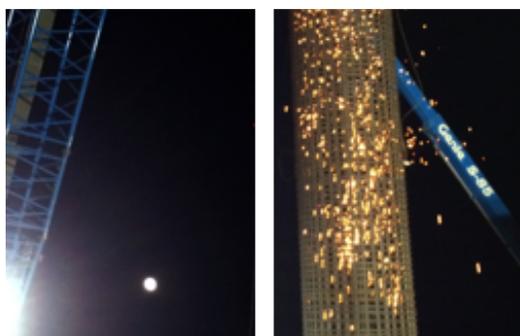


# Engineer Estimating Guidelines

a guide for the preparation of roadway construction cost estimates





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# Estimating Guide

## GENERAL

The Project Engineer's Estimate of Cost serves two purposes:

- It estimates the fair and reasonable price RCTD should expect to pay for each of the items of work to be performed.
- It provides the ability to validate the adequacy of available funding.

Historical Bid price information is maintained by RCTD. In addition, Caltrans publishes annual cost data books. The Caltrans documents are produced by the Office of Office Engineer and are posted on Caltrans web site at:

[www.dot.ca.gov/hq/esc/oe/awards/index.html](http://www.dot.ca.gov/hq/esc/oe/awards/index.html)

Caltrans also provides a searchable database with cost history that is available at the following web site:

[sv08data.dot.ca.gov/contractcost/index.php](http://sv08data.dot.ca.gov/contractcost/index.php)

To estimate the price of individual items, use recent bid prices for similar projects considered to have had competitive bidding.

Consider factors which might affect bid prices, such as: quantity, project location and accessibility, project terrain, effect of existing traffic on the contractor's operations, source and availability of materials and water, time limits which might require more than ordinary overtime work or double shifting, and season of the year in which the work is to be done.

The amount of funds allocated for the project should not influence the estimated prices. Reducing prices to keep the estimate of cost within the program amount will not reduce bid prices at the time bids are opened. Bid overruns can cause serious problems such as delay of award, or rejection of bids and need to re-advertisement.

Bear in mind that many funds are for project improvement (Capital Outlay) only. For these fund sources, do not set up funds for items to become County facilities if those items are to be used for other purposes. (Example: It may be illegal to have funds for Changeable Message Signs for traffic control and then require the contractor to turn such signs over to maintenance forces.)

#### Basic Engineering Estimate

Include all elements of the project such as railroad work, temporary or detour structures (and their removal), removal of existing structures, supplemental work and mobilization.

The Project Estimate of Cost has these components:

- Contract Items.
- Supplemental Work.
- County-furnished Materials and Expenses.
- Contingencies.

## **CONTRACT ITEMS**

### **GENERAL**

Contract items are the bid items of work used in the Engineer's Estimate, the Bid Schedule and Contract Book.

List the items of work in numerical sequence by Item Code number. The item description should be exactly as shown in the Coded Item List. Electronic or hard copies of the coded item list may be obtained from RCTD.

### **NON-STANDARD ITEMS**

When work does not fit an established item and it is anticipated that the work is not unique to the project, the County Specifications Engineer will need to create a new one. The item description should be understandable but as brief as possible. Use the same style and format as that used for standard items. Do not use abbreviations. If the work is unique to the project and not expected to be used on future projects, the work should be coded using bid item 000003 with the description replaced with an appropriate description for the work.

All County created items shall begin with the first two digits equal to "01". The Second two digits shall represent the section of the Caltrans specification that the bid item is related to. These second two digits represent the first two digits that are provided on item codes that are created by Caltrans and generally correspond to the relevant section of the specifications. The last two digits are provided sequentially.

### **SPECIALTY ITEMS**

Some items of work require equipment and expertise not normally possessed by most general contractors. Therefore, the awarded contractor may have to subcontract these items. It is Caltrans' policy (and subsequently County policy) to allow the subtraction of the cost of this specialized work from the total non-specialty contract amount, and only require the awarded contractor to perform a minimum of 50 percent of the remaining contract work. The Standard Specifications requires the prime contractor to perform at least 50 percent of the dollar amount of the contracted work, excluding specialty items. This

requirement is to ensure that the contractor does the majority of work and is not just a work broker.

Specialty items of work are designated on the Engineer's Estimate with an (S).

These guidelines apply to Specialty Items:

- When a project contains work that is different from the basic type of work and that work would normally be done by a specialty contractor, designate the item or items covering such work as specialty items.
- If the prime contractor's forces can be expected to perform the work, do not designate the work as a specialty item.
- The following rules apply when designating specialty items:
- If the Engineer's Estimate is less than \$500,000, each specialty item must have a value of \$2,000 or more.
- If the Engineer's Estimate is greater than \$500,000, each specialty item must have a value of \$5,000 or more.
- Group items (for example, striping, pavement markings, and pavement markers) to meet the value criterion.
- Keep specialty items to a minimum to ensure that the awarded contractor does the majority of the work. If the prime contractor is expected to be other than a general contractor, designate as specialty items work which would not be done by the awarded contractor.
- If it is anticipated that the prime contractor will be a general contractor, limit specialty items to those listed in Table B.
- When a highway project involves the construction, alteration or modification of an off-highway building structure, designate items of building work as specialty items.

**Table A**  
**Approved Specialty Items**

| ITEM CODE          | SPECIALTY ITEMS  |
|--------------------|--|
| 120090             | CONSTRUCTION AREA SIGNS  |
| 120100             | TRAFFIC CONTROL SYSTEM   |
| 12----             | TRAFFIC CONTROL DEVICES SUCH AS PORTABLE CHANGEABLE MESSAGE SIGN, BARRICADE, CONES, ETC. |
| 1531--             | PLANE PAVEMENT   |
| 20----             | EROSION CONTROL, PLANTING, IRRIGATION AND PLANT ESTABLISHMENT WORK                       |
| 4201--THRU 4202--  | GRIND AND GROOVE PAVEMENT  |
| 490340 THRU 499010 | DRIVING PILES, CAST-IN-DRILLED-HOLE CONCRETE PILING AND SHEET PILING                     |
| 500001             | PRESTRESSING CAST-IN-PLACE CONCRETE  |
| 5124--THRU 5125--  | ERECT PRECAST MEMBERS  |
| 515059 THRU 515165 | CORE CONCRETE  |
| 517950 THRU 518220 | SOUND WALLS  |
| 519080 THRU 519119 | JOINT SEALING  |
| 5201--             | BAR REINFORCING STEEL  |
| 5301--             | SHOTCRETE  |
| 5400--THRU 5401--  | WATERPROOFING  |
| 5502--             | ERECT STRUCTURAL STEEL   |
| 5601--THRU 5610--  | INSTALL SIGN STRUCTURES, CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION)            |
| 5900--THRU 5902--  | CLEAN AND PAINT STEEL  |
| 60----             | RAILROAD TRACK WORK  |
| 7110--THRU 719506  | SANITARY SEWERS  |
| 7405--THRU 7415--  | PUMPING PLANT RELATED WORK AND EQUIPMENT   |
| 7500--THRU 7505--  | MISCELLANEOUS METALS   |
| 8000--THRU 8099--  | FENCES   |
| 8320--THRU 8395--  | RAILINGS AND BARRIERS (EXCEPT CONCRETE)  |
| 83959-THRU 8396--  | CRASH CUSHIONS   |
| 8405--THRU 8407--  | STRIPING AND PAVEMENT MARKINGS   |
| 8501--THRU 8502--  | PAVEMENT MARKERS   |
| 8601--THRU 8690--  | SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS   |
| 9901--THRU 9950--  | BUILDINGS AND RELATED FACILITIES   |

If an item listed in Table A is a majority of the work, do not designate it as a specialty item.

Furnishing specialty type items, such as "furnish steel piling" or "furnish sign structure" are not to be designated as specialty items.

Items with the prefixes temporary, adjust, remodel, relocate, and reconstruct which are similar to the approved specialty items listed in Table A, should also be designated as specialty items. Examples are temporary traffic stripe and reconstruct metal beam guard railing.

### FINAL PAY QUANTITIES

Final pay quantities are to be designated on Engineer's Estimate using (F) as appropriate for the item involved. Do not identify final pay items on the plans. Payment will be made for the total quantity shown on the Engineer's Estimate unless the Engineer orders a change in the dimensions of the work. Do not round final pay items in the Engineer's Estimate. The contract items of work listed in Table B are generally designated final pay.

**Table B**  
**Items Generally Designated as Final Pay**

| ITEM  | CONSTRUCTION WORK                  |
|---|------------------------------------|
| Minor Concrete (Minor Structure)  | Drainage Inlets and Pipe Headwalls |
| Miscellaneous Iron and Steel  | Frames and Grates                  |
| Class A Concrete (Structure)  | Box Culverts and Wingwalls         |
| Bar Reinforcing Steel   | Box Culverts and Wingwalls         |
| Furnish and Install Sign Structures (Tubular, Truss, Lightweight, etc.) | Overhead Sign Structures           |
| Structure Excavation (Bridge)   | Bridges                            |
| Structure Backfill (Bridge)   | Bridges                            |
| Structural Concrete, Bridge   | Bridges                            |
| Structural Concrete, Bridge Footing                                     | Bridges                            |
| Structural Concrete, Approach Slabs                                     | Bridges                            |
| Sound Wall (Masonry Block)  | Walls, Bridges                     |
| Structural Concrete, Retaining Wall                                     | Retaining Walls                    |
| Bar Reinforcing Steel (Bridge)  | Bridges                            |
| Bar Reinforcing Steel (Retaining Wall)                                  | Retaining Walls                    |
| Miscellaneous Metal (Bridge)  | Bridges                            |
| Miscellaneous Metal (Restrainer)  | Bridges                            |
| Railings and Concrete Barrier on Structures                             | Bridges                            |
| Pipe (Supply Line)  | Irrigation Systems                 |

Independent verification of Final pay quantity calculations shall be provided.

### **MOBILIZATION & DE-MOBILIZATION**

Mobilization reimburses the contractor for costs incurred before and during "move in". Mobilization requires that contractor furnish and/or deliver to the job site all labor, materials, resources, and temporary support facilities, including but not limited to portable sanitary facilities, and equipment necessary to perform the required Work. In addition, contractor shall prepare all required written plans and schedules, including but not limited to: Site-Specific Health and Safety Plan, initial and progress construction schedules, and sub-contractor work plans.

Demobilization will be paid after the Work has been deemed substantially complete, contractor has provided record documents in accordance with the requirements of the specifications, and contractor has demobilized from the site, which shall include removal of all materials, resources, equipment, temporary support facilities, and all remaining construction debris at the completion of the work.

Use a mobilization item when the number of working days for the project is 120 or more (excluding plant establishment working days) and the estimated cost is \$300,000 or more. A mobilization item may be included for projects consisting principally of bridgework even if the project's number of working days and estimated cost are less than the criteria above.

On large and complex projects including interchanges and bridges it is common to split 10% of the construction cost between the items of mobilization demobilization.

## **SUPPLEMENTAL WORK**

Supplemental Work is work which is anticipated and required for completion of the project but is of such an uncertain nature or amount that it cannot be done on a contract item basis.

Do not use Supplemental Work:

- to take the place of complete design work and quantity calculations. When work can be shown or specified such that it is biddable, it must be paid for by contract item.
- to reserve extra funds for contingencies by adding items or amounts in excess of what can be reasonably anticipated.
- to perform work which should be funded from other sources.
- for contract funds to be paid to anyone other than the contractor such as railroad inspection work. Include these funds under County-Furnished Materials and Expenses.

The Standard Specifications indicate that various portions of removal work (unsuitable material, slides, buried manmade objects, etc.) will be paid as extra work. Funds for this work should come from contingencies unless specific information is available to show that the amount of work is sufficient to justify a separate entry in Supplemental Work.

Work mentioned in a general way in the contract special provisions should be funded from contingencies unless specific information is available to show that the amount is sufficient to justify a separate entry in Supplemental Work.

Itemize any extra work identified in the contract special provisions as Supplemental Work, except as discussed above.

Justification must be provided for Individual Supplemental Work items equal to or greater than the following dollar amounts or percent of the total amount of Contract Items, whichever is greater:

Projects less than \$300,000 = \$ 4,000 or 5%

Projects less than \$1 million = \$15,000 or 2.5%

Projects more than \$1 million = \$25,000 or 1%

If the Total Supplemental Work excluding items shown in Table C to be excluded is equal to or greater than the following dollar amounts or percent of the total amount of Contract Items, whichever is greater; justification must be provided:

Projects less than \$300,000 = 10%

Projects less than \$1 million = \$ 30,000 or 5%

Projects between \$1-5 million = \$ 50,000 or 3%

Projects between \$5-25 million = \$ 150,000 or 2%

Projects more than \$25 million = \$ 500,000 or 1%

Base the justification for supplemental work on factual information, such as experience with similar work, conditions, and materials.

When an anticipated quantity of work cannot be estimated within 25 percent, it is appropriate to establish a contract item with the quantity set at a level such that an underrun of more than 25 percent is unlikely. Funds can then be included in Supplemental Work to cover overruns.

Table C is a partial listing of typical work for which it would generally be appropriate to include funds in Supplemental Work.

**Table C**  
**Items Appropriate for Supplemental Work**

| TYPE OF WORK   | CONDITIONS FOR USING SUPPLEMENTAL WORK   |
|--|--|
| Additional Asphalt Concrete<br>Additional Imported Borrow<br>Increased Paving Asphalt  | Only if the type of work is a large percentage of total, material source is not known, and material from different likely sources varies greatly in density.   |
| Clean and Seal Random Cracks<br>Salvage and Stockpile Excess Screenings<br>Remove Unsuitable Material<br>Remove Slide<br>Subsurface Drainage<br>Remove Rock and Debris   | If evidence indicates more than can be funded from contingencies.  |
| Maintain Traffic<br>(include flagging costs)<br>Maintain Detour<br>Maintain Existing Plants<br>Maintain Water Supply<br>Maintain Existing Electrical System<br>Apply Pesticide   | If need for extra work is related to the work being performed on the project in question.  |
| Detour Signing   | If on local streets or roads.  |
| Locate Existing Irrigation Facilities<br>Settlement Platform Installation<br>Compensation Adjustments for Price Index<br>Fluctuations of Paving Asphalt  | For projects with 5 000 tonnes of asphalt concrete and 50 working days. <u>Excluded</u> from limits since calculated by formula.   |
| Federal Trainees   | If project is Federal Aid eligible, with at least 100 working days.  |
| Repair Existing Irrigation System<br>Prune Existing Plants<br>Replace Existing Plant Material<br>Dispose of Removed Plant Material<br>Maintain Existing Plants<br>Maintain Existing Irrigation<br>Mowing<br>Correct Plant Deficiencies<br>Modify Irrigation System<br>Remove Rock and Debris<br>Additional Water | For restoration projects, Initial repair of existing irrigation facilities, Initial removal of litter, Initial plant removal, or Damage repair.<br><br><u>Excluded</u> from total Supplemental Work<br>Note: There is no exclusion on any individual Supplemental Work Item. |
| Additional Footing Work  | Earthquake Retrofit projects.  |
| Clean Deck Joints  | Bridge maintenance projects.   |
| Damage Investigation   | Bridge Repair projects.  |
| Incentive for Asphalt Concrete QC/QA   | QC/QA Projects - Equal to 4% of estimate for asphalt concrete. <u>Excluded</u> from limits.  |
| Partnering   | Projects with estimated cost of \$1,000,000 or more - <u>Excluded</u> from limits.   |

Table D provides a partial list of types of work for which it is normally inappropriate to include funds in Supplemental Work.

**Table D**  
**Items Not Appropriate for Supplemental Work**

| TYPE OF WORK  | REASON FOR NOT USING SUPPLEMENTAL WORK  |
|---|---|
| Additional Roadwork<br>Additional Drainage Work<br>Additional Electrical Work<br>Improvement for Safety<br>Unforeseen. . . . .<br>Possible. . . . .<br>Miscellaneous. . . . . | Too general. Entries for this type work may be appropriate if they are more specific.     |
| Clean Out Existing Culverts<br>Repair Existing. . . . .   | Improper to perform maintenance work if funded from state or federal funds.               |
| Railroad Work<br>Electrical Service<br>Resident Engineer's Office<br>Motorist Service Patrol<br>Traffic Management Plan   | Include under County-furnished Material and Expense unless paid to or through Contractor. |
| Haul Material   | Should be included in contract item work.   |

**COUNTY-FURNISHED MATERIALS AND EXPENSES**

Items to be listed under this component consist of:

- work to be done by County forces or others concurrently with contract construction operations; or
- materials to be purchased and charged against the project but to be paid for directly by the County, not the contractor.

Item codes for this category of work should have a 0106 or 06 prefix (0106XX or 06XXXX). County-furnished materials and expenses are to be subtotaled and included as part of the total cost of the project.

Typical items of County expense include payment to a utility company to provide water meters and electrical service or work to be done by a railroad or other agency under a service contract, or may be work performed by County personnel such as providing painted striping. Rental cost of the Resident Engineer's office may be included when the project cost exceeds \$300,000 and the project time limit is 50 or more working days.

FHWA has approved the following materials as being in the public interest for Caltrans to furnish to the contractor as State-Furnished Materials on Federal Aid projects:

- Permanent sign panels and mounting hardware
- Types N, P, and R object marker panels and reflectors
- Laminated wood box posts and metal caps
- Survey Monument Disks
- Markers for railings and concrete barriers
- Traffic signal controller assemblies, including wired cabinets and loop detector units
- Closed circuit television cameras, changeable message signs and assemblies
- Lamps for traffic signal units, flashing beacons and sign illumination fixtures
- Asphalt concrete sealant for inductive detector loops
- Self-adhesive reflective numbers and sealer for numbering lighting equipment
- Recycled (salvaged) material in stock, such as temporary traffic signals and flashing beacons
- Seed and plants not commercially available, either by type or size, that must be grown or obtained for specific projects

The above list can therefore be considered for any County contracts. Obtain FHWA concurrence for any materials not listed above on a project-by-project basis during PS&E development for Federally funded projects.

## **CONTINGENCIES**

The next-to-last entry of the Project Estimate of Cost is to allow for contingencies. Typically, the amount for contingencies will be a nominal 10 percent of the subtotal of the cost of contract items, supplemental work, and

County-furnished materials and expenses. The contingency amount is included in the grand total of the final estimate to allow for unforeseen costs.

## **ESTIMATING ITEM PRICES**

Estimating is not an exact science, and no estimator can be "right" all the time. However, estimators can prepare reasonable estimates of the cost of the work to be performed by the contractor.

Estimates should never be artificially reduced to stay within the funding limits, nor should they be reduced to make available more project funding.

Many overruns are due to conditions that existed at the time the estimate was initially prepared and should have been considered. Estimators should consider the following factors which experience has shown will affect the bid prices on construction projects.

### **FLUCTUATION OF COSTS**

Review and update estimates just prior to project advertisement. Review and update unit prices and estimates as conditions change. Estimates must be current at the time the project is ready to list.

Material shortages may develop at unexpected intervals, causing an increase in material prices. Wages continually increase, although usually at a somewhat predictable rate. The time of year a project is advertised or constructed often affects prices.

### **TRAFFIC CONDITIONS**

Traffic conditions can have a significant affect on bid prices. Adjust prices to reflect special difficulties, dangers, and expenses caused by traffic. Contractors are inclined to raise their prices when they bid on projects with difficult traffic conditions. A separate bid item for traffic control is appropriate when a lot of work and expense is expected.

### **RESTRICTIVE WORK HOURS OR METHOD OF WORK**

Restricting the working hours or the method of work on a project may have a major affect on prices. If the special provisions limit work to nighttime or short shifts, increase unit prices to reflect:

- the cost of premium wages for night work
- premium payment for partial shifts
- general decreases in productivity and efficiency.

Night work for asphalt concrete can be especially expensive where small quantities are involved because asphalt plants do not usually operate at night and may have to do special runs at a much higher operating cost per unit. On the other hand, night work can reduce bid prices for projects with a lot of daytime traffic, where traffic control costs may be reduced significantly by allowing night-time work.

### **SMALL QUANTITIES OF WORK**

Small quantities of work will nearly always have higher unit cost than identical work in larger quantities. Move-in cost, overhead, and so on must be distributed over a much smaller base. Production is usually inefficient and slow for small quantities, which will also increase unit costs.

### **SEPARATED OPERATIONS**

Separated operations will generally have higher item costs. The order of work or scattered locations of work may require portions of a work unit to be constructed as separate operations, each requiring separate move-in and move-out costs. The unit prices should then be based on the smaller operations, not on the total quantities for the project.

### **HANDWORK AND INEFFICIENT OPERATIONS**

Handwork and small or inefficient operations (even though equipment may be used) will have higher unit costs than work adaptable to mass production machine operation or high production rates.

## **ACCESSIBILITY**

Work on an existing interchange may require long out-of-direction movements by construction personnel and equipment if the contractor must observe one-way ramp movements or enter or leave a freeway only at interchanges. Material hauling done under these conditions can be especially expensive.

Work is expensive at the top of retaining walls, on slopes, or where workers must climb slopes to get to the work area, regardless of whether the operation is handwork or is done by equipment. This is because work, which is easy to do on level ground or a gentle slope, may be almost impossible to do on steep slopes. Such a work situation will affect the contractor's bid.

## **GEOGRAPHIC LOCATION**

Geographically remote locations usually result in higher bid prices. Estimates should reflect subsistence payments when required. The source of supplies and the distance to the project from these sources should also be considered.

## **CONSTRUCTION SEASON**

The time of the year construction is scheduled may affect the bid prices. Contractors are usually more available for work early in the spring and will therefore bid competitively at that time. Later in the spring or summer, many of the contractors have on-going contracts to keep them busy and therefore tend to bid higher or not at all.

For projects to be awarded near the end of summer or the construction season, it is important to know if construction can be finished before the construction season ends. If a job cannot be finished before the end of the construction season, contractors will increase bid prices to cover overhead during winter suspension, to repair winter damage, and so on. Even if contractors reasonably expect to finish before winter, they may protect themselves by increasing bids to allow for damage due to early rains. This is especially true if construction involves work in or around drainage channels in high precipitation or snow areas.

## **MATERIAL SHORTAGES**

Material shortages will have a major affect on bid prices since prices are directly affected by supply and demand. Where a shortage is especially acute, the District might consider a change in design rather than face increasing prices.

## **ESTIMATE PRICING METHODS**

There are two methods commonly used for estimating prices. One method is to use previous bid prices as a basis for establishing prices on the proposed project. The other method is to make a complete analysis of production rates, labor costs, and material costs. These methods can be used individually or in combination. RCTD performs estimates using the previous bid price method almost exclusively.

### **PREVIOUS BID PRICES METHOD**

Basing estimates on previous bid prices is probably the most widely used and the most practical method. When using this method, take into consideration these factors:

- Use of approximately the same size and type of project having similar quantities for individual items.
- Consider using the average of the 3 low bidders or using the second low bidder.
- At a minimum, revise previous bid prices by the projected change in the California Construction Cost Index between the date of the old bid and the anticipated date of the new bid.
- Adjust the reference bid price to reflect conditions of the project, such as type of terrain, geographical location, soil, traffic and other related factors.
- Do not use lump sum bid prices or unit prices for items of work (for example, culverts) that include varying amounts of other related work.
- Seasonal work items vary by the time of year. Use comparable months.
- Sources of previous bid prices

The Specification Engineer maintains a cost history database for most common bid items used by the County. Bid Item bid price history reports are posted on RCTD's web site.

### **COMPLETE ANALYSIS METHOD**

This method is not usually practical for all contract items of work. It may be used occasionally for earthwork items where rock or unusual haul is required, or for lump sum items such as signals and lighting.

When using this method, carry-out these initial steps:

- Analyze the proposed construction.
- Estimate production rates.
- Compile a materials list.

Then:

- find materials costs using available price lists,
- determine labor and equipment hours based on the production rates,
- calculate sub-total using the above factors and finally,
- add overhead and profit for the total cost.

It is especially important to consider possible premium pay for overtime on night work and subsistence. On larger projects with long time limits, it will be necessary to determine if the majority of a work item will be done early or late in the project. To provide for work which cannot be done early in the project, it may be necessary to forecast wage scales and material cost increases in order to accurately estimate contract item costs.

### **GUIDELINES FOR ROUNDING QUANTITIES**

A PS&E contains two kinds of quantities:

- Actual calculated quantities are shown on the plans to help the contractor and the Engineer complete the project.

- Estimated quantities are included in the Engineer's Estimate, the Bid Schedule and the Contract book to simplify bidding and avoid errors in extensions.

With the exception of final pay items, quantities must be rounded. In addition to simplifying bidding, rounding keeps the estimate from seeming more accurate than it can actually be. Measurements and calculations cannot always produce absolutely accurate individual quantities. The total quantity, in turn, cannot be more accurate than the least-accurate individual quantity.

Total quantities are to be rounded by adjusting the calculated quantities, usually upward. Round on total or end quantities only, never on partial quantities or subtotals. Quantities on Plans should be actual calculated quantities, never rounded quantities.

Quantities greater than 1,000 are to be rounded to no more than 3 significant figures. The significant figures are those figures of a number that begin with the leftmost figure and extend to the last figure to right that is not zero. For example, 5,050 and 1,620,000 have 3 significant figures.

Quantities less than 1,000 are to be rounded to no more than 2 significant figures.

Avoid decimal quantities. However, it is not always possible to eliminate the decimal for small quantities. For example, a total quantity such as 1.4 m<sup>3</sup> (Cubic Meter) of Minor Concrete (Minor Structure), cannot be rounded up to 2 m<sup>3</sup> or down to 1 m<sup>3</sup> without having an estimated quantity more than 25 percent off the calculated quantity. Therefore, decimal quantities of less than 5 must be rounded to one decimal place. Volumetric or weight quantities of 5 or greater are to be rounded to the nearest whole number.

Sometimes it is possible to avoid the use of decimal quantities by changing the unit of measure. For example, use 500 kg of commercial fertilizer instead of 0.5 tonne.

Rounding must not produce a condition where the estimated quantity will be beyond the 25 percent limit for overruns or underruns specified in Section 4 of the Standard Specifications.

Final pay quantities entered in the Engineer's Estimate are not to be rounded, except to eliminate any decimal figures for total pay quantities of more than 5 units (cubic meters, meters, etc.). When the total final pay quantities contain decimal figures and they are 5 units or less, the quantity shall be rounded to not more than one decimal place when entered in the Engineer's Estimate.

## **SEGREGATED ESTIMATES**

### **FEDERAL-AID PROJECTS**

Segregated estimates are required when Federal-Aid projects involve any of the following:

- Highway work -- Segregate each item quantity according to Federal Fund type using the appropriate reimbursement ratio. Current reimbursement ratios and applications can be obtained from the Budget Program, Office of Federal Resources, or the FHWA Transportation Engineer.
- Structures -- Separate each structures by component level. Funding segregations used in highway work are not applicable to structures estimates because FHWA requires costs to be identified by individual structure.
- Non-participation items of work.
- Non-participation portions of the project.
- Work paid for by others (for example, cities, Caltrans, or local transportation agencies contributing to construction costs under cooperative agreements).
- Utility relocation when done by contract item work (by Right of Way, Utility, or Railroad Agreement).
- Work which is not a part of the project (work that is being done on the same County contract but outside of the Federal Aid project limits).

If a Cooperative Agreement or Utility Agreement requires anyone other than the County to pay for any of the contract items, Supplemental Work, or County-furnished Materials and Expenses, then those items are to be segregated as nonparticipating work.

The information needed to prepare Federal segregated estimates is generally available to the Project Engineer before the PS&E is complete. All funding sources and levels should be determined prior to PS&E submittal.

#### **OTHER AGENCIES INVOLVED**

Where other sources are contributing funds toward construction through a cooperative agreement, utility agreement, right of way contract, purchase order, or other instrument, a segregated estimate may be required which identifies each contributing agency.

## UNITS OF MEASURE

Estimates are prepared using abbreviations for units of measure. The standard abbreviations used for Unit of Measure are shown in Table E.

**Table E**  
**Unit of Measure**

| English                     |       | Metric          |       |
|-----------------------------|-------|-----------------|-------|
| UNIT                        | ABBR. | UNIT            | ABBR. |
| Acre                        | ACRE  | Calendar Day    | CDAY  |
| Calendar Day                | CDAY  | Each            | EA    |
| Cubic Foot                  | CF    | Hectare         | HA    |
| Cubic Yard                  | CY    | Hour            | H     |
| Each                        | EA    | Kilogram        | KG    |
| Gallon                      | GAL   | Kilometer       | KM    |
| Hour                        | HR    | Lane Kilometer  | LNKM  |
| Lane Mile                   | LNMI  | Liter           | L     |
| Linear Foot                 | LF    | Lump Sum        | LS    |
| Lump Sum                    | LS    | Meter           | M     |
| Mile                        | MI    | Square Meter    | M2    |
| Pound                       | LB    | Cubic Meter     | M3    |
| Square Foot                 | SQFT  | Station (100 m) | STA   |
| Square Yard                 | SQYD  | Tablet          | TAB   |
| Station (100 ft)            | STA   | Tonne (1000 kg) | TONN  |
| Tablet                      | TAB   | Track Foot      | TF    |
| Thousand Foot Board Measure | MFBM  | Working Day     | WDAY  |
| Ton                         | TON   |                 |       |
| Track Foot                  | TF    |                 |       |
| Working Day                 | WDAY  |                 |       |

If abbreviations are needed for non-standard units of measure, the Specifications Engineer should add them to the approved list before incorporating a final estimate into the contract file.

## ENGLISH / METRIC CONVERSION

Table F is provided to assist engineers with the conversion from english to metric or from metric to english. Use of these standard conversion factors will provide consistent results by all engineers.

**Table F**  
**English/Metric Unit Conversion**

### Conversion Factors From English Units to Metric Units

| UNIT                        | ABBR. | MULTIPLY   | UNIT            | ABBR. |
|-----------------------------|-------|------------|-----------------|-------|
| Acre                        | ACRE  | 0.4046856  | Hectare         | HA    |
| Calendar Day                | CDAY  | 1          | Calendar Day    | CDAY  |
| Cubic Foot                  | CF    | 0.02831685 | Cubic Meter     | M3    |
| Cubic Yard                  | CY    | 0.7645549  | Cubic Meter     | M3    |
| Each                        | EA    | 1          | Each            | EA    |
| Gallon                      | GAL   | 3.785412   | Liter           | L     |
| Hour                        | HR    | 1          | Hour            | H     |
| Pound                       | LB    | 0.4535924  | Kilogram        | KG    |
| Linear Foot                 | LF    | 0.3048     | Meter           | M     |
| Lane Mile                   | LNMI  | 1.609344   | Lane Kilometer  | LNKM  |
| Lump Sum                    | LS    | 1          | Lump Sum        | LS    |
| Thousand Foot Board Measure | MFBM  | 2.359737   | Cubic Meter     | M3    |
| Mile                        | MI    | 1.609344   | Kilometer       | KM    |
| Square Foot                 | SQFT  | 0.09290304 | Square Meter    | M2    |
| Square Yard                 | SQYD  | 0.8361274  | Square Meter    | M2    |
| Station (100 ft)            | STA   | 0.3048     | Station (100 m) | STA   |
| Tablet                      | TAB   | 1          | Tablet          | TAB   |
| Ton                         | TON   | 0.9071847  | Tonne (1000 kg) | TONN  |
| Track Foot                  | TF    | 1          | Track Foot      | TF    |
| Working Day                 | WDAY  | 1          | Working Day     | WDAY  |

### Conversion Factors From Metric Units to English Units

| UNIT            | ABBR. | MULTIPLY  | UNIT                        | ABBR. |
|-----------------|-------|-----------|-----------------------------|-------|
| Hectare         | HA    | 2.471054  | Acre                        | ACRE  |
| Calendar Day    | CDAY  | 1         | Calendar Day                | CDAY  |
| Cubic Meter     | M3    | 35.31467  | Cubic Foot                  | CF    |
| Cubic Meter     | M3    | 1.307951  | Cubic Yard                  | CY    |
| Each            | EA    | 1         | Each                        | EA    |
| Liter           | L     | 0.264172  | Gallon                      | GAL   |
| Hour            | H     | 1         | Hour                        | HR    |
| Kilogram        | KG    | 2.204623  | Pound                       | LB    |
| Meter           | M     | 3.28084   | Linear Foot                 | LF    |
| Lane Kilometer  | LNKM  | 0.6213712 | Lane Mile                   | LNMI  |
| Lump Sum        | LS    | 1         | Lump Sum                    | LS    |
| Cubic Meter     | M3    | 0.423776  | Thousand Foot Board Measure | MFBM  |
| Kilometer       | KM    | 0.6213712 | Mile                        | MI    |
| Square Meter    | M2    | 10.76391  | Square Foot                 | SQFT  |
| Square Meter    | M2    | 1.19599   | Square Yard                 | SQYD  |
| Station (100 m) | STA   | 3.28084   | Station (100 ft)            | STA   |
| Tablet          | TAB   | 1         | Tablet                      | TAB   |
| Tonne (1000 kg) | TONN  | 1.102312  | Ton                         | TON   |
| Track Foot      | TF    | 1         | Track Foot                  | TF    |
| Working Day     | WDAY  | 1         | Working Day                 | WDAY  |

