



# Construction Estimating Using Excel

An Online Continuing Education Course for Engineers

**Course Number: PD-2005**  
**Credit: 2 Hours / 2 PDH / 2 CPD**

## Construction Estimating Using Excel

Construction estimating usually involves the estimating of *material, labor, equipment, overhead and contingencies*. For this course, we will only look at construction materials. Usually we do a quantity take-off from the drawings or plans. Estimators may also be involved in *planning and* scheduling. About 62 percent of cost estimators work in the construction industry. Cost estimators held about 221,000 jobs in 2006. We will look at the following groups of *materials*.

- Concrete
- Earthwork
- Finishes
- Masonry
- Metals
- Openings
- Paving
- Thermal & Moisture Protection
- Wood

This is NOT all the material groups.

In construction estimating we use many different *units*, to list a few:

- Cubic feet, cf, ft<sup>3</sup>, cu ft
- Cubic yards, cu yd, yd<sup>3</sup>,
- Feet, ft
- Square feet, sf, ft<sup>2</sup>, sq ft
- Tons
- Pounds, lbs, #
- Linear feet, lf
- Square, sq
- Foot board measure, fbm
- Gallons, gal

This is NOT all the units used in construction estimating.

Many estimators use the *Master Format* by the Construction Specifications Institute. MasterFormat™ is the specifications-writing standard for most commercial building design and construction projects in North America. It lists titles and section numbers for organizing data about construction requirements, products, and activities. By standardizing such information, MasterFormat facilitates communication among architects, specifiers, contractors and suppliers, which helps them meet **building owners' requirements, timelines and budgets**.

**GENERAL REQUIREMENTS SUBGROUP**  
**Division 01 General Requirements**

**FACILITY CONSTRUCTION SUBGROUP**

- Division 02 Existing Conditions**
- Division 03 Concrete**
- Division 04 Masonry**
- Division 05 Metals**
- Division 06 Wood, Plastics, and Composites**
- Division 07 Thermal and Moisture Protection**
- Division 08 Openings**
- Division 09 Finishes**
- Division 10 Specialties**
- Division 11 Equipment**
- Division 12 Furnishings**
- Division 13 Special Construction**
- Division 14 Conveying Equipment**
- Division 15 Reserved**
- Division 16 Reserved**
- Division 17 Reserved**
- Division 18 Reserved**
- Division 19 Reserved**

**FACILITY SERVICES SUBGROUP**

- Division 20 Reserved**
- Division 21 Fire Suppression**
- Division 22 Plumbing**
- Division 23 Heating, Ventilating, and Air Conditioning**
- Division 24 Reserved**
- Division 25 Integrated Automation**
- Division 26 Electrical**
- Division 27 Communications**
- Division 28 Electronic Safety and Security**
- Division 29 Reserved**

**SITE AND INFRASTRUCTURE SUBGROUP**

**Division 30 Reserved**

**Division 31 Earthwork**

**Division 32 Exterior Improvements**

**Division 33 Utilities**

**Division 34 Transportation**

**Division 35 Waterway and Marine**

**Construction**

**Division 36 Reserved**

**Division 37 Reserved**

**Division 38 Reserved**

**Division 39 Reserved**

**PROCESS EQUIPMENT SUBGROUP**

**Division 40 Process Integration**

**Division 41 Material Processing and  
Handling Equipment**

**Division 42 Process Heating,  
Cooling, and Drying  
Equipment**

**Division 43 Process Gas and Liquid  
Handling, Purification,  
and Storage Equipment**

**Division 44 Pollution Control  
Equipment**

**Division 45 Industry-Specific  
Manufacturing  
Equipment**

**Division 46 Reserved**

**Division 47 Reserved**

**Division 48 Electrical Power  
Generation**

**Division 49 Reserved**

## Earthwork13a

Let's get started estimating. We have to excavate a ditch for the footing of a building. The ditch is 4' wide at the bottom and 8' wide at the top. That means the average width is 6 feet. The side slope is 1:1 and the ditch is 2' deep. The volume of the ditch would be the cross-sectional area times the linear feet of ditch. If the area is in square feet and the length is in linear feet, then the volume will be in cubic feet. To convert cubic feet to cubic yards, you divide by 27.

7	A	B	C	D	E	F	G	H	I	J	K
8	Cost Code	Description	Comments/ Calculations	L(ft)	W(ft)	No.	Total		Sub Total	Quantity	Unit
9											
10		Continuous footing	Footing base extends 6" past								
11			foundation wall								
12			Short side	41	2	2	82				
13			Long side	79	2	2	158				
14			Interior wall	79	2	1	79				
15			TOTAL LENGTH CONTINUOUS FOOTING				319				
16											
17			Assume depth excavation = 2'								
18			Assume slope 1:1								
19											
20			Width at bottom								
21			footing + 2' =	4							
22											
23			Width at top								
24			width at bottom + (depth * slope)	8							
25											
26			Average width =	6							
27											
28				D(ft)	W(ft)	L(ft)	ft <sup>3</sup>				
29				2	6	319	3828			142	cu yd
30											
31											

The values in orange are input and the values in yellow are calculated. A **cell address** is defined by its column first and then the row number, like C7. In cell G12, the equation looks like this, =D12\*F12. All **equations** must start with = or +. The \*, is the **arithmetic operator** for multiplication. We are multiplying the value in cell D12 by value in cell F12. The equation in G15 is =SUM(G12:G14). The SUM is a **built-in function**. G12:G14, represents a range of cells from G12 to G14, including G13. We use a colon for adjacent cells and a comma for non-adjacent cells in a range. The equation in J29 is =G29/27. This is where we convert cubic feet to cubic yards. The /, is the **arithmetic operator** for division. **Arithmetic operators** have an order of precedence:

1. Parentheses, ()
2. Exponentiation, ^
3. Multiplication and division, \*, /
4. Addition and subtraction, +, -

Excel will do parentheses first and addition and subtraction last. If operators have the same order of precedence, then it does them left to right.

## Earthwork14a

In our next worksheet, we are to excavate 6 inches of top soil from the building, sidewalks and parking lots. After the construction is completed for the building, sidewalks and parking lots, we will backfill with the top soil that we removed. Some will be left over so it will have to be removed from the project.

	B	C	D	E	F	G	H	I	J	K
8	Description	Comments/ Calculations						Sub Total	Quantity	Unit
9		Assume 6" depth	L(ft)	W(ft)			Area sf			
10	Top Soil Removed									
11		Bldg	90	50			4500		83	cu yd
12		Front sidewalk	37.5	20			750		14	cu yd
13		Side sidewalk	25	1			25		0	cu yd
14		Parking lot	89	74			6586		122	cu yd
15		Front parking lot	30	15			450		8	cu yd
16		Back parking lot	30	11.5			345		6	cu yd
17										
18		Total removed					12656		234	cu yd
19										
20	Top Soil Replaced									
21		Bldg	80	40			3200		59	cu yd
22		Front side walk	53.5	10			535		10	cu yd
23		Side sidewalk	15	11			165		3	cu yd
24		Parking lot	79	64			5056		94	cu yd
25		Front Parking lot	20	20			400		7	cu yd
26		Back parking lot	11.5	20			230		4	cu yd
27										
28		Total replaced					3070		57	cu yd
29										
30		Area stripped					12656			
31		Area replaced					3070			
32		Volume to be removed					9586		178	cu yd

In cell H11, we calculate the area by  $=D11 * E11$ . Since the length and width are in feet, the area will be in square feet. In cell J11, we calculate the volume by  $=H11 * 0.5 / 27$ . We multiplied by 0.5 feet, (6 inches), and divided by 27 to get it into cubic yards. Rows 18 and 28 are calculated by using the SUM function, like  $=SUM(H11:H16)$ . In cell J32, it shows there will be 178 cubic yards that will have to be removed from the project. This will add to the cost of the project because of the labor, equipment and haul distance to remove the soil from the project.

Note: The lines were created with the **border** command. It is easy to create the form you need in Excel. You just select the cells and apply the type of border from a list of borders. The colored cells were created with the **fill color** command.

## Paving15a

In this worksheet, we are to calculate the tons of asphalt and base material. First we have to calculate the area in square feet. The asphalt is 5 inches thick and is 32.5 tons / 1000 square feet. The base material is 8 inches thick and is 36.8 tons / 1000 square feet.

	A	B	C	D	E	F	G	H	I	J	K
7											
8	Cost Code	Description	Comments/ Calculations						Sub Total	Quantity	Unit
9				L(ft)	W(ft)			Area s.f.			
10		Parking lot									
11			Front parking lot	20	20			400			
12			Rear parking lot	20	11.5			230			
13			Parking lot	79	60			4740			
14								5370			
15											
16											
17		Asphalt	5" is 32.5 tons/1000						5.4	175	tons
18											
19		Subgrade	8" is 36.8 tons/1000						5.4	198	tons
20											
21											
22											

The area in cell H11 is calculated by the formula =D11\*E11. The sum function. The value in cell H14 is calculated by the formula =H14/1000. To calculate the tons of asphalt, the formula is =I17\*32.5. To calculate the tons of subgrade, the formula is =I19\*36.8. If we know the area in square feet, we could calculate the tons of asphalt and subgrade.

Note: In construction, we use Excel. If you find a paper form. There are no need to do the calculations with a calculator. The number precision in Excel is 15 digits.

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times the width, like 20\*20 (H11), the SUM function. The value in cell H14 is calculated by the formula =H14/1000. To calculate the tons of asphalt, the formula is =I17\*32.5. To calculate the tons of subgrade, the formula is =I19\*36.8. If we know the area in square feet, we could calculate the tons of asphalt and subgrade.

Another reason to use Excel is that it will automatically recalculate all values when you change a pencil and a paper form. The