



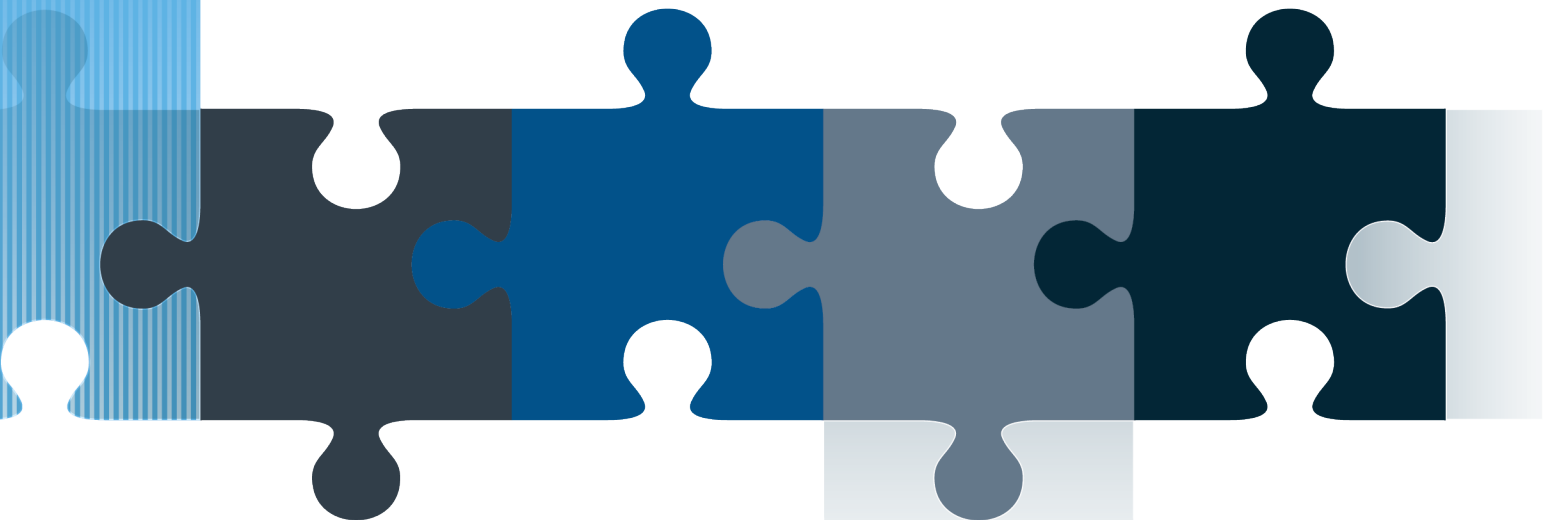
# Solving the Construction Estimating Puzzle: How to Estimate Thoroughly and Accurately for Every Project

Puzzles come in all sizes and degrees of difficulty. Colorful 12-piece puzzles of happy dinosaurs for the curious toddler. 500-piece illustrated scenes of old-timey storefronts. Mammoth jigsaw landscapes that cover an entire drafting table. While no two puzzles are exactly alike, the strategies for completing them are consistent, no matter how great the challenge. The same could be said for construction estimating.

There are proven methods an estimator should follow from scoping to quantity takeoff to cost estimating to produce a thorough, accurate estimate that stays within the project's budget and timeline. The advice in this guide is the same for estimating any project, from a simple bathroom renovation to a towering new office complex.

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## BEFORE STARTING THE ESTIMATE: PUZZLE PREP

Everyone starts a puzzle the same way: By taking a good, long look at the front of the box to get a full picture of what the puzzle should be when it's complete. This happens before a piece ever leaves the box. Construction estimating has its own prep work and it has the same effect. By studying contract documents and doing some legwork before you estimate quantities or prices, you'll establish a clear picture of what will be built in the end.

### Sink Your Teeth Into the Scope of Work

Among the contract documents provided to you when a project goes out to bid is a Scope of Work (SOW). A Scope of Work is a detailed statement explaining exactly what is expected of the team completing a particular construction contract. A well-written scope defines the who, what, when, where and how of a project. The scope should include everything—from required materials and equipment to project milestones and deliverables—so it's important that you familiarize yourself with it.<sup>1</sup>

What's in a Scope of Work?

- ① **Purpose statement.** This explains the intended function of the structure being built.
- ① **Contractor responsibilities.** In addition to project and subcontractor management, this often includes advising on and accepting design documentation.
- ① **Owner responsibilities.** Generally, this concerns approving plans and how to communicate disputed items.
- ① **Project execution requirements.** This includes standards, regulations and special requirements.
- ① **The quality, quantity and means of execution.** A contractor should have enough details to estimate labor costs.
- ① **Project timeline.** This includes milestones.
- ① **Payment and reporting schedules.** Everyone needs to be aware of the schedule in order to meet due dates.
- ① **Related tasks and duties.** These are required to obtain expected results in accordance with the project goal.
- ① **Contractor performance evaluation.** The evaluation methods and metrics used for complete transparency and agreement.



“GOOD ESTIMATORS ARE MADE GREAT THROUGH THEIR KNOWLEDGE OF CONSTRUCTION AND THEIR ABILITY TO MENTALLY BUILD THE PROJECT MULTIPLE TIMES BEFORE THE PROJECT IS ACTUALLY BUILT.”

Rory Woolsey, CEP

## BEFORE STARTING THE ESTIMATE: PUZZLE PREP (CONT.)

### Review Plans and Specs

During your first review of the plans and specifications, identify and note all items to be estimated. Examine carefully the General Conditions, Supplemental Conditions and Special Conditions sections of the specifications. These sections describe the items that have a direct bearing on the proposed project but may not be part of the actual construction. A good example of such an item is an office trailer: It won't materially build anything but the build can't happen without it.

### Visit the Job Site

As an estimator, you should always visit the project site to address specific conditions that may not be apparent from reviewing the plans. Be sure to look for site access, proximity to utilities and other resources and adequate space for storage and equipment.

### Check the Weather

If snow is common in your area, allow for the expense of snowplowing if the project spans the winter season. If rain is in the forecast, determine whether site drainage will be necessary.

### Remember the Puzzle Box

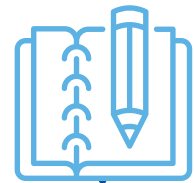
Studying contract documents and visiting the job site will paint a clear picture of what the job is ultimately trying to accomplish—just like the front of a puzzle box.

One of the most exhilarating parts of doing a puzzle is dumping the pieces from the box and watching them spread. It's a moment alive with possibilities. It's the instant the challenge officially begins. For the construction estimator, that instant is the quantity takeoff.

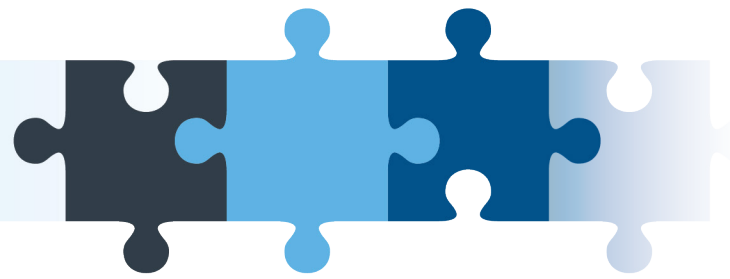
The purpose of the quantity takeoff is to provide a complete list of material, equipment and tasks for an accurate cost estimate. That's a lot of puzzle pieces. Industry practices have been established to maximize the speed, ease and accuracy of the takeoff process. These practices should be adhered to. No estimate will be reliable if a mistake is made during quantity takeoff, no matter how precise your construction cost data.

### Follow the Leader

It is likely that the person preparing the quantity takeoff will also prepare the cost estimate. But if not, it is best to follow the takeoff preferences of the cost estimator to prevent confusion and misinterpretation. Use footnotes, symbols or sketches to clarify any ambiguities so the takeoff is as clear and informative as can be.



# QUANTITY TAKEOFF: SETTING OUT THE PIECES



## Takeoff From the Ground Up

A good approach to completing a quantity takeoff is to follow the order of the actual construction, from the footings up to the roof. This will provide you a clear mental picture of the project. If a project consists of more than one building, perform a separate quantity takeoff for each building, since unit costs may vary from structure to structure.

## Keep Quantities Simple and Consistent

A quantity takeoff is a massive list of materials and measurements. It's best to keep quantities as simple and consistent as possible. This is especially important when dealing with spreadsheets. The following is a field-tested method for entering quantities.

- ① Enter the building component in the far-left column, labeled "Description."
- ② Next, list the number of components, followed by their dimensions. Where possible, use the dimensions stated in the plans instead of measuring by scale. Always express dimensions in the same order: length x width x height (or depth).
- ③ List quantities of unit items associated with each component in the subsequent columns. When taking off strip footings, for example, the associated items include structural excavation, concrete, formwork, backfill and disposal. Measurements, such as cubic yards of concrete, are applied to each unit item.
- ④ If you enter different sizes of the same component in your takeoff, list quantities in the appropriate columns and find the total. This way, you can calculate, for instance, the number of cubic yards of concrete needed for strip footings for the entire building and sum it up at the bottom of the column labeled "Concrete."

**Figure 0-4** Quantity Sheet

**RSMeans data Forms**  
QUANTITY SHEET

SHEET NO. \_\_\_\_\_  
PROJECT \_\_\_\_\_ ESTIMATED NO. \_\_\_\_\_  
LOCATION \_\_\_\_\_ ARCHITECT \_\_\_\_\_ DATE \_\_\_\_\_  
TAKE OFF BY \_\_\_\_\_ EXTENSIONS BY: \_\_\_\_\_ CHECKED BY \_\_\_\_\_

DESCRIPTION	NO.	DIMENSIONS			UNIT	UNIT	UNIT	UNIT
<b>Strip Footings</b>								
Structural Excavation	LS							
Concrete	35	12	14	3				
Formwork	LS							
Backfill	LS							
Disposal	LS							

## Keep Scale in Mind

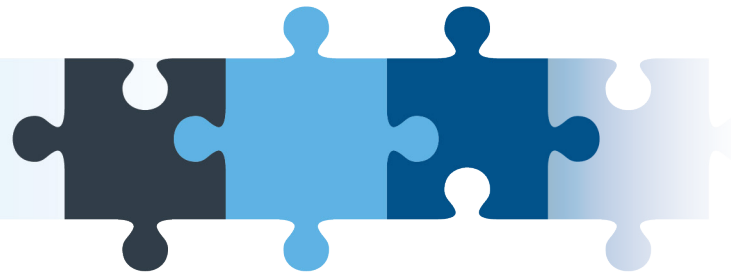
Check the plan, drawings and details carefully for change in scale, plans reduced from their original scale, notes such as "NTS" (Not to Scale) or discrepancies between plans and specs. As you go, it doesn't hurt to do some mental arithmetic if a quantity or measurement seems fishy—drafters make errors too.

## Remember Labor

A quantity takeoff is used for listing material items, but it lists labor services as well. These services are called work items and while they may not appear in the plans, they are required to complete the job.

Any item that has a cost value should be assigned a unit of measure, even if it is only a lump sum (LS). The term lump sum is used for work items that cannot be measured or expressed in any other way. These tend to be General Conditions task like cleanup or street sweeping. The note "LS" signifies an item that requires a cost allowance based on judgment.

# QUANTITY TAKEOFF: SETTING OUT THE PIECES (CONT.)



## Keep Consistent With Plans

Whenever possible, identify items in the quantity takeoff by their location on the plans. When working with building plans, use a consistent system. For instance, take measurements in a clockwise direction around a floor plan, first recording measurements of items displayed horizontally on the plans and then recording those shown vertically.

## Do It With Decimals

Use decimals, not fractions, in quantity takeoffs. Decimals are faster, more precise and easier to use on a calculator or in a spreadsheet. Convert plan dimensions from feet and inches to “decimal feet,” that is, feet and tenths of a foot.

In most cases, the use of two decimal places is sufficient for quantity surveying purposes and easy to enter on a calculator or a computer. However, when writing a product calculation, decimals are usually meaningless. It is best to develop rules for precision that are consistent with measurement capabilities. Here’s an example:

ITEM	INPUT	OUTPUT
Earthwork	Nearest 0.10 feet	Nearest CF or CY
Concrete	Nearest 0.01 feet	Nearest CF or CY
Formwork	Nearest 0.01 feet	Nearest SF
Finishing & Precast	Nearest 0.01 feet	Nearest SF
Lumber	Nearest 0.10 feet	Nearest BF
Finishes	Nearest 0.10 feet	Nearest SF or SY

You must learn the measurement standards for each industry. For instance, lumber dimensions of 12 ½ feet must be rounded up to 14 feet to align with standard sawmill cutting practices.

Finally, do not convert units until all items in a column are totaled. For instance, keep concrete in cubic feet (CF) until all quantities listed in the concrete column have been listed. Then convert the total to cubic yards (CY).

## Be Real About Waste

Some material will be wasted during construction and you should allow for this waste in your takeoff. Before you make a waste allowance, quantities are referred to as *net quantities*. After the waste allowance is made, quantities are considered *gross quantities*.

## Mark as You Go

Avoid errors of omission and duplication by marking the plans as you takeoff items. Make colored pencil or highlighter shadings and check marks directly on the plans. That way, if you stop and start again you can safely assume any unmarked item has not been taken off yet.

Typically, a single kind of marking won’t work for every category. You have to develop a system that works for you.

## Develop Your Puzzle Process

Just as it is best to sort pieces by color, find the corners and frame the border of a puzzle, following a repeatable procedure during quantity takeoff will result in an accurate estimate completed quickly.

# COSTING THE ESTIMATE: ASSEMBLING THE PIECES



You've studied the box, dumped your pieces, organized them and built your frame. Now it's time to put the puzzle pieces together and apply costs to your takeoff quantities.

## Types of Costs

All costs included in a unit price estimate fall into one of two categories: direct costs and indirect costs. Direct costs are those linked to the physical construction of a project. Material, labor and equipment prices are all direct costs, as are subcontractor costs. Direct costs are commonly called “bare” or “unburdened” costs.

Indirect or overhead costs are incurred in completing the project but are not applicable to any specific task. They may include items such as supervision, insurance, temporary facilities, professional services and contingencies. Indirect costs are separated into two categories: job site overhead and main office overhead.

Job site overhead costs are indirect costs associated with the job site. They can be estimated in detail but are typically calculated as a percentage of direct costs and included in CSI MasterFormat Division 1 of the estimate.

Main office overhead costs are associated with the operation of the contractor's main or home office. Overhead costs are typically calculated as a percentage of the total project cost and added at the end of the estimate. Some costs, such as professional services, may be counted as either project overhead or main office overhead, depending on how the resource is used.

### Construction Estimating Checklist

- Direct Overhead Costs (Project Overhead)
  - Personnel
    - Superintendent (if for that project only)
    - Project manager (if for that project only)
    - Field engineer (if for that project only)
    - Cost engineer (if for that project only)
    - Scheduler
    - Warehouse personnel (if for that project only)
    - Watchman/guard dogs
    - Tool room keeper (if for that project only)
    - Tool room keeper (if for that project only)
    - Timekeeper (if for that project only)
    - Foreman (if for that project only)
    - Site safety manager
  - Bonds
    - Surety
    - Bid
    - Payment
    - Performance
  - Miscellaneous
    - Vehicles
    - Permits
    - Licenses
    - Tools and equipment
    - Photographs
    - Surveying
    - Testing
    - Job signs
    - Pumping
    - Dust control
    - Scaffolding
    - Lifting/hoisting
    - Cleanups (periodic)
    - Final cleanup
    - Damage/repair to adjoining buildings and/or public ways
  - Temporary Facilities
    - Field office expense
      - Set-up and removal
      - Light
      - Water
      - Telephone/Internet
      - Supplies
      - Equipment
      - Fax machine
      - Copy machine
      - Ring binder machine
      - Coffee machine
      - Computer(s)/software
    - Temporary light and power
    - Temporary heat
    - Temporary water
    - Cell phone/tradex
    - Toilet facilities
    - Enclosure
    - Storage trailers
    - Fencing
    - Barricades and signals
    - Construction road
    - Project sign

- Indirect Costs (Main Office Overhead)
- Salaries
  - President
  - Executives
  - Secretaries/reception
  - Estimators/schedulers
  - Project managers
  - Construction manager
  - Cost engineers
  - Purchasing agent
  - Cost/bookkeeping
  - Engineers
  - Other office personnel
  - Yard personnel
    - Tool manager
    - Mechanical/maintenance
    - Drivers
    - Equipment operators
- Office
  - Maintenance of ownership
  - Electricity
  - Gas
  - Water
  - Sewer
  - Telephone
  - Internet
  - Postage
  - Office equipment
  - Furniture/furnishings
  - Office supplies
  - Advertising
  - Literature
  - Club/association dues
- Professional Services
  - Legal
  - Accounting
  - Architectural
  - Engineering
- Vehicles
  - Cars/trucks
  - Cost of operation
  - Mileage expenses
- Insurance
  - Fire
  - Property damage
  - Vehicles
  - Public liability
  - Windstorm
  - Worker's compensation
  - Unemployment
  - Social security
  - Flood
  - Theft
  - Elevator

## Gathering Cost Data

Every item in the estimate must contain an associated cost—every single item. That's a lot of costs to get together and, like puzzle pieces, it's best to find them one at a time. Fortunately for you, there are many reliable sources of construction costs.

**COSTS FROM PREVIOUS PROJECTS AND ESTIMATES:** Sometimes the best place to look for cost data is your last job, provided the estimate for your last job was accurate.

**SUBCONTRACTOR QUOTES:** Subbing out the concrete work? That subcontractor should be able to give you accurate costs for his services.



## COSTING THE ESTIMATE: ASSEMBLING THE PIECES (CONT.)



**SUPPLIER QUOTES:** It is common to call a supplier and ask for costs. Fair warning: The supplier may expect your business in exchange for this info.

**PUBLISHED COST DATA:** There is a lot to be said for published cost data from independent sources. Cost databases are researched and maintained by teams of cost engineers with industry experience. Additionally, you can rely on these sources for costs you, your subs and your suppliers do not have readily available and they can be used to validate your costs and costs you receive from other sources. [RSMMeans data from Gordian](#), for example, contains more than 85,000 unit line items gathered and scrutinized by a team of engineers who spend a collective 22,000+ hours every year verifying the validity of their cost data. To ensure you have recent, localized construction prices, there is no beating published cost data.

85,000  
unit line items







22,000+  
research hours/year

970+  
locations






In all likelihood, you are going to use multiple sources of cost data during the course of an estimate. No matter which source you are using at a given time, you should follow the same system and sequence for pricing as you did for the quantity takeoff. If you started with the footings for the takeoff, start with the footings when you apply costs as well. Keeping consistent throughout the project will make it easier to check that your estimate is complete.

### Organizing the Data

At this stage of the estimate, you have a large amount of data on hand. All that information must be assembled, organized and analyzed. Generally, the information falls into one of the following major categories:

-  Quantity takeoffs for all general contractor items
-  Material supplier quotes and published prices
-  Material supplier telephone quotes
-  Subcontractor quotes
-  Equipment supplier quotes and published prices
-  Cost analysis
-  Historic costs from previous projects
-  Cost data from independent sources

That's a lot of information to get your arms around—you need a system to handle it all efficiently. Your goal is to transfer everything from the quantity takeoff to the cost estimate one time without rework. This is a tall task, but doable if you follow this procedure:

-  Code each document with a division number in a consistent place. Give yourself only one place to look for division.
-  Use telephone quote forms and templates for uniformity.
-  Document the source of every quantity and price.
-  Use a logical, consistent directory filing system and file naming conventions.
-  Back up all important data.



## COSTING THE ESTIMATE: ASSEMBLING THE PIECES (CONT.)



All subcontractor costs should be noted and listed separately. These costs contain the subcontractors' markups and should be treated differently from other direct costs after you calculate the overhead, profit and contingency allowance.

Unit price estimates for building construction are typically organized according to the divisions of the CSI MasterFormat. Within each division, identify, list and assign costs to each component or individual construction item. This level of detail and definition is necessary to complete an accurate estimate. Additionally, each item can be divided into material, labor and equipment components.

### The Estimate Summary: The Final Piece of the Puzzle

When you complete pricing of direct costs, you have two choices: Either make further price changes and adjustments on the Cost Analysis or Consolidated Estimate document or transfer total costs for each subdivision to the Estimate Summary document so further price changes are recorded in one place. Given the immense volume of unit items in an estimate, it is standard practice to transfer costs to the Estimate Summary. Be sure to double-check this step, as errors are easy to make.

To save time, it is wise to create a standard Estimate Summary document that lists items repeatedly estimated. Appropriate column headings or categories for any Estimate Summary include:



Material



Labor



Equipment



Subcontractor



Total

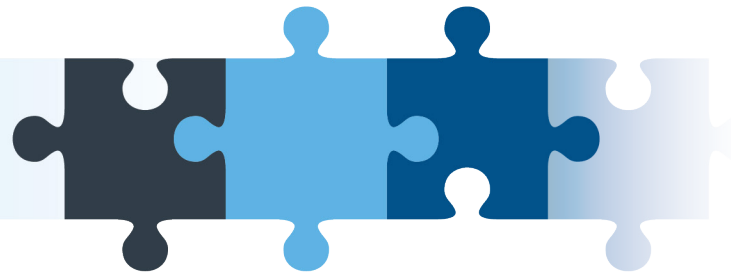
Remember to apply the appropriate markups to total dollar values. Generally, the sum of each column has different percentages added to account for indirect costs, including:

- 🎯 Sales tax
- 🎯 Main office overhead
- 🎯 Profit
- 🎯 Contingencies

### Factoring in Subcontractor Costs

Since subcontractors complete over 50% of the work on a typical building project, pay special attention to two aspects of bid preparation. The first is the subcontractor's Scope of Work. It is essential to have a clear understanding of subcontractor scope to compare competing bids and to ensure you have included all items the subs may have excluded, such as cutting and patching, temporary protection and the like. The second aspect that needs a careful eye is pricing. Subcontractor prices typically arrive on bid day, leaving little time to analyze competing bids or address last-minute gaps in coverage. Thorough communication and coordination throughout the bid process will go a long way to minimize eleventh-hour changes.

# ESTIMATING TIPS: PUZZLE MASTERY



As you complete puzzles, you build puzzle-building habits. The same could be said for creating construction cost estimates—the more frequently you estimate, the more efficient you'll become. Below are tips and tricks for optimizing your estimating process to become more efficient, minimize rework and produce accurate estimates.

## Tips and Tricks for Manual Estimates

Estimating by hand is, to put it charitably, not ideal. Handwriting may be illegible. If work is interrupted, finding your place later may waste precious time. Errors of omission may be more common. Estimating by hand should be a bygone practice, but if you must estimate by hand, here are some ways to do it more effectively:

- Write on only one side of a page.
- Keep each type of document (quantities, materials, equipment, etc.) separate and filed in order by division number.
- Keep the entire estimate in one or more compartmented folders.

## Tips and Tricks for Estimating on Electronic Spreadsheets

Estimating in Excel or electronic spreadsheets makes construction estimating easier, though this method has its flaws. Versioning can get cumbersome. Formatting can devour your time. One formula mistake can tank the whole estimate. Here are some tips for optimizing your process:

- Save commonly used templates in their own folder.
- Spot-check important formula results with manual calculations.
- Save your work frequently.
- Combine related spreadsheets into workbooks.
- Use a naming convention that indicates whether a spreadsheet is in progress or complete.
- When entering quantities into a cell, include useful numerical information. For example, if 10% is added to a quantity of 300, enter  $=300*1.1$  instead of 330 to keep track of the addition.

## Tips and Tricks for Estimating With RSMeans Data Online

It is an industry best practice to use a construction estimating software. RSMeans Data Online offers the ability to create and manage estimates in an online platform backed by North America's leading construction cost database. Here are some tips for using RSMeans Data Online successfully:

- Mark commonly-used assembly and unit items as "favorites" to save them for quick access.
- Follow price trends and set alerts to be notified when costs change. You can choose to receive notifications for local costs and/or costs for particular materials and equipment.
- Check the reference section for the City Cost Index, common construction abbreviations, crew explanations, video tutorials and even more tips for success.
- Customize assemblies and units to meet your estimating needs. Add, swap and remove assembly components to meet project requirements or to value engineer.
- Print, email or export estimates to Excel for easy sharing with other project stakeholders.
- Use predictive costs to create accurate conceptual estimates up to three years in the future.



# CONSTRUCTION ESTIMATING: THE ULTIMATE PUZZLE

Estimating for building construction is the ultimate puzzle. Not only are there thousands of pieces to put together, but you have to find them yourself—they don't have the decency to come in a box. Like completing a puzzle, putting together an estimate requires patience, attention to detail and the discipline to orient yourself toward a goal and work toward it. It helps to have the right tools as well.

RSMeans Data Online helps you complete more estimates in less time and with fewer headaches. With RSMeans Data Online, you can:

- Find reliable, localized construction cost data for fast access to labor, equipment and material prices.
- Create square foot, assembly and line item estimates and easily share, print and export to Excel.
- Receive automatic price updates for certainty and peace of mind with every estimate.
- Estimate accurately up to three years into the future with predictive cost data.

**Ready to piece together construction cost estimates quickly and accurately? [Sign up for a free 30 day trial of RSMeans Data Online.](#)**

## RESOURCES

[Estimating Checklist](#)

[Quantity Takeoff Sheet](#)

<https://www.thebalancesmb.com/must-have-items-on-a-scope-of-work-sow-844916>



## About Gordian

Gordian is the world's leading provider of facility and construction cost data, software and services for all phases of the building lifecycle. A pioneer of Job Order Contracting (JOC), Gordian's solutions also include our proprietary RSMeans data and Sightlines Facilities Intelligence solutions. From planning to design, procurement, construction and operations, Gordian's solutions help clients maximize efficiency, optimize cost savings and increase building quality.

