         27       30         36       40         17       13         18       20         27       30         36       40         17       30         36       40         18       20         27       30         36       40         17       30         36       40         17       35         22       24         23       25         10       23         11       15         12       12         13       141         15       164         164       100         164       150         168       205         168       205         168       205         161       153         153       68         164       153         155       61         168       255         175									AND A DESCRIPTION OF A	
245         270           12         13           14         15           18         20           27         30           36         40           11         45           12         13           14         15           15         36           16h         23           17         30           36         40           17         30           36         40           17         30           36         40           23         25           16         23           17         36           17         26           120         132           120         132           120         132           120         132           120         132           120         132           120         132           120         132           150         50           161         155           168         75           168         75           175         16									there is a second se	
12       13         14       15         18       20         27       30         36       40         17       30         36       40         18       23         25       4.         45       50         50       22         24       236         25       4.         44       50         50       59         65       259         259       285         120       132         164       180         45       50         45       50         46       205         45       50         46       205         45       50         46       205         45       50         50       55         68       75         86       95         32       35         32       35         33       36         40       41         45       61         44       48         55       60 <td>1</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>and the second se</td> <td></td>	1								and the second se	
Inch         14         15           Inch         23         25           Hr.         45         50           Eo.         22         24           236         260         259           Eo.         22         24           236         260         32           Image: Solution of the state s									P 12 - Contractor and a second second second	
Image: second	Bernelle Gebeure		Contraction of the local division of the loc	Yord on one on the					14	
Inch       36       40         Hr.       45       50         Ea.       22       24         236       260       259         257       259       285         120       132       164         141       155       186         141       155       186       205         45       50       45       50         141       155       186       205         143       164       180       141         155       186       205       68         75       68       75       68         75       68       75       68         76       86       95       32         32       35       23       25         55       61       36       40         41       45       55       61         44       48       55       60         59       65       59       65         109       120       44       48         55       60       59       65         59       65       55       60         59       <	and a second second	a din sa sad she	Alexandra Party Second			10 ( ) ( ) ( )	All sources and the sources of		ő í	
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Hr.         45         50           Ea.         22         24           236         260           59         65           259         285           120         132           164         180           45         50           120         132           164         180           45         50           141         155           186         205           45         50           45         50           46         205           68         75           68         75           86         95           32         35           32         35           32         35           32         35           32         35           32         35           32         35           33         25           55         61           44         48           55         60           59         65           109         120           44         48           55					W loch					
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164       180         45       50         141       155         186       205         45       50         45       50         45       50         45       50         45       50         45       50         45       50         45       50         50       55         68       75         68       75         87       96         32       35         32       35         32       35         32       35         32       35         32       35         32       35         32       35         32       35         33       40         41       45         64       70         59       65         109       120         44       48         55       60         59       65         55       60         59       65         430       475	-	d - Otto AND an provide	f Alde Adamson (A. Al	100 111 1-1 - 1 - 1 - 1 - 1 - 1 - 1 - 1					5	
141       155         186       205         45       50         50       55         68       75         68       75         86       95         32       35         23       25         55       61         36       40         41       45         64       70         55       61         36       40         41       45         55       61         36       40         41       45         55       61         36       40         41       45         55       61         36       40         41       45         64       70         59       65         109       120         44       48         55       60         59       65         250       275         430       475	LER NOR			HERE REAL	DECEMBER OF IN	and the second second	con 15 los este ser el seu	COLUMN OFFICIARY 1/1/1	164	
186       205         45       50         50       55         68       75         68       75         87       96         32       35         32       35         33       25         55       61         44       40         41       45         44       48         55       60         59       65         60       59         65       60         59       65         200       275         430       475										
45         50           50         55           68         75           68         75           87         96           32         35           23         25           55         61           36         40           41         45           64         70           55         61           36         40           41         45           64         70           55         61           44         48           55         60           59         65           250         275           430         475										
50       55         68       75         68       75         87       96         86       95         32       35         23       25         55       61         41       45         64       70         99       20         44       48         55       60         59       65         20       44         48       55         60       59         55       60         59       65         250       275         430       475										205
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## 01 45 Quality Control

014	5 23 – Testing and Inspecting Services									
		c		Labor-	Unit	Material		are Costs	Total	Total Incl O&P
The second se	Soil density, nuclear method, ASTM D2922	Crew	Output	ΠΟΟΙΣ	Ea.	Material	Labor	Equipment	35	38.50
4735	Solid density, indiced internoo, ASTM 02/922 Sond cone method ASTM D1556				LU.				27	30
4740 4750	Moisture content, ASTM D 2216								-, 9	10
4730	Permeability test, double ring infiltrometer								500	550
4800	Permeability, var. or constant head, undist., ASTM D 2434								227	250
4850	Recompacted		NA-AGE	acter o araição			nja jan i aizinazinazingen hinjen		250	275
4900	Proctor compaction, 4" standard mold, ASTM D 698				-				123	135
4950	6" modified mold								68	75
5100	Shear tests, triaxial, minimum								410	450
5150	Maximum				and a state of the second s		स्तुत्वात् सामगणमास्तुत्वार्थः सम्बद्धां सामग्रेत्वार्थ्वः सम्बद्धाः सम्बद्धाः सम्बद्धाः स्व		545	600
5300	Direct shear, minimum, ASTM D 3080								320	350
5350	Maximum								410	450
5550	Technician for inspection, per day, earthwork								320	350
5570	Concrete		o construction of						280	310
5650	Bolting		1.000		*****				400	440
5750	Roofing								480	530
5790	Welding				₩		a 19. ta un colarizza das processas en co		480	530
5820	Non-destructive metal testing, dye penetrant				Day				310	340
5840	Magnetic particle								310	340
5860	Radiography								450	495
5880	Ultrasonic				Ŵ		1997 - F. Aller F. (1997), ferfinisk 1998 - F. (1997), ferfinisk 1997 - F. (1997), fer		310	340
6000	Welding certification, minimum		-		Ea.				91	100
6100	Maximum				"				250	275
7000	Underground storage tank									
7500	Volumetric tightness test ,<=12,000 gal.		la de la companya de		Ea.			n en han sjerte de kant han te beste beiser.	435	480
7510	<=30,000 gal.				p .				615	675
7600	Vadose zone (soil gas) sampling, 10-40 samples, min.				Day				1,375	1,500
7610	Maximum	14 6 6 7 19 19 19 19 19 17 9 6 6 19 19 19 19 19 17 9 9 7 19 19 19 19 19 19 19 9 9 7 19 19 19 19 19	l		<i>ø</i> 				2,275	2,500
7700	Ground water monitoring incl. drilling 3 wells, min.				Total "		nen en de la calendaria (distan 1993) : la calendaria (distan 1997) : la calendaria (distance) 1997) : la calendaria (distance) 1997) : la calendaria (distance)		4,550	5,000
7710	Maximum								6,375	7,000
8000	X-ray concrete slabs				Ea. ″				182	200
9000	Thermographic testing, for bldg envelope heat loss, average 2,000 S.F.		******		"					500

## **Temporary Utilities**

## Union ISI - Temporary Electricity

01 51	13.80 Temporary Utilities								
0010	TEMPORARY UTILITIES			al anta provinsi pola alternative provinsi alternative provinsi alternative provinsi alternative provinsi provinsi provinsi alternative provinsi provinsi provinsi alternative provinsi provinsi provinsi alternative provinsi provinsi provinsi alternative provinsi provinsi provinsi provinsi provinsi provinsi alternative provinsi					
0100	Heat, incl. fuel and operation, per week, 12 hrs. per day	1 Skwk	100	.080	CSF Flr	36.50	3.63	40.13	46
0200	24 hrs. per day	"	60	.133		69.50	6.05	75.55	86.50
0350	Lighting, incl. service lamps, wiring & outlets, minimum	1 Elec	34	.235		2.80	12.15	14.95	22
0360	Maximum	"	17	.471		5.85	24.50	30.35	44
0400	Power for temp lighting only, 6.6 KWH, per month						or and the fills	.92	1.01
0430	11.8 KWH, per month							1.65	1.82
0450	23.6 KWH, per month							3.30	3.63
0600	Power for job duration incl. elevator, etc., minimum							47	51.50
0650	Moximum			ter tente of a cell new new entrate for transfer tente entrative tente tente entrative tente tente entrative tente tente	₩			110	121
0700	Temporary construction water bill per mo. average				Month	63		63	69.50
1000	Toilet, portable, see Equip. Rental 01 54 33 in Reference Section								
		1		Broo provide e	「「「日本」の日本日本	TRUCK PUT THE CONTRACT CONTRACTOR			

## 01 52 Construction Facilities

## 01 52 13 - Field Offices and Sheds

	13.20 Office and Storage Space	Crew	Daily Output		Unit	Material	2012 B Labor	lare Costs Equipment	Total	Total Incl O&F
	OFFICE AND STORAGE SPACE									
0020	Office trailer, furnished, no hookups, 20' x 8', buy	2 Skwk	1	16	Ea.	8,550	725		9,275	10,600
0250	Rent per month					144			144	158
0300	32' x 8', buy	2 Skwk	.70	22.857		13,600	1,050		14,650	16,700
0350	Rent per month	a 144 erees meno				185		and a control of the second	185	203
0400	50' x 10', buy	2 Skwk	.60	26.667		22,300	1,200		23,500	26,600
0450	Rent per month					279	California de la companya de la comp		279	305
0500	50' x 12', buy	2 Skwk	.50	32		27,000	1,450		28,450	32,100
0550	Rent per month					365			365	400
0700	For air conditioning, rent per month, add				Ŵ	41.50			41.50	45.5
0080	For delivery, add per mile				Mile	4.60			4.60	5.0
0890	Delivery each way				Eo.	200			200	220
0900	Bunk house trailer, 8' x 40' duplex dorm with kitchen, no hookups, buy	2 Carp	]	16		37,300	705	a proposition of the second	38,005	42,200
)910	9 man with kitchen and bath, no hookups, buy		1	16		38,000	705		38,705	43,000
)920	18 man sleeper with bath, no hookups, buy		1	16	Ŵ	49,000	705		49,705	55,000
000	Portable buildings, prefab, on skids, economy, 8' x 8'		265	.060	S.F.	86	2.66		88.66	99
100	Deluxe, 8' x 12'	-   w	150	.107	n	96	4.70		100.70	114
200	Storage boxes, 20' x 8', buy	2 Skwk	1.80	8.889	Ea.	2,625	405		3,030	3,525
250	Rent per month					72			72	79
300	'40' x 8', buy	2 Skwk	1.40	11.429		3,325	520		3,845	4,500
350	Rent per month				¥	94			94	103
000	Air supported structures, see Section 13 31 13.13									107 B 1000
1 52	13.40 Field Office Expense									·
010 <b>F</b>	IELD OFFICE EXPENSE									
100	Office equipment rental average				Month	200			200	220
120	Office supplies, average				"	75			200 75	82.5
125	Office trailer rental, see Section 01 52 13.20								13	UZ.JU
140	Telephone bill; avg. bill/month incl. long dist.				Month	81			81	89
160	Lights & HVAC				//////////////////////////////////////	152			152	167

## 01 54 Construction Aids 01 54 09 - Protection Equipment

0010	4 09.50 Personnel Protective Equipment PERSONNEL PROTECTIVE EQUIPMENT
0015	Hazardous waste protection
0020	Respirator mask only, full face, silicone
0030	Half face, silicone
0040	Respirator cartridges, 2 req'd/mask, dust or asbestos
0050	Chemical vapor
0060	Combination vapor and dust
0100	Emergency escape breathing apparatus, 5 min
0110	10 min
0150	Self contained breathing apparatus with full face piece, 30 min
0160	60 min
0200	Encapsulating suits, limited use, level A
0210	Level B
0300	Over boots, latex
0310	PVC
0320	Neoprene
)400	Gloves, nitrile/PVC
0410	Neoprene coated

Eo.	270 42.50	270 42.50	297 46.50
	2.64	2.64	2.90
	3.74	3.74	4.11
	6.45	6.45	7.10
	465	465	510
	500	500	550
	1,750	1,750	1,925
	2,925	2,925	3,225
	1,200	1,200	1,325
w	335	335	370
 Pr.	6.35	6.35	7
	23	23	25.50
	44	44	48.50
	21	21	23.50
	27.50	27.50	30.50

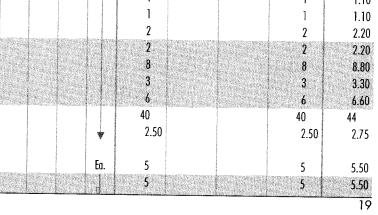
## 01 54 Construction Aids

01 54 09 - Protection Equipment		Daily Labor-			2012 Bare Costs				Total
oment	Crew	Daily Output		Unit	Material	2012 Bo Labor	re Costs Equipment	Total	Incl O&P
				Ea.	255			255	281
					242			242	266
				¥	54.50			54.50	60
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nd									
	A-3H	1	8	Doy		380	825	1,205	1,500
	A-31	1	8			380	955	1,335	1,650
	A-3J	1	8			380	1,175		1,900
	-	1	1						2,900
	1	1	1				1 1		3,625 3,625
	A-3M		10			710	2,213	2,70J	J,02J
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<u>R015423-20</u>	)			Fa	320			330	365
					0				282
					173			173	190
	ningeneren anaren er	nega, ricindulois		and the second secon	91.50			91.50	100
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24' long, buy									315
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	*	84.80	1	¥	1.92	8.30	)	10.22	15.
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R015473-1	)								
R015423-1 & dismontle	) 3 Carj			C.S.F.		132		132	217
	nd krete footing copacity ding and Platform	Id A-3H A3i A3i A3i A3i A3i A3i A3i A3i A3i A3i	Id         A3H A3J A3J A3J A3J A3K A3L A3K A3L A3K A3L A3M A3M A3L A3M A3M A3M A3L A3M A3M A3M A3L A3M A3M A3M A3M A3M A3M A3M A3M A3M A3M	Ind       A-3H       1       8         A-3H       1       8       A-3J       1       8         A-3J       1       16       A-3J       1       16         A-3L       1       16       A-3M       1       16         A-3M       1       16       A-3M       1       16         A-3L       1       16       A-3M       1       16         A-3M       0.5       176       Concerts       176         Concerts       A-3N       0.5       176       Concerts         Concerts       A-3N       0.5       176       Concerts         R015423-20       R015423-20       R015423-20       R015423-20       R015423-20       R015423-20         R015423-20       R015423	k sizes         S.F.           nd         A3H         1         8         Doy           A3H         1         8         Doy         A3J         1         8           A3H         1         8         A3J         1         8         A3J         1         16           A3K         1         16         A3I         1         16         A3I         1         16           create footing copacity         A3N         0.5         17.6         Monthing           R015423-20         Ea         Ea         Ea         Ea         Ea           R015423-20         Ea         Ea         Ea         Ea         <	rd       A3H       1       8       Day         rd       A3H       1       8       A3H       1         rd       A3H       1       16       A3H       1         rd       A3H       1       16       A3H       1       16         rd       A3H       1       16       16       16       16       16       16       16       16       16	242         \$4.50         k sizes	Image: space of the system	242         242         242         242         54.50         54.50           k sizes         5.1         1.10         1.10         1.10         1.10         1.10           k sizes         7.4         7.4         7.4         7.4         7.4           k sizes         7.15         1.15         1.15         1.15         1.15           k sizes         7.4         7.4         7.4         7.4         7.4           k sizes         7.4         7.4         7.4         7.4         7.4           k sizes         7.15         7.15         1.15         1.15         1.15           k sizes         1.6         7.10         2.27         2.985         1.33           k size         1.6

## 01 54 Construction Aids 01 54 23 - Temporary Scaffolding and Platform

0301	23.70 Scaffolding
0460	Building interior, wall face area, up to 16' high
0560	16' to 40' high
0800	Building interior floor area, up to 30' high
0900	Over 30' high
0906	Complete system for face of walls, no plank, material only rent/mo
0908	Interior spaces, no plank, material only rent/mo
0910	Steel tubular, heavy duty shoring, buy
0920	Frames 5' high 2' wide
0925	5' high 4' wide
0930	6' high 2' wide
0935	6' high 4' wide
0940	Accessories
0945	Cross braces
0950	Uhead, 8" x 8"
0955	J-head, 4" x 8"
0960	Bose plote, 8″ x 8″
0965	Leveling jack
1000	
1100	Steel tubular, regular, buy
1150	Frames 3' high 5' wide
1200	5' high 5' wide
1350	6'-4" high 5' wide
	7'-6" high 6' wide
1500	Accessories cross braces
1550	Guardrail post
1600	Guardrail 7' section
1650	Screw jacks & plates
1700 1750	Sideorm brackets
1/30	8" costers
1900	Plank 2" x 10" x 16'-0"
1910	Stairway section
Recommendation of the	Stairway starter bar
1920	Stairway inside handrail
1930	Stairway outside handrail
1940	Walk-thru frame guardrail
2000	Steel tubular, regular, rent/mo.
2100	Frames 3' high 5' wide
2150	5' high 5' wide
2200	6'-4" high 5' wide
2250	7'-6" high 6' wide
2500	Accessories, cross braces
2550	Guardrail post
2600	Guardrail 7' section
2650	Screw jacks & plates
2700	Sidearm brackets
2750	8" costers
2800	Outrigger for rolling tower
2850	Plank 2" x 10" x 16'-0"
2900	Stairway section
2940	Walk-thru frame guardrail
3000	Steel tubular, heavy duty shoring, rent/ma.
3250	5' high 2' & 4' wide
3300	6' high 2' & 4' wide

Î	S								
		Daily	Labor-			2012 Bo	are Costs		Total
	Crew			Unit	Material	Labor	Equipment	Total	Incl O&P
	5 Clab	8	5	C.S.F.		176		176	288
	3 Carp	12	2			88		88	145
		10	2.400	₩ CCF		106		106	174
ui)	₩ 1¢	150	.160	C.C.F.		7.05	alidaber ev contance	7.05	11.55
	4 Carp	160	.200		<b>4</b> 7	8.80		8.80	14.45
				C.S.F.	36			36	39.50
				C.C.F.	3.42			3.42	3.76
1	uchika sayah 196 menutika			Eo.	81.50			01 50	
na masta ta ta ta	All to a Property of the second se			EU.	93		000 - Mal 10 Mar	81.50	90
Pol Post VICOLO					93 93.50		hannan an qui qu	93	102
47.000 XX XX XX XX	1-10/337 AD-34	and the second se			109			93.50	103
			1221 Hoge	Y	107	leven store and a second		109	120
				Eo.	15.85			15.85	17 10
				- LU.	19.10			15.65	17.40 21
					13.90			13.90	The second second second second second
Disconchiem.					15.50			15.50	15.30 17.05
10 Procession				Tolar	33.50		a name a second s	33.50	36.50
Contraction of the local distance				¥	00.50	- 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 140 - 1	31 GJ Gadaer - wo	00.00	30.50
A SHOW WORKS		******	r Million an come	Ea.	75	an , Boy - we want		75	82.50
					88			88	96.50
and the second					118			118	129
					158			158	173
					15.50			15.50	17.05
	- Human States and State	1000000			16.40		an this straig of	16.40	18.05
COVA PARAMANA	18 Links	and the second second	e er tantananan		6.30		100 Million 100 Million	6.30	6.95
Invicuosau					21.50		No	21.50	24
AN INTERPROPERTY AND					25.50			25.50	28.50
					31			31	34
					24.50			24.50	27
					275			275	305
-					32			32	35
-					53			53	58
			-		81.50			81.50	90
airtinferron o		9		¥	41.50		***	41.50	46
			Opposite and						
				Ea.	5			5	5.50
				11	5			5	5.50
					5.15			5.15	5.65
					7			1	7.70
	YU YU KARANGA KA	- And and a second	Millioner		1		Station row spectra	1	1.10
		a card and a second	Photo & evenes		1		rifer i normania	1	1.10
			Annaly Links	La	1	a service ratio can t	A DODOOL	1	1.10
		*			2		No decimiente par	2	2.20



## 01 54 Construction Aids 01 54 36 - Equipment Mobilization

### Daily Labor-Total 2012 Bare Costs 01 54 36.50 Mobilization Crew Output Hours Unit Material Total Inci 0&P Equipment Labor 0020 Dozer, loader, backhoe, excav., grader, paver, roller, 70 to 150 H.P. B-34N 4 2 Eo. 70.50 126 196.50 253 3 2.667 377 0100 B-34K 460 Above 150 HP 94 283 0300 Scraper, towed type (incl. tractor), 6 C.Y. capacity 3 2.667 94 283 377 460 2.50 3.200 560 0400 10 C.Y. 113 340 453 2.50 3.200 113 560 0600 Self-propelled scraper, 15 C.Y. 340 453 2 4 695 141 425 566 0700 24 C.Y. Shovel or dragline, 3/4 C.Y. 3.60 2.222 0900 78.50 236 314.50 385 1000 1-1/2 C.Y. 3 2.667 94 283 377 460 Ŵ 1100 Small equipment, placed in rear of, or towed by pickup truck A-3A 8 1 34.50 17.40 51.90 74.50 Equip up to 70 HP, on flatbed trailer behind pickup truck A-3D 4 2 68.50 62 130.50 179 1150 2000 Crane, truck-mounted, up to 75 ton, (driver only, one-way) 1 Eqhv 7.20 1.111 53 53 84 ne, truck-mounted, over 75 ton A-3E 2.50 6.400 266 55.50 321.50 485 Crawler-mounted, up to 75 ton A-3F 2 8 330 765 1,000 435 Over 75 ton A-3G 1.50 10.667 🚽 445 660 1,105 1,425 For each additional 5 miles haul distance, add 10% 10% Z500 3000 For large pieces of equipment, allow for assembly/knockdown 3001 For mob/demob of vibrofloatation equip, see Section 31 45 13.10 3100 For mob/demob of micro-tunneling equip, see Section 33 05 23.19 For mob/demob of pile driving equip, see Section 31 62 19.10 3200 3300 For mob/demob of caisson drilling equip, see Section 31 63 26.13 01 54 39 - Construction Equipment #012113-5D As % of contractor's here lates cost for project, minimum. 0025 Int -5IN . Antran 2%

## 01 55 Vehicular Access and Parking

## 5 23 - Temporary Roads

-	23.50 Roads and Sidewalks									
	TOADS AND SIDEWALKS Temporary									
	Roads, gravel fill, no surfacing, 4" gravel depth	B-14	715	.067	S.Y.	4.15	2.49	.47	7.11	9.10
0010	8" gravel depth	. "	615	.078	, , , , , , , , , , , , , , , , , , , ,	8.30	2.89	.54	-11.73	14.45
1000	Ramp, 3/4" plywood on 2" x 6" joists, 16" O.C.	2 Carp	300	.053	S.F.	1.23	2.35		3.58	5.20
1100	On 2" x 10" joists, 16" O.C.	"	275	.058	"	1.70	2.57		4.27	6.10
01	56 Temporary Barriers and	d En	cio	SU	es					
100	TA AN IN TANK AND A LA RANGE	-		-	100	Contraction of the	-		COLUMN D	HICO.

## 01 56 13.60 Tarpaulins

0010	TARPAULINS			
0020	Cotton duck, 10 oz. to 13.13 oz. per S.Y., minimum	F78		.86
0050	Maximum	. 80 .	.80	.88
0100	Polyvinyl coated nylon, 14 oz. to 18 oz., minimum	.48	.48	.53
0150	Maximum	.68	.68	.75
0200	Reinforced polyethylene 3 mils thick, white	.15	.15	.17
0300	4 mils thick, white, clear or black	.20	.20	.22
0400	5.5 mils thick, clear	.23	.23	.25
0500	White, fire retordant	.35	.35	- 31
0600	12 mils, oil resistant, fire retardant	.28	.28	.31
0700	8.5 mils, black	.57		.63

## 01 56 Temporary Barriers and Enclosures 01 56 13 - Temporany

01 5	6 13.60 Tarpaulins		Crev			apor-	μ.		2012	Bare Costs	e distriction fo	Toto
0710	Woven polyethylene, 6 mils thick			w Out	put h	ours	Unit	Materia	Labor	Equipment	Total	Incl 0
0720	Steel reinforced polyethylene, 4 mils thick						S.F.	and a second sec	5		.3	
0730	Polyester reinforced w/integrol fastening system 11 mils thick							.5			.53	3
0740	Mylar polyester, non-reinforced, 7 mils thick	Sacarda HEL Colonado			Chinese man			1.0	5		1.07	
	6 13.90 Winter Protection					_	¥	1.1	7		1.17	
0010	WINTER PROTECTION				Rinds (massa	naferi sate son						
0100	Framing to close openings		2 AL									
0200	Tarpaulins hung over scaffolding, 8 uses, not incl. scaffolding		2 Clab	1. Otto Charte		ALC: NOT THE OWNER	S.F.	.39	.75		1.14	1
0250	larpoulin polyester reinf, w/integral fastening system 11 mile thick			150		1.0	1	.25	.37		.62	
0300	rierub libergiass panels, steel trame, 8 uses			1600	和印刷州的方面	City Burner		.80	.35		1.15	1
01 5	6 16 - Temporary Dust Barriers		*	1200	0] .01	3	*	.85	.47		1.32	1
01 56	16.10 Dust Barriers, Temporary											
0010	DUST BARRIERS, TEMPORARY	allo (w socional data	All will be an and		-							<u> 1828 - 18</u>
0020	Spring loaded telescoping pole & head, to 12", erect and dismantle											
0025	Cost per day (based upon 250 days)	<b>清</b> 日	Clab	240	.03	3 E	a.		1.17			
0030	To 21', erect and dismantle					D	ay	.24			1.17	1.
0035	Cost per day (based upon 250 days)	1	Clab	240	.033		11.1		1.17		.24	
0040	Accessories, caution tape reel, erect and dismantle					Do	JY	.39			1.17	1.9
0045	Cost per day (based upon 250 days)	]	Clab	480	.017	Ec	1.		.59		.39	.4
060	Foam rail and connector, erect and dismantle	No. of the Local State				Da	ly i	.05		- and the second	.59	.9
065	Cost per day (based upon 250 days)	1(	.lab	240	.033	Ea	1011-1000000		1.17		.05	.0
070	Caution tape					Do	y	.10			1.17	1.9
080	Zipper, standard duty	10	lab	384	.021	C.L.	F.	2.65	.73		.10	]
090	Heavy duty			60	.133	Ea.		8	4.68		3.38	4.1
100	Polyethylene sheet, 4 mil			48	.167	"		9.50	5.85		12.68 15.35	16.45
110	6 mil	California (Jaco		37	.216	Sq.	PLOT A REPORT	3.23	7.60		10.83	20
)00	Dust portition, 6 mil polyethylene, 1" x 3" frame	*		2	.216	"	NT-WARD	4.54	7.60		12.14	16
80	2" x 4" frame	2 Ca			.008	S.F.	Same and the second second	.27	.35		1	17.45
1 56		″	2	000	.008	"	-	.29	.35		.62 .64	.88
	3.10 Barricades										.04	.90
	RRICADES											
COLUMN STREET, OCT												
i0 i0	5' high, 3 rail @ 2" x 8", fixed	2 Cor	p 2	0	800	L.F.		C 20				
A CALL CALL CALL	Movable Stack with Cold Cold Cold Cold Cold Cold Cold Cold	, "	3	S I PARTY	533	ы, И		5.30	35.50		40.80	64
0	Stock units, 6' high, 8' wide, plain, buy				200	Ea.		4.35 475	23.50		27.85	43.50
0	With reflective tape, buy	101.000 1202-0704 101 101 101				<b>LU.</b> //	1917-1203-2515-12	<b>54</b> 0		and the second state of th	175	520
0	Break-a-way 3" PVC pipe barricade	And in the last of	T T B T T T B Bad + age -	Productive (1) (4) and			-	040		5	540	595
0	with 3 eo. 1' x 4' reflectorized panels, buy	-				Ea.	1	60	in the second	an a		
	Plywood with steel legs, 32" wide	1	a na - Ar a Ar a a A	and a strength of the	A NUMBER OF STREET	1		99.50	ANY A MULTINE LAST	1	2	176
) I	Warning signal flag tree, 11' high, 2 flags, buy						OF ANY INCOME.	30		สียาไปใบบรรณ์ที่เราะระสี่เหลงโดกของเลย	Second and the state of the second	109
and a minimized by the	Troffic cones, PVC, 18" high 28" high					1		10		常行的 即位的第三人称单数形式		365
)							10 28834 22	11.60			10	11
G	unidini woodon 31 high 1" 1"		200	0 .08	1 0	E	100000	1.15	250		11.60	12.80
G	uardrail, wooden, 3' high, 1" x 6", on 2" x 4" posts	2 Carp		THE HUMBER	和別加拿出回归		the addition of the	2.26	3.53 4.28	191802-12122/2411	4.68	7.05
G	2" x 6", on 4" x 4" posts	2 Carp "	165	09.				4.40	4 / 8	1	1	0.00
G	2" x 6", on 4" x 4" posts Portable metal with base pads, buy	n service of the serv	102-11-24661	.09		Conception of the local division of the loca		1	1.20	-	6.54	9.50
6	2" x 6", on 4" x 4" posts Portable metal with base pads, buy Typical installation, assume 10 reuses	n service of the serv	102-11-24661		7	And the second se	1	5.25		1	5.25	16.75
G	2" x 6", on 4" x 4" posts Portable metal with base pads, buy Typical installation, assume 10 reuses irricade tape, polyethylene, 7 mil. 3" wide x 500' long roll		165		7		1	5.25 2.50	1.18	]	5.25 3.68	16.75 4.68
G Ba Ba	2" x 6", on 4" x 4" posts Portable metal with base pads, buy Typical installation, assume 10 reuses rricade tape, polyethylene, 7 mil, 3" wide x 500' long rall rricades, see Section 01 54 33.40		165		7		1	5.25 2.50		1	5.25 3.68	16.75
G Bo Bo	2" x 6", on 4" x 4" posts Portable metal with base pads, buy Typical installation, assume 10 reuses irricade tape, polyethylene, 7 mil, 3" wide x 500' long rall irricades, see Section 01 54 33,40		165		7		1	5.25 2.50		]	5.25 3.68	16.75 4.68

22

(1) 自动转移的 (1)			
2 Clab	400	040	10
A CAR STREET, S	100	UTU.	

4.50

1.40

7.25 23

5.90

## 01 56 Temporary Barriers and Enclosures

01 5	6 26 - Temporary Fencing									
			Daily	Labor-	п.,	u. • I	2012 Ba		Total	Total Incl O&P
	6650 Temporary Fencing	Crew 2 Clab	Output Ron	Hours	Unit 1 F	Material 5 30	Labor 1 87	Equipment	7.17	8.90
	6' high Rented chain link, 6' high, to 1000' (up to 12 mo.)	2 400	400	.035	<b></b>	6.30	1.40		7.70	9.25
	Over 1000' (up to 12 mo.)		300	.053	ubo gener	3.29	1.87		5.16	6.70
	Plywood, painted, 2" x 4" frame, 4' high	A-4	135	.178		5.45	7.50		12.95	18.20
0550	4" x 4" frame, 8' high	"	110	.218		10.20	9.20		19.40	26
0400	Wire mesh on 4" x 4" posts, 4' high	2 Carp	100	.160		9.25	7.05		16.30	22
0550	8° high	, n	80	.200	¥	13.90	8.80		22.70	30
01 5		/5								
Contraction of the second	29.50 Protection									
	PROTECTION								0 F0	33.00
0020	Stair tread, 2″ x 12″ planks, 1 use	1 Corp	) 75	.107	Tread	3.83	4.70		8.53	11.90
0100	Exterior plywood, 1/2" thick, 1 use		65	.123		1.41	5.45		6.86	10.45
0200	3/4" thick, 1 use		60	.133		2.10	5.90		8	11.95
2200	Sidewalks, 2" x 12" planks, 2 uses	2) 12000 PT PT PT	350	.023	S.F.	.64	1.01		1.65	2.35
2300	Exterior plywood, 2 uses, $1/2''$ thick	and the second se	750	.011		.24	.47		.71	1.03
2500	3/4" thick		600	.013	W	.35	.59		.94	1.35
015	6 32 - Temporary Security									
01 56	32.50 Watchman				Tabus (J.Maga			s constanti de constanti i		
0010	WATCHMAN								٩r	27.50
0020	Service, monthly basis, uniformed person, minimum				, Hr.				25 45 50	1
0100	Maximum								45.50	
0200	Person and command dog, minimum								31 54 FO	34
0300	Mananger seit versionen met des sind eine eine eine seit des sind eine eine seit des sind eine seit des s		and the second data and the se		ψ.	Management of the second			54.50	60 220
0500	Sentry dog, leased, with job patrol (yard dog), 1 dog				Week		a manufacture a series		290	320
0600	2 dogs				"				390	430
1		Į.	1	1	L La	8	1		1 375	1 500

## 01 58 Project Identification

Purchase, trained sentry dog, minimum

Maximum

01 58 13 - Temporary Project Signage

01 58 13.50 Signs 0010 SIGNS 37.50 34 S.E. High intensity reflectorized, no posts, buy 0020

Ea.

.

## 71 Examination and Preparation 01

**section** 

## 01 71 23.13 Construction Layout

ield En

01 71 23 - F

0010         CONSTRUCTION LAYOUT           1100         Crew for layout of building, trenching or pipe laying, 2 person cr           1200         3 person crew           1400         Crew for roadway layout, 4 person crew	ew A-6 1 16 Day A-7 1 24 A-8 1 32	705 1,150 1,500	78.50 78.50 78.50	783.50 1,228.50 1,578.50	1,225 1,925 2,500
01 71 23.19 Surveyor Stakes					
0010 SURVEYOR STAKES					72.50

## 01 74 Cleaning and Waste Management 01 74 13 - Progress Cleaning

## 01 74 13.20 Cleaning Up

0100	Final by GC at end of job
0052	Cleanup af floor area, continuous, per day, during const.
0042	Rubbish removal, see Section 02 41 19.23
0040	Maximun
0020	After job completion, allow, minimum
0010	CLEANING UP

## 01 76 Protecting Installed Construction 01 76 13 - Temporary Protection of Installed Construction

01 70 13.20 Temporary Protection

## 0010 TEMPORARY PROTECTION

0020

Flaoring, 1/8" tempered hardboard, taped seams 0030 Peel away carpet protection

## 91 Commissioning 01 13 - General Commissioning Requirements

### 01 91 13.50 Building Commissioning 0010 BUILDING COMMISSIONING 0100 Basic building commissioning, minimum 0150 Moximum 0200

Enhanced building commissioning, minimum

0250 Maximum

1,375

2,725

1,500

3,000

## 01 93 Facility Maintenance

- Facility Maintenance Equipment

## VI 73 VO.30 Equipment

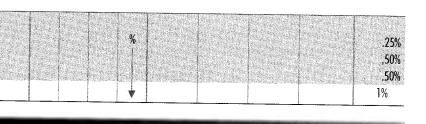
0010	EQUIPMENT, Purchase
0090	Carpet care equipment
0110	Dual motor vac, 1 H.P., 16" brush
0120	Upright vacuum, 12" brush
0130	14" brish
0140	Soil extractor, hot water 5' wand, 12" head
0150	Dry foam, 13" brush
0160	24" brush
0240	Floor care equipment
0260	Polishing, buffing, waxing machine, 175 RPM
0270	.33 H.P., 11" dia. brush
0280	1 H.P., 16" dia. brush
0290	18" dia, brush
0300	1.5 H.P., 20" dia. brush
0310	24" dia. brush
)330	Scrubber, automatic, 2 stage 1 H.P. vacuum motor
)340	20" dio, brush
)350	28″ dia, brush
1200	Plumbing maintenance equipment
1220	Kinetic water ram
1240	Cable pipe snake, 104 ft., self feed, electric, .5 H.P.

0800

0900

Crew	Daily Output	Labor- Hours	Unit	Material	2012 Bi Labor	are Costs Equipment	Total	Total Incl 0&P
			Job "					.30%
								1%
 A-5 ″	16 11.50	1.125 1.565	M.S.F. ″	1.75 2.78	39.50 55	3.30 4.59	44.55 62.37	70 97.50

2 Carp 1500 .011 S.F.	.30 .4/85
1 Clab 3200 .003 "	



Ea.	980	980	1,075
	335	335	365
	380	380	420
	2,075	2,075	2,300
	1,575	1,575	1,725
*	2,150	2,150	2,350
Ea.	600	600	660
	970	970	1,075
	1,125	1,125	1,225
	1,275	1,275	1,400
*	1,375	1,375	1,525
Ea.	9,350	9,350	10,300
n I	13,600	13,600	15,000
Ea.	203	203	223
"	2,250	2,250	2,500

# 01 93 Facility Maintenance

	s.50 Equipment	Grew	Daily Output	Labor- Hours	Unit	Material	2012 B Labor	are Costs Equipment	Total	Total Incl O&P
	Specialty equipment							-1-1-1-		[
	Litterbuggy,9 H.P. gasoline				Ea.	5,075		And a second sec	5,075	5,600
1000	Propane					2,675			2,675	2,925
1570	Pressure cleaner, hot water, minimum					3,375			3,375	3,725
1580	Maximum				w	6,125			6,125	6,750
1590	Vacuum cleaners, steel canister									
1600	Dry only, two stage, 1 H.P.				Eo.	305	ti disini di dangingi Shirisini ang gaya Shirisini ang gaya Shirisini ang sagara		305	335
1610	Wet/dry, two stage, 2 H.P.				0-10-00-00-00-00-00-00-00-00-00-00-00-00	460			460	505
1620	4 H.P.		- No. In and the second			795			795	875
1630	Wet/dry, three stage, 1.5 H.P.		Tao Tali a			460		11.00	460	505
1670	Squeegee wet only, 2 stage, 1 H.P.			WP. Jan Jahalati		770			770	845
1680	2 H.P.					1,325			1,325	1,450
1690	Asbestos and hazardous waste dry vacs, 1 H.P.				ł	1,900			1,900	2,075
1700	2 H.R.				Nacional de la companya Nacional de la companya de la companya	1,925			1,925	2,125
1710	Three stage, 1 H.P.				1.1.1019 (Julium 2.1.1019 (Julium) 2.1.1019 (Jul	2,300			2,300	2,525
1800	Upholstery soil extractar, dry-foam	-11.311(11(11(11(11(11(11(11(11(11(11(11(11(			¥	3,450			3,450	3,800
1900	Snow removal equipment			to an even on the second	_					
1920	Thrower, 3 H.P., 20", single stage, gas				Ea.	625			625	690
1930	Electric start			wegionauro	าสารหมายนาย	725		laid initial at the stars are a second	725	800
1940	5 H.P., 24", 2 stage, gas					1,200			1,200	1,325
1950	11 H.P., 36"				*	2,900			2,900	3,200
1970	Trash receptacles and closures; see Section 12 93 23.20									
2000	Tube cleaning equip., for heat exchangers, condensers, evap.		nnandruciu maandruciu maandruciuu naandruciuu	n Sign (na stationar) Ann Sign (na station) I Eisin (Station), Seac	-					
2010	Tubes/pipes 1/4"-1", 115 volt, .5 H.P. drive	e			Ea.	1,525			1,525	1,675
2020	Air powered			COM Decidence	and the second se	1,600		4	1,600	1,750
2040	1" and up, 115 volt, 1 H.P. drive		econtration.		¥.	1,700			1,700	1,875
01 9	13 09 - Facility Equipment							ala dan barran yang dan sang dan sa Biblioten yang dan barran yang dan barran yang Malayan yang dan sang dan sang dan sag		
01 93	09.50 Moving Equipment									
20.0000000000000	MOVING EQUIPMENT, Remove and reset, 100' distance,									
0020	No obstructions, no assembly or leveling unless noted									
0100	Annealing furnace, 24' overall	B-67	4	4	Eo.		182	72.50	254.50	365
0200	Annealing oven, small		14	1.143			52	20.50	72.50	105
0240	Very large		1	16			725	289	1,014	1,475
0400	Band saw, small		12	1.333			60.50	24	84.50	122
0440	Large		8	2		- The last of the	91	36	127	183
0500	Blue print copy machine			2.286			104	41.50	145.50	210
0600	Bonding mill, 6"		Calific Courses of States	2.286			104	41.50	145.50	210
0620	12″		Santaj hijer je mes sos s	2.667			121	48	169	244
0640	18″		4	4			182	72.50	254.50	365
0660	24″	W.	2	8	1999) (1995) 1997) (1997) 1997) (1997) (1997) (1997) 1997) (1997) (1997) (1997) (1997) 1997) (1997)		365	145	510	730
0700	Boring machine (jig)	B-68		3.429			156	41.50	197.50	292
0800	Bridgeport mill, standard	B-67	5	1.143			52	20.50	72.50	105
1000	Calibrator, 6 unit	"	i	1.143			52	20.50	72.50	105
1100	Comparitor, bench top	2 Clab		1.143		angeri-warnen er er i 114 - 114 - 114 - 114 - 114 - 114 - 114 - 114 - 114 - 114 - 114 - 114 - 114 - 114 - 114 -	40		40	66
1140	Floor mounted	B-67	and the second second	2.286			104	41.50	145.50	210
	Computer, desk top	2 Clab	25	.640			22.50		22.50	37
1200			a fairt	110			22.50		22.50	
1300	Copy machine	"	25	.640						37
1300 1500	Deflasher	" B-67	14	1.143			52	20.50	72.50	105
1300 1500 1600	Deflasher Degreaser, small		14	1.143 1.143			52 52	20.50	72.50 72.50	105 105
1300 1500 1600 1640	Deflasher Degreaser, small Large 24' overall	₿-67	14 14 1	1.143 1.143 16			52 52 725	2010 Coloren en escereter por	72.50 72.50 1,014	105 105 1,475
1300 1500 1600	Deflasher Degreaser, small	B-67	14 14 1 25	1.143 1.143			52 52	20.50	72.50 72.50	105 105

# 01 93 Facility Maintenance 01 93 09 - Facility Equipment

1900	Drafting table
2000	Drill press, bench top
2040	Floor mounted
2080	Industrial radial
2100	Dust collector, portable
2140	Stationary, small
2180	Stationary, large
2300	Electric discharge machine
2400	Environmental chamber walls, including assembly
2600	File cabinet
2800	Grinder/sander, pedestal mount
3000	Hack saw, power
3100	Hydraulic press
3500	Laminar flow tables
3600	Lathe, bench
3640	6″
3680	10″
3720	12"
4000	Milling machine
4100	Molding press, 25 ton
4140	60 ton
4180	100 ton
4220	150 ton
4260	200 ton
4300	300 ton
4700	Oil pot stand
5000	Press, 10 ton
5040	15 ton
5080	20 ton
5120	30 ton
5160	45 ton
5200	60 ton
5240	75 ton
5280	100 ton
5500	Raised floor, including assembly
5600	Rolling mill, 6"
5640	9″
5680	12"
5720	13″
5760	18"
5800	25″
6000	Sander, floor stand
6100	Screw machine
6200	Shaper, 16"
6300	Shear, power assist
6400	Slitter, 6"
6440	8″
6480	10"
6520	12″
6560	16"
6600	20″
6640	24″
6800	Snag and tap machine

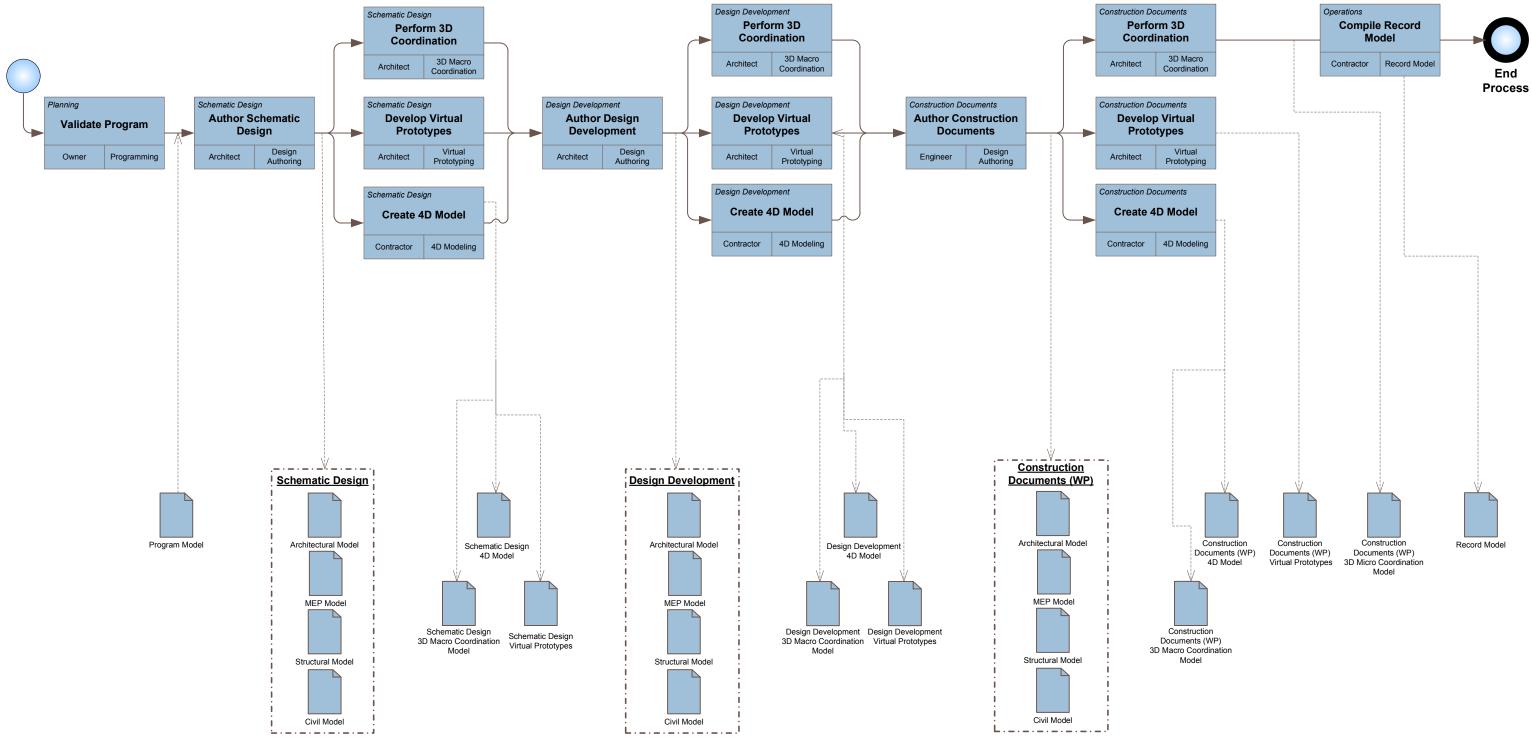
5

(n	ew	Daily Output	Labor- Hours	Unit	Material	2012 Bi Labor	are Costs Equipment	Total	Total Incl 0&P
2 (	:lab	14	1.143	Eo.		40	Lyoipinein	40	66
17	n	]4	1.143			40		40	66
B-(	67	14	1.143			52	20.50	72.50	105
	v	7	2.286			104	41.50	145.50	210
2 C	lab	25	.640	1997 - 20 March 1997	and a star of the second	22.50		22.50	37
B-é	67	7	2.286		ar and an an an	104	41.50	145.50	210
"	,	2	8	Allefterrook		365	145	510	730
B-6	58	7	3.429			156	41.50	197.50	292
4 C	lab	18	1.778	L.E.		62.50		62.50	102
2 CI	lab	25	.640	Ea.		22.50		22.50	37
B-6	57	14	1.143			52	20.50	72.50	105
2 Cl	lab į	24	.667			23.50		23.50	38.50
B-6	7	14	1.143			52	20.50	72.50	105
"		14	1.143			52	20.50	72.50	105
2 Cl	ab	14	1.143			40		40	66
B-6	7	14	1.143		- nor en stad kang	52	20.50	72.50	105
		13	1.231			56	22.50	78.50	113
		12	1.333			60.50	24	84.50	122
		8	2			91	36	127	183
11		5	3.200			145	58	203	293
1		4	4			182	72.50	254.50	365
	WW/Odes and	2	8		1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -	365	145	510	730
		1.50	10.667	10110-001		485	193	678	975
		1	16		MAN-TO AND	725	289	1,014	1,475
		.75	21.333			970	385	1,355	1,950
		14	1.143			52	20.50	72.50	105
		5 ( Third P	1.143			52	20.50	72.50	105
		12	1.333			60.50	24	84.50	122
New Protocology		10	1.600			72.50	29	101.50	146
		8	2	19730000004444		91	36	127	183
	Concerning fails	6	2.667			121	48	169	244
	22.2	4	4		100 M 100 M	182	72.50	254.50	365
	1		6.400			291	116	407	585
¥		2	8	¥ İ		365	145	510	730
2 Carj	Contraction of the	entrait a chimin	.064	S.F.		2.82		2.82	4.63
B-67		2000-95416-0056165	n og geberer	Eo.		104	41.50	145.50	210
The second se	and the designation of	1	2.667			121	48	169	244
	4.1000000000000000000000000000000000000	4	4		and one one one	182	72.50	254.50	365
	3	Ę	1.571		5 (says moderne) = 1	208	82.50	290.50	415
		2	8	(Claubert		365	145	510	730
		1	16			725	289	1,014	1,475
	100	ALC: 1 1017	.143			52	20.50	72.50	105
			.286			104	41.50	145.50	210
		and the state of the	.143			52	20.50	72.50	105
	1	4	4			182	72.50	254.50	365
Not for conservations of	- j	1	.143	a frequencies	CP and an and a second second	52	20.50	72.50	105
-011.01	- 1	1	.231	a data representation	**************************************	56	22.50	78.50	113
ng ga utana		Commenced and the second	.333			60.50	24	84.50	122
	1.001.00		.455			66	26.50	92.50	133
	1.000	STORE - BARTER	.600			72.50	29	101.50	146
	16984	8	2			91	36	127	183
	gaarse's	erender om handele	667			121	48	169	244
	1	72.	286		1114014	104	41.50	145.50	210

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## APPENDIX D

## LEVEL 1 BIM EXECUTION MAP



Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team. http://www.engr/psu.edu/ae/cic/bimex