

New Call-Center Office Building

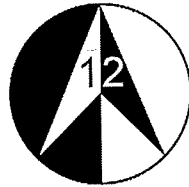
Oneida County Industrial Park

5992 Judd Road

Oriskany, New York

By

Twelve North Engineering



Engineering Report: Construction Cost Estimating
& Scheduling

Table of Contents

Purpose	Page 1
Background	Page 1
Basis of Design	Page 2
Appendixes	
A. Construction Cost Estimate	Page 9
B. Construction Schedule	Page 10

Purpose

This project was to estimate and construct a construction schedule for a new Call Center Office Building at 5992 Judd Rd., Oriskany, New York. The existing lot is an undeveloped 4.1 acres including light forestry. The proposed Office Building is to be a three story building including a full basement. The building must be adequately designed to accompany its full time occupancy three hundred full-time workers over three shifts daily, one hundred and twenty at all times, Monday through Saturday. All employees must also have on-site parking while also conforming to all ADA accessibility requirements.

Background

The overall project goal is to provide engineering plans and specifications for a commercial tenant at the site, which takes advantage of the proximity to major transportation routes, excellent location relative to the urban center of Utica, and the presence of government agencies to provide entitlement funding, also situated in Utica, New York.

The design team overall goal is to create a site that is not only functional, but also aesthetically pleasing. This should be a site that is easy for maintenance and ground crews to maintain, and one that will also be able to retain its value for several years without redesign or needless additions. Along with being functional, it is a goal to be self-sustaining and reuse as many natural resources as possible.

Our design is required to allow for ample parking for all employees, as well as easy access from the major transportation routes near the site, including Airport Road and Judd Road. The site must meet all ADA accessibility requirements, along with providing drop off zones for trucks, and allowing for vehicular traffic to flow freely without any requirement for operating in reverse except to depart parking spaces. Along with transportation standards we are to conform to New York State, Town of Whitesboro, and Oneida County building codes and regulations.

Basis of Design

Cost Estimate

Source of Estimate

To estimate the cost for the proposed Office Building, the team used the RS Means: Heavy Construction Cost Data manual, 2013 edition. This source was used because it contained almost every bid item that was necessary for this project. The 2013 edition is also what was available to the team. Also, a few other sources were used to receive the most appropriate cost for specific bid items. These sources include: The University of New Hampshire, Septic Solutions Inc., Environment One Corp., Ferguson Enterprises Inc., Lowes Home Improvement, and EK Engineering Corporation. These sources were used when material costs and design was not available through RS Means.

Setup of Estimate

The estimate was done using the Microsoft Excel program. The team set the worksheet up so that every bid item had inputs of:

- Activity Title
- CRN or Cost Reference Number from RS Means
- Crew Required to carry out the activity
- Quantity of activity
- Units pertaining to the RS Means
- Material Costs per unit
- Labor Costs per unit
- Daily Output of crew for that activity
- Equipment Costs per unit

These inputs came directly from the RS Means manual after the correct reference number was found. The specific cost inputs were given in cost in dollars, per unit of measure. Therefore these costs given can be multiplied by the quantity of that activity to receive the overall cost in dollars of that activity. The outputs provided by the spreadsheet were:

- Total Material Costs
- Total Labor Costs
- Total Equipment Costs
- Total Activity Cost
- 8-Hour work days required to complete the activity

The material, labor, and equipment cost were calculated separately so that the activity costs can be broken down into sections for ease when the customer receives the project estimate. The individual cost were then added together to show the total cost of each activity within the overall project. The number of eight hour work days were calculated by taking the total quantity, and dividing it by the daily output. This was done to help the team create the construction schedule.

Building

For this project, the building costs were calculated using a Rough Order Magnitude (ROM) estimate. Because the building design and the estimate were all happening at the same time, it would be difficult to construct a well detailed cost estimate on the building itself. A Rough Order Magnitude estimate is typically used only in the procurement phase or pre design phase. A ROM estimate is not highly accurate but is usually within a 15% margin of the actual cost. Within the RS Means manual, the ROM cost is found in the back of the book. It is estimated using an overall square footage cost for the building. With this ROM cost data, we were able to gain the costs of five sections within the project:

- Structure (steel, exterior, and interior improvements)
- HVAC (heating, ventilation, and air-conditioning)
- Masonry (foundation and exterior masonry)
- Electrical
- Plumbing

These cost projections were estimated using the overall outside dimensions of the office building being designed. These dimensions were seventy-three feet wide, by one hundred-seven feet eight inches long. This gave the team the square footage estimates, we then multiplied the square footage by four due to the three office floors and one basement floor to get the total square footage of the building.

Site Work

The site work is what consists of a majority of the estimate. Careful consideration needed to be taken with regards to the site work that needed to be done. To start, the site on Judd Rd. needed to be cleared of all the brush and small forestry. The area that needs to be cleared is 4.1 acres of land, this clearing activity is also known as grubbing. Other concerns with the site were the elevations. To help solve this, we decided first to have a crew come in and do a rough grading of the site so it made it easier for construction to start. The rough grading area came out to be about 179,800 square feet.

Also included in the site work, was the parking lot. The parking lot was designed as a medium duty lot meeting NYSDOT specifications. First before anything in the parking lot could be installed, the subgrade, after excavation, needs to be prepped. This includes leveling and compacting the earth underneath so that minimal settling will occur. This proposed parking lot consisted of three layers of material. The material, labor, and equipment were all estimated using a unit of tons. This is because when the contractor builds the lot, the materials are typically ordered in measurements of tons. At first the quantities are calculated in cubic yards and then converted to tons using a relationship of 1.5 tons per cubic yard. The first layer is a sub base that is composed of bank run gravel 12 inches deep. After the sub base is done and compacted, the binder course of asphalt can be installed. This layer is 3 inches thick. The final layer for the parking lot is to be a 1 ½ inch thick wearing course.

After the parking lot is completed, the final details can be installed throughout the lot. This includes all of the parking space striping, signs, sidewalks, and curbing. The lot striping is estimated by each stall. There are a total of 196 stalls that need to be striped. The striping to be used is going to be 4 inch wide white paint. The parking lot will also include 6 handicap parking spaces. The handicap symbol is also to be painted with white paint and will each include a 12 inch by 18 inch handicap sign and post. The sidewalk is to be constructed on the front side of the

building. It is to be a 5 inch slab on grade, 3000 psi concrete. This was estimated using cubic yards because concrete is ordered in cubic yards. Curbing is too installed on two sides of the structure and around the perimeter of each island containing green space within the parking lot. Curbing to be used is cast-in-place concrete in 6 inch by 18 inch sections.

After the parking lot and curbing is completed, there needs to be landscaping done. This includes fine grading, topsoil, planting trees and shrubbery, mulching, and seeding. The area that needs fine grading is 9,910 square yards. In the estimate, topsoil, mulching, and seeding were all grouped together in one bid item. This item was measured using thousand square feet. Total area that needed to be landscaped was 5,830 square feet. On top of this, the team decided to plant trees and shrubs throughout the site. The costs of the trees and shrubbery came from Lowes Home Improvement website. Labor costs were provided from RS Means. There are a total of 21 shrubs and 10 trees being planted.

Storm Water

The method of handling the storm water that was used in this project was porous pavement. For the estimate of the porous pavement, the team used the design provided from The University of New Hampshire's website. This gave us adequate design so that the bid items would be more ideal. The porous pavement consists of 4 layers of material. The first step in this process is to excavate 2 feet 4 inches of earth and prep the subgrade underneath. Then there is to be at least 12 inches of number 4 stone compacted as the sub base. The next layer is to be a minimum of 4 inches of number 2 stone, encased within this stone is to be a minimum of 4 inch PVC pipe, but the designer decided to use 6 inch PVC pipe so therefore there needs to be a minimum of 6 inches of number 2 stone surrounding the drain pipes. On top of the number 2 stone lays a minimum of 6 inches of approved AASHTO number 57 stone. The final layer on top is the porous pavement itself. This is to be at least 4 inches thick and to be level with the remainder of the parking lot. An actual cost of the porous pavement was unavailable due to the relatively new application. Therefore the cost of the porous pavement was taken to be 110 percent cost of the finish course covering the remainder of the parking lot. These material costs were also estimated using measurements in tons. The PVC pipe that is to be laid under the porous pavement also has to be ran under the parking lot to an outflow in case of an infiltration overflow problem. This was taken into consideration when estimating the cost of pipe and earthwork involved when

installing it. There is also a retention pond that is to be constructed just outside the parking lot to hold excess storm water. This was estimated to be excavated in bank cubic yards which is still compacted earth.

Utilities/ Sewage and Septic

When designing a new building, the waste water and sewage details need to be designed. In this project, the sewage and waste water have been designed to go into a septic tank and then into the leech fields. There was many factors that came into consideration when the team designed the septic system. In the estimate, the team got many of their costs from references in the industry. The two 9,000 gallon septic tanks and their earthwork came from the RS Means manual. Also from the RS Means manual, the costs of excavating, backfilling, and the material of 5,500 feet of leech field piping were calculated. The septic system design incorporated a pump station which was referenced from Septic Solutions Inc. The team determined that the best cost estimate would be from a direct supplier. The designed septic system also included the use of 3 sand filters. These sand filter costs were referenced from EK Engineering Corporation. There is also excavation and backfill costs associated with the sand filters that was taken from RS Means. The team also called a couple companies to get a direct quote for the RPZ enclosed shelter, or also known as a hot box, for material, shipping, labor, and equipment costs. The team also contacted a company, Environment One Corporation, for a total cost of sewage pit located in the basement of the building.

Results

After all activities were taken care of, the team then went and added up the totals of each. We also included a sales tax cost on all materials other than the items within the rough order magnitude estimate. The sales tax amount was taken as 8% due to the project being located in New York. The team also decided to add in a contingency cost margin of 20% on the entire project. After everything was completed, the estimated grand total of this project is \$7,594,554.

Scheduling

In this project, the group was asked to create a proposed construction schedule for the project at 5992 Judd Rd. The main source of the time estimates related to each activity came from the RS Means manual. In the cost estimate spreadsheet, there were column inputs designated for the daily output for crews with respect to that particular activity. The team was then able to calculate how many eight hour work days it would take by dividing the total quantity of the activity by the daily output of the crew. These days were then rounded up to the nearest whole day. Not all of the activities were associated with a crew or daily output therefore some of the time frames had to be estimated with reference from the professor. These activities include:

- Structural Steel
- HVAC
- Electrical
- Plumbing
- Masonry
- Foundation
- Interior improvements

These activities were estimated because their costs were done using a Rough Order Magnitude estimate. These estimates were not associated with production because they are not detailed. They are not broken up into individual items, instead they are grouped together in a whole for a quick cost estimate.

Setup of the Schedule

The schedule was created using the Microsoft Project program. This program allowed the group to enter individual items and their time frames. It also allowed the team to enter each activity's predecessor so that there were no scheduling conflicts. It made it easier to show that an activity can start depending on which predecessor ended first. The team decided to have the project start underway on Monday May 4, 2015. The team decided not to take a winter break during construction because most of the outside work will be completed before the winter of 2015. The project is to be completed on Monday April 18, 2016. The entire project is estimated to take a period of 11 months and 16 days. After the schedule was completed, the team determined the

critical path. The critical path is the path of activities that must stay on a tight schedule in order for the project to be completed on time. The critical path for this project is:

- 1) Grubbing
- 2) Structural Excavation
- 3) Structure Foundation
- 4) Steel Structure
- 5) Plumbing
- 6) Heating Ventilation Air-Conditioning (HVAC)
- 7) Electrical
- 8) Interior Improvements

The schedule also includes a few milestones. A milestone is an event that marks a special or important date within the construction phase. This project includes two milestones. One milestone is on September 3, 2015, which marks the completion of the steel structure. The other milestone will be on April 18, 2016, which is the completion of the project.

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Activity	CRN #	Unit Cost/	Equipment Cost	Total Cost
Rough Order Magnitude (ROM)				
Structural	Building= 73x107.67x4 floor			\$ 3,763,368.00
Masonry				\$ 441,732.00
Plumbing				\$ 251,520.00
HVAC				\$ 499,896.00
Electrical				\$ 514,044.00
Total ROM =				\$ 5,470,560.00

Site Work				
Grubbing	31 13 13.100600	208.00	\$ 852.80	\$ 1,279.20
Rough Grading	31 22 13.200280	1,975.00	\$ 3,551.05	\$ 6,877.35
Fine Grading	31 22 16.100100	0.36	\$ 3,567.60	\$ 6,837.90
Site Excavation	31 23 16.425300	0.87	\$ 6,973.92	\$ 10,420.80
Fill and Compaction	31 23 23.130600	0.69	\$ 1,018.44	\$ 79,704.00
Hauling	31 23 23.201082	9.60	\$ 14,169.60	\$ 20,176.92
Prep Subgrade	31 22 16.101020	0.46	\$ 4,569.64	\$ 8,543.24
Sub Base (Reg.)	32 11 23.232032	1.29	\$ 6,407.43	\$ 97,641.29
Binder Course (Reg.)	32 12 16.130812	3.35	\$ 4,160.70	\$ 98,006.22
Finish Course (Reg.)	32 12 16.130851	4.62	\$ 2,869.02	\$ 50,890.95
Striping	32 17 23.140800	0.97	\$ 190.12	\$ 1,463.96
Handicap Symbol Painting	32 17 23.141200	-	\$ -	\$ 293.88
Handicap Signs	32 17 23.141210	22.00	\$ 132.00	\$ 1,361.52
Curbing	32 16 13.130410		\$ -	\$ 18,004.74
Sidewalks	03 30 53.404700	0.36	\$ 19.44	\$ 8,935.92
Topsoil/Seed/Mulch	32 92 23.100500	28.50	\$ 166.16	\$ 3,008.86
Shrubbing	32 93 43.100600		\$ -	\$ 1,911.19
Trees	32 93 43.100754		\$ -	\$ 3,061.89
Total Site Work =				\$ 418,419.84

Stormwater				
No. 2 Stone (Porous)	32 11 23.232020	2.23	\$ 932.14	\$ 10,251.03
No.4 Stone (Porous)	32 11 23.232023	1.65	\$ 2,065.80	\$ 29,239.21
AASHTO #57 Stone (Porous)	32 11 23.232011	0.99	\$ 619.74	\$ 13,787.02
Porous Pavement	~110% of Finish Course	4.62	\$ 1,931.16	\$ 37,234.60
6" Pipe (Porous)	33 21 13.108360	21.00	\$ 92,400.00	\$ 201,616.80
Stormwater Earthwork	31 23 16.425100	0.85	\$ 140.25	\$ 255.75
Total Stormwater =				\$ 292,384.42

Utilities/ Sewage & Septic				
Septic Tank	9,000 Gallon 33 36 13.13020	208.00	\$ 416.00	\$ 21,906.00
Septic Piping	33 31 13.252000		\$ -	\$ 22,583.00
Septic Cut/Backfill	33 36 50.102200	7.24	\$ 789.16	\$ 4,561.65
Leach Field Cut	33 36 50.102400	2.07	\$ 11,385.00	\$ 22,440.00
Leach Field Backfill	33 36 50.102600	2.45	\$ 1,496.95	\$ 19,802.51
Pump Station	Septic Solutions Inc.		\$ -	\$ 3,010.78
Sand Filter	EK Engineering Reference		\$ -	\$ 42,078.00
Sand Filter Cut	33 36 50.102200	4.79	\$ 9,048.31	\$ 17,832.16
Sand Filter Fill	33 36 50.102600	2.45	\$ 4,628.05	\$ 16,339.85
RPZ Enclosed Shelter	Ferguson Enterprises Inc.	289.00	\$ 289.00	\$ 6,555.24
Basement Sewage pit	Environment 1 Corp.			\$ 11,247.00
Utilities Total =				\$ 188,356.19

	\$ 6,328,795.08
20%	\$ 1,265,759.02
	\$ 7,594,554.09

ID	Task Mod	Task Name	Half 2, 2016				
			M	A	M	J	J
1		Site Clearing & Grubbing					
2		Structural Excavation					
3		Fill & Compaction					
4		Structure Foundation					
5		Steel Structure					
6		Structure Complete					
7		Plumbing					
8		HVAC					
9		Electrical					
10		Septic Tank					
11		Septic Accessories (Pump, Sand Filter, RP)					
12		Leach Field					
13		Sidewalks					
14		Sub Base Course					
15		Binder Course					
16		Finish Course					
17		Porous Pavement					
18		No.4 Stone (porous)					
19		No.2 Stone (porous)					
20		AASHTO #57 Stone (porous)					
21		6" Storm water pipe (porous)					
22		Parking Lot Striping					
23		Handicap Markings					
24		Handicap Signs					
25		Curbing					
26		Rough Grading					
27		Prep Subgrade					
28		Storm Water Earthwork					
29		Topsoil/Seed/Mulch/Shrubbing/Trees					
30		Fine Grading					
31		Interior Improvements					
32		Project Complete					

..... Topsoil/Seed/Mulch/Shrubbing/Trees

Interior Improvements

Project Complete 4/18

Project: 5992 Judd Rd.
Date: 4/31/2015

- Critical Inactive Task
- Critical Split Inactive Milestone
- Critical Progress Inactive Summary
- Task Deadline