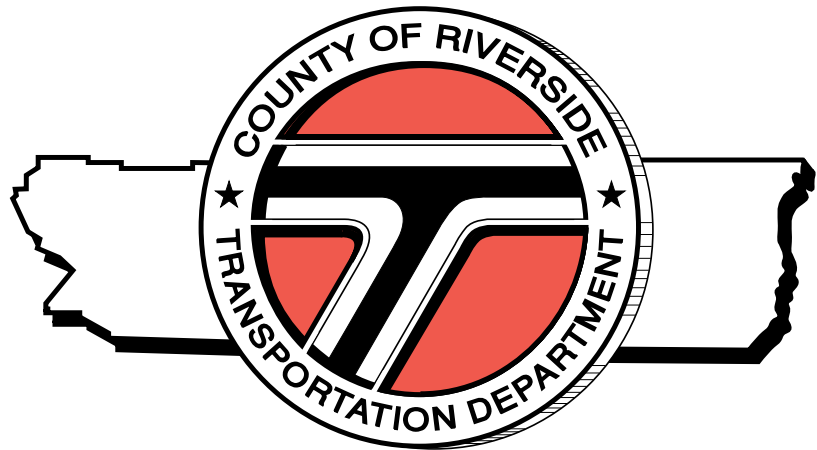


Engineer Estimating Guidelines for Roadway Construction Projects



For use in the
COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

County Administrative Center
4080 Lemon Street
Riverside, CA 92501

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GENERAL

The Project Estimate of Cost serves two purposes:

- It estimates the fair and reasonable price the County should expect to pay for each of the items of work to be performed, based on expected prices as of the date the estimate is made. The preliminary estimate should be the best guide in determining whether or not the bids were valid and competitive.
- It provides the ability to review if current funding is sufficient.

To estimate the price of individual items, use recent bid prices for similar projects considered to have had competitive bidding. Bid price information can be obtained from the Contracts and Utilities Group. The Contracts and Utilities Group maintains bid summaries and a historical bid item cost database. In addition, Caltrans publishes annual cost data books. These documents are produced by the Office of Office Engineer in the Engineering Service Center (ESC-OE) and is posted on Caltrans web site (http://tresc.dot.ca.gov/office_engineer/CoCoDa.html).

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 project readvertisement.

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 published by the Contracts and Utilities Group. A electronic copy of the coded item list may be obtained on the County Intranet at

www.co.riverside.ca.us/depts/transp/engineering/estimate.htm

or a hard copy may be obtained from the County Specifications Engineer.

Non-standard items

When work does not fit an established item, the County Specifications Engineer must 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.

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. The last two digits will be provided sequentially.

The abbreviations used for Unit of Measure should be those listed below in Table A.

Table A
Units of Measure with Standard Abbreviations

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 must add them to the approved list before incorporating a final estimate into the contract file.

MOBILIZATION

Mobilization reimburses the contractor for costs incurred before and during "move in". 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 bridge work even if the project's number of working days and estimated cost are less than the criteria above.

The item of mobilization will be 10 percent of the sum of all contract item costs, not including the item of mobilization.

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 subtract 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 (Section 8-1.01) 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 B
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 B 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 B, 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 Engineers Estimate Guidelines

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 C are generally designated final pay.

Table C
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.

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

Table D
Items Appropriate for Supplemental Work

TYPE OF WORK	CONDITIONS FOR USING SUPPLEMENTAL WORK
Additional Asphalt Concrete Additional Imported Borrow 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 Salvage and Stockpile Excess Screenings	
Remove Unsuitable Material Remove Slide Subsurface Drainage Remove Rock and Debris	If evidence indicates more than can be funded from contingencies.
Maintain Traffic (include flagging costs)	

Maintain Detour Maintain Existing Plants Maintain Water Supply Maintain Existing Electrical System 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 Settlement Platform Installation	
Compensation Adjustments for Price Index 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 Prune Existing Plants Replace Existing Plant Material Dispose of Removed Plant Material Maintain Existing Plants Maintain Existing Irrigation Mowing Correct Plant Deficiencies Modify Irrigation System Remove Rock and Debris Additional Water	For restoration projects, Initial repair of existing irrigation facilities, Initial removal of litter, Initial plant removal, or Damage repair. <u>Excluded</u> from total Supplemental Work 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 E provides a partial list of types of work for which it is normally inappropriate to include funds in Supplemental Work.

Table E
Items Not Appropriate for Supplemental Work

TYPE OF WORK	REASON FOR NOT USING SUPPLEMENTAL WORK
Additional Roadwork Additional Drainage Work Additional Electrical Work Improvement for Safety Unforeseen. Possible. Miscellaneous.	Too general. Entries for this type work may be appropriate if they are more specific.
Clean Out Existing Culverts Repair Existing.	Improper to perform maintenance work if funded from state or federal funds.
Railroad Work Electrical Service Resident Engineer's Office Motorist Service Patrol 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 must 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.

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.

Most 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.

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. Engineers may obtain the cost history for a bid item by contacting the Specifications Engineer. It is anticipated that the Bid Item Cost History Database will be available over the County network at some time in the future. Until then, Engineers will need to contact the Specifications Engineer.

The Contracts and Utilities unit is also planning to produce a document that contains the bid prices for items awarded during the previous year. Engineers will also be able to obtain cost data from this document when it becomes available.

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:

Engineers Estimate Guidelines

- 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 m³ (Cubic Meter) of Minor Concrete (Minor Structure), cannot be rounded up to 2 m³ or down to 1 m³ 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.

English / Metric Conversion

The following table 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.

Conversion Factors From English Units to Metric Units

Unit	Abbr.	Multiply:	Unit	Abbr.
Acre	ACRE	0.4046856	Hectare	HA
Calendar Day	CDAY	1.0	Calendar Day	CDAY
Cubic Foot	CF	0.02831685	Cubic Meter	M3
Cubic Yard	CY	0.7645549	Cubic Meter	M3
Each	EA	1.0	Each	EA
Gallon	GAL	3.785412	Liter	L
Hour	HR	1.0	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	1.0	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	1.0	Tablet	TAB
Ton	TON	0.9071847	Tonne (1000 kg)	TONN
Track Foot	TF	1.0	Track Foot	TF
Working Day	WDAY	1.0	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	1.0	Calendar Day	CDAY
Cubic Meter	M3	35.31467	Cubic Foot	CF
Cubic Meter	M3	1.307951	Cubic Yard	CY
Each	EA	1.0	Each	EA
Liter	L	0.264172	Gallon	GAL
Hour	H	1.0	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	1.0	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	1.0	Tablet	TAB
Tonne (1000 kg)	TONN	1.102312	Ton	TON
Track Foot	TF	1.0	Track Foot	TF
Working Day	WDAY	1.0	Working Day	WDAY