

## Chapter 1

# Basic Calculations

*RSMeans Building Construction Cost Data* (BCCD) is the most widely used reference book for estimating construction costs in the U.S. and Canada. The costs for each construction item are broken down into the components of material, labor, equipment, and overhead and profit. The book also contains square foot costs by project type. The square foot cost data must be adjusted to fit the specific location, size, and conditions of a particular project. *Means CostWorks*® is the electronic version of *Building Construction Cost Data* and contains all the same information plus additional features—including the ability to adjust all cost figures by a specific location factor, apply quantities to line items, and export cost data to a spreadsheet.

### ***Means Cost Data Format***

#### **The Means Unit Price Line**

All Means unit price (UP) data is presented in the same basic format:

		03 30 53 Miscellaneous Cast-In-Place Concrete	Crew	Daily Output	Labor Hours	Unit	Bare Mat.	Bare Labor	Bare Equip.	Bare Total	Total Incl. O&P	
40	0010	CONCRETE IN PLACE										40
	0020	Including forms (4 uses), concrete, placement, reinforcing										
	0050	steel and finishing unless otherwise indicated										
	0100	Concrete in place, avg. concrete framed building, incl finish	C14B	40	5.212	C.Y.	258	185	18.10	461.10	595	
	0130	Concrete in place, avg. substructure only	C14D	70	2.850	C.Y.	600	101	10.30	711.30	835	
	0150	Concrete in place, avg. for superstructure only, incl finish	C14B	33.50	6.233	C.Y.	163	222	21.50	406.50	550	

Each line in the Means database contains information unique to that line: a specific 12-digit number address, detailed description, crew, daily output of the task using the noted crew, labor hours for the task using the specific crew, and a unit of measurement. Also included are the unit bare cost (material, labor, equipment, and total) and the total unit cost including overhead and profit.

Unit price information is presented according to the 50 CSI MasterFormat divisions (2004 revision). These divisions are divided into major subdivisions and

then into subsections of similar items. Within each subsection, items are arranged alphabetically by type. Each line item is unique.

## Address Number

The address number of the line item shown below can be read as three parts:

03 30 53 is the Level Three – CSI MasterFormat subdivision. Note that this number is part of the 03 30 Level Two – MasterFormat subdivision (cast-in-place concrete). The first two digits of that number represent the Level One MasterFormat division. (For this item, it is Division 3, or 03, which is Concrete.)



40 (bold number in extreme left and right columns) is the Level Four – Means major classification (concrete in place).

0350 (2<sup>nd</sup> column from left) is the Means individual line number.

*Note that while MasterFormat uses a period after the level three subdivision (03 30 53.40 0350), the period is not needed to input the line number in CostWorks software.*

## Description

Column 3 contains a detailed description of the item. For a full description of an item, one must read up through the subsection, including all descriptive information that appears on lines above and to the left of the selected item.

03 Concrete		US National Average Costs					 <b>First Source</b> www.FirstSourceONL.com				
 03 30 Cast-In-Place Concrete							Union				
	03 30 53 Miscellaneous Cast-In-Place	Crew	Daily Output	Labor Hours	Unit	Bare Mat.	Bare Labor	Bare Equip.	Bare Total	Total Incl. O&P	
40	0010 CONCRETE IN PLACE										
	0020 Including forms (4 uses), concrete, placement, reinforcing steel and finishing unless otherwise indicated										
	0050										
	0100 Concrete in place, avg, concrete framed building, incl	C14B	40	5.212	C.Y.	258	185	18.10	461.10	595	
	0130 Concrete in place, avg, substructure only	C14D	70	2.850	C.Y.	600	101	10.30	711.30	835	
	0150 Concrete in place, avg, for superstructure only, incl fin	C14B	33.50	6.233	C.Y.	163	222	21.50	406.50	550	
	0300 Beams, 5 kip per L.F., 10' span	C14A	15.60	12.804	C.Y.	287	455	46	788	1,075	
	0350 25' span	C14A	18.55	10.782	C.Y.	298	385	39	722	970	


Thus, the complete description for the item in line 03 30 53.40 0350 is “Concrete in place including forms (4 uses), reinforcing steel, including finishing unless otherwise indicated, Beams, 5 kip per LF, 25' span.”

In the RSMeans print books, the description box of some items may include an illustrative sketch or a reference box. The reference box next to the item indicates a Means reference number or assembly. Reference numbers and assemblies contain detailed information that may be helpful to the estimator. Several reference boxes indicate that all these notes apply to all the items in that section. For example, R033053-10, R033053-50, R033053-60, R033105-80, and R033105-85 apply to items 03 30 53.40 0010 through 03 30 53.40 7050.

Those items with the CN next to them have their material prices updated on a quarterly basis. CN refers to *The Change Notice*, a quarterly online publication of RSMeans. For example, concrete mix with 3,000 and 5,000 psi strength (items 03 31 05.35 0150 and 0400) is tracked on a quarterly basis.

In *CostWorks*, a gray background on the 4-digit portion of the line number indicates that there is an available illustration. To view it, click the graphics icon (drawing board) on the tool bar. Reference information is indicated by blue numbers in the 4-digit portion of the line number. You can view this by clicking the line number and then clicking the titles on the pop-up list.

## Crew

In the database, a crew refers to a unique grouping of workers and equipment, identified by letter and number. The crew on each line includes the trade or trades and equipment required to efficiently perform the indicated task. Crew details are shown in the reference section at the back of the print book, or by clicking on the Crew button  at the top of the *CostWorks* screen.

Crew Lookup - based upon National Average Costs						
File						
Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C14A (Union)	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (out)	\$37.55	\$300.40	\$58.46	\$467.71	\$35.61	\$55.83
16 Carpenters	\$35.55	\$4,550.40	\$55.35	\$7,084.80		
4 Rodmen (reinf.)	\$39.50	\$1,264.00	\$65.05	\$2,081.60		
2 Laborers	\$27.40	\$438.40	\$42.65	\$682.40		
1 Cement Finisher	\$34.40	\$275.20	\$50.75	\$406.00		
1 Equip. Oper. (med.)	\$36.70	\$293.60	\$55.40	\$443.20		
1 Gas Engine Vibrator		\$21.40		\$23.55		
1 Concrete Pump (small)		\$700.60		\$770.65	\$3.61	\$3.97
<b>200 L.H., Daily Totals</b>		<b>\$7,844.00</b>		<b>\$11,959.91</b>	<b>\$39.22</b>	<b>\$59.80</b>

Crew labor hours are shown in the lower left corner of the crew box. In the case of Crew C14A, the total is: 200 LH Daily Totals. This figure represents the total labor hours worked by the 25 members of Crew C14A in a normal eight-hour workday.

If the task is done by one type of laborer with no equipment (e.g., the crew is composed of one trade only), there will be no crew ID. Instead, there will be an abbreviation of that particular labor trade and the number of workers. For example, most items in section 03 21 10.60 are done by rodmen, abbreviated as Rodm. Hence, Rodm appears in the crew column. The labor trade table on the inside back cover of the *BCCD* lists the abbreviations and their full references. These are also available in *CostWorks*.

In *CostWorks*, create and open a project, and select Unit Costs. The screen will display items similar to any page in *Building Construction Cost Data*. Go to the

desired item (by scrolling up or down, clicking on the up or down arrows, or using the Go To or Search functions). When you highlight the item (try highlighting item number 03 30 53.40 0300), you see the display of the crew ID in the crew box at the bottom of the screen.

The screenshot shows the CostWorks software interface. At the top, there's a menu bar (File, Edit, Select, View, Navigate, Tools, Help) and a toolbar with various icons. Below the menu bar, there's a header section with "03 Concrete" and "US National Average Costs". A search bar contains "03 30 Cast-In-Place Concrete". To the right, there's a "First Source" logo and the website "www.FirstSourceONL.com".

The main table lists various concrete items. The selected item is "03 30 53 Miscellaneous Cast-In-Place". The table columns are: Item, Description, Crew, Daily Output, Labor Hours, Unit, Bare Mat., Bare Labor, Bare Equip., Bare Total, and Total Incl. O&P.

			Crew	Daily Output	Labor Hours	Unit	Bare Mat.	Bare Labor	Bare Equip.	Bare Total	Total Incl. O&P
40	0010 CONCRETE IN PLACE										
	0020 Including forms (4 uses), concrete, placement, reinforcing steel and finishing unless otherwise indicated										
	0050										
	0100 Concrete in place, avg. concrete framed building, incl.	C14B	40	5.212	C.Y.	258	185	18.10	461.10	595	
	0130 Concrete in place, avg. substructure only	C14D	70	2.850	C.Y.	600	101	10.30	711.30	835	
	0150 Concrete in place, avg. for superstructure only, incl fin	C14B	33.50	6.233	C.Y.	163	222	21.50	406.50	550	
	0300 Beams, 5 kip per L.F., 10' span	C14A	15.60	12.804	C.Y.	287	455	46	788	1,075	
	0350 25' span	C14A	18.55	10.782	C.Y.	298	385	39	722	970	
	0500 Chimney foundations, industrial, minimum	C14C	32	3.476	C.Y.	129	118	.66	247.66	325	
	0510 Maximum	C14C	23.50	4.724	C.Y.	152	160	.90	312.90	420	
	0700 Columns, square, 12" x 12", minimum reinforcing	C14A	11.95	16.722	C.Y.	305	595	60.50	960.50	1,325	
	0720 Average reinforcing	C14A	10.15	19.743	C.Y.	485	705	71.50	1,261.50	1,700	
	0740 Maximum reinforcing	C14A	9.05	22.148	C.Y.	725	790	80	1,595	2,125	

Below the table, there's a "Settings" section with tabs for "Estimator", "Unit Costs", "Assembly Costs", "Project Costs", "Square Foot Models", and "Residential Models". The "Estimator" tab is selected.

The "Estimator" tab shows a detailed view of item "03 30 53.40 0800 Structural concrete, in place, column, square, min reinforcing, 16" x 16", includes forms(4 uses), reinforcing steel, and finishing".

Qty	To List	Crew	C14A	Output	Hours	Unit	C.Y.
1.000				16.20	12.330		
Material	243	Labor	440	Equip.	44.50	Total	727.50
						O&P	1,000

You can look at Crew C14A composition and costs by clicking on the crew icon at the top of the screen, or by double clicking on the crew box in the line item. Close it by clicking on the x in the upper right corner. The screen can be customized to meet your needs.

You can make the crew column, or almost any column, disappear by clicking on the corresponding gray button in the bottom of the screen. You can make it reappear by clicking on the button again. Columns can be expanded by grabbing and dragging the divider lines at the tops of the columns.

Costs in the crew details box are itemized in three ways:

- Bare costs
- Including subs O&P (overhead and profit)
- Cost per labor hour

The bare cost is based on the wages displayed in column A of the table "Installing Contractor's Overhead and Profit" (located on the inside back cover of the printed book, or under Labor and Crew Information on the reference icon on the

*CostWorks* toolbar). The cost “Including Subs O&P” is based on the labor wages with add-ons, displayed in columns H and I of the same table. Equipment cost, including O&P, is calculated by adding 10% to the bare equipment cost. The cost per labor hour is based on labor and equipment cost, divided by total labor hours.

In our example, total daily labor bare cost of crew C14A is:

$$\$300.40 + \$4,550.40 + \$1,264.00 + \$438.40 + \$275.20 + \$293.60 = \$7,122.00/\text{day}.$$

If this number is divided by 200 labor hours per day, we’ll get \$35.61 per **average** labor hour. If we repeat these steps with labor wages including O&P, we’ll get \$55.83 per **average** labor hour.

For equipment, total daily bare cost is \$21.04 + \$700.60 = \$721.64, or \$3.61 **average** per labor hour. This is a hypothetical number that represents the average equipment cost per labor hour if the equipment costs are spread evenly among all workers.

When a crew contains a .5 or .25 worker, it means the worker is working a half day (4 hours) or a quarter of a day (2 hours) during a normal workday.

## Daily Output

The number of units of a defined task that a designated crew will produce in one eight-hour workday is referred to as the **daily output**. **Daily output** represents an average figure, which will vary with job conditions. Daily output is measured in the units specified in the unit column. For line 03 30 53.40 0350, the output is 18.55 CY per day. (Refer to this line number in the graphic on the previous page.)

## Labor Hours

This number represents the total number of labor hours it takes to produce one unit of this task using the specified crew. This number is calculated by dividing the crew labor hours (found in the crew detail) by the daily output.

$$\frac{\text{Labor Hours}}{\text{Unit}} = \frac{\text{Total Daily Crew Labor Hours}}{\text{Daily Output}}$$

$$\frac{\text{Labor Hours}}{\text{CY}} = \frac{200 \text{ Labor Hours}}{18.55 \text{ CY/day}} = \frac{10.782 \text{ Hours}}{\text{CY}}$$

This basic relationship of crew labor hours and productivity can be used to calculate labor hours for crews of different composition. It can also be used to calculate the length of time it will take to perform this task with crews of differing composition.