

Landscape Architecture PS & E Guide

SECTION 10

Specifications & Estimates

Contents

Specifications

- 10-1 [Ensuring a Full, Complete and Accurate PS&E](#)
- 10-1 [Special Considerations](#)
- 10-2 [Calculating Construction Working Days](#)
- 10-3 [Writing Specifications](#)
 - 10-3 [Overview of SSP Structure](#)
 - 10-3 [Non-Standard Special Provisions](#)

Estimate of Cost

- 10-4 [General](#)
- 10-4 [Contract Items](#)
 - 10-4 [Non-Standard Contract Items](#)
 - 10-5 [Mobilization](#)
 - 10-5 [Specialty Contract Items](#)
 - 10-6 [Final Pay Quantities](#)
 - 10-6 [Items Generally Designated as Final Pay for Highway Planting Projects](#)
- 10-8 [Just what is extra work?](#)
- 10-9 [Supplemental Work](#)
- 10-10 [State-Furnished Materials and Expenses](#)
- 10-11 [Contingencies](#)
- 10-11 [Supplemental Work, State-Furnished Materials and Expenses, and Contingency Requirements](#)
- 10-12 [Estimating Item Prices](#)
 - 10-12 [Fluctuation of Costs](#)
 - 10-12 [Traffic Conditions](#)
 - 10-12 [Restrictive Work Hours or Method of Work](#)
 - 10-12 [Small Quantities of Work](#)
 - 10-12 [Separated Operations](#)
 - 10-12 [Handwork and Inefficient Operations](#)
 - 10-13 [Accessibility](#)
 - 10-13 [Geographic Location](#)
 - 10-13 [Construction Season](#)
 - 10-13 [Material Shortages](#)
- 10-13 [Estimate Pricing Methods](#)
 - 10-13 [Previous Bid Prices Method](#)
 - 10-14 [Complete Analysis Method](#)
 - 10-14 [Plant Establishment Cost Considerations](#)
- 10-15 [Estimating - Conditions Which Affect Project Cost](#)
- 10-17 [Guidelines for Rounding Quantities](#)

Specifications & Estimates continued

- 10-18 [Segregated Estimates](#)
 - 10-18 [Federal-Aid Projects](#)
 - 10-18 [District and County Segregated Estimates](#)
 - 10-19 [Other Agencies Involved](#)
- 10-19 [Highway Planting – Estimate Check List](#)
 - 10-19 [Contract Items](#)
(Important items to be checked)
- 10-21 [List of the most common BEES errors](#)

Specifications

Ensuring a Full, Complete and Accurate PS&E

All work to be accomplished in a project must be identified in the PS&E for the Contractor to be able to estimate, bid and construct the project. Use this checklist to help determine how the work will be described and paid for in the contract documents:

- The work is covered in the Standard Special Provisions (SSP's).
- The work is covered in the Standard Specifications.
- The work is covered in the Standard Plans.
- The work is covered in the Project Plans.
- The work is covered in the Estimate (BEEs).
- The work is covered elsewhere – Structures or Electrical plans or specifications.

If work is not covered by any of the above methods, a Non-standard Special Provision (NSSP) needs to be developed. A NSSP needs to be consistent with ALL of the PS&E components. The NSSP must not contradict the Standard Specifications.

The value of having a complete and consistent PS&E is so the Department will obtain fair and competitive bids for construction of a project. Inconsistent PS&E's are the primary problem with bidding. Consistent means that the quantities, descriptions and dimensions match in the plans, specifications and estimate. Projects must receive a final consistency review prior to delivery to Division of Engineering Services-Office Engineer (DES-OE). The following checklist will assist in providing quality assurance of a PS&E:

- All the work shown on the plans or discussed in the SSP has an item in the Estimate/Cost Breakdown.
- Each item of work on the plans has a SSP.
- Notes on the plans are clear and consistent (not contradictory or repetitive) with SSP's or Standard Specifications.
- Slope arrows and ratios are shown on the plans.
- The totals for plan sheet quantities (i.e., IQ sheets, crossover tables, and Plant List) match the Estimate.
- The Sprinkler Schedule identifies all sprinkler heads

shown on the project plans, and matches the Irrigation Quantity (IQ) sheet and Estimate.

- Details are provided for all work shown on the plans.
- Electrical work (i.e., NEW controller enclosure cabinets) is covered on the Electrical sheets, in the Estimate, and SSP's.
- Electrical work appears in the same geographic location on the Electrical Plans as on the Irrigation Plans.
- Each item in the Estimate has a Pay Clause in the SSP's or the Standard Specifications. All items of work on a project need to be covered or paid for in some manner. The units of measure in the specification must match the Estimate.
- A letter of approval from the SSP Sponsor is provided with the PS&E submittal for any "NEW" SSP's or substantial edits to Standard Special Provisions (i.e., NSSP's).

Special Considerations

- Plant Establishment Work – Clearly identify the extent of Plant Establishment on plans and/or in SSP's. Plant Establishment is typically the most costly item of work on a project. Therefore, it is very important that this work be described clearly.
- Maintain Existing Plants – Clearly identify the limits of Maintain Existing Plants on the plans.
- Construction Window Work – If there is a construction window requirement (i.e., for site collected seed for erosion control, custom plant propagation, or willow cuttings) imposed by an Interagency Agreement, carefully consider whether this restriction allows the work to be performed. Consideration needs to be given for how long the project will be in DES-OE, how long advertisement and award will take, and when construction actually will begin. Also, be aware that State budget issues and timing of CTC vote for funding the project may cause delays in DES-OE for several months beyond typical delivery dates. Problems will occur in bidding and in construction if the Department places construction window requirements in a contract that cannot be met by the Contractor.

Special Considerations continued

- Erosion Control Work and Fugitive Dust – Do not specify work (such as straw blowing) in situations that may lead to fugitive dust emissions. This is especially important for projects with work in Placer County and the South Coast Air Quality Management District. Alternative erosion control methods to consider specifying include bonded fiber matrix (BFM) or stabilized fiber matrix (SFM).
- Air Quality – To minimize air quality problems during construction, communicate with local Air Quality personnel and provide appropriate information in the PS&E.
- Traffic Control – Consider the potential impact highway planting construction activities may have on lanes, ramps, and shoulders if the project is only accessible from the highway. Be certain the District Traffic Engineer understands the work being accomplished during construction of the project. Large quantities of material such as trees, shrubs, pipe or mulch may cause the need for traffic control. The final application of mulch during Plant Establishment may require lane closures and/or night work to stockpile and apply the material. Work in gore or extending gore areas may require lane closures and/or night work to apply the materials.

Calculating Construction Working Days

It is very important that the calculated working days are adequate to complete the work. If the working days are too short, the Contractor may inflate the bids as insurance against paying liquidated damages. Remember to allow time for review of required project submittals such as stormwater pollution prevention plans.

Production rates vary depending on existing conditions and work to be performed

- Soil Conditions
- Slope Ratio
- Existing Vegetation (Clear and Grub versus Roadside Clearing)

Traffic control directly impacts production rates. Workers, equipment and materials must be transported to the construction area daily. Size of shoulders is critical in determining if shoulder or lane closures will be needed.

Night work reduces production rates up to 50% due to:

- Lack of visibility
- Material suppliers not open or surcharge for plant openings
- Labor rate increased due to night premium
- Cost to light the area
- Labor paid for 8 hours regardless of actual time worked.

Items to consider with general time requirements:

- Check and Test Existing Irrigation systems: 2 days per controller
- Submittals/approvals of materials/SWPPP/WPCP: 1 month. No work can be done on/to the ground without an approved SWPPP or WPCP (except Construction Area Signs)
- Roadside Clearing: 1 acre/day/flat area, ½ acre/day slopes
- Mow Only: 4-8 acres/day/flat area; 2-3 acres/day/slopes
- New water meter (by either Contractor or Utility Co): 2 days each (lead time may be as long as 6 weeks)
- Jack & Drill new irrigation x-over conduit for a 2-lane ramp: 1 day/each
- Backflow preventer: 2 days/each
- Main Supply line: 600 lf/day – 300 lf/night; including pressure testing
- Lateral Supply lines: 600 lf/day – 300 lf/night (soils should slow this down)
- Remote Control Valves: 8 ea/day
- Flush lines, install heads, jet trenches: 1500 lf/day
- Install EA Controller/functional test systems: 5 days/each controller and corresponding system
- Weed germination and kill for GC areas: 24 working days (water 14 calendar days, spray, water 14 days, spray and wait three days for chemicals to clear)
- Rock Blanket/PCC/AC: for gores: 1000 sqft/day, 500 sqft/night
- Mulch 4": 100 CY/day if using a blower truck, 150 CY if stockpiling material on the site. 60 CY/day if hand spreading
- Planting with 6-8 person crew:
 - 1 gal plants: 400 ea/day
 - 5 gal plants: 155 ea/day
 - 15 gal plants: 50 ea/day
 - Ground cover plants (cuttings or from flats): 10,000-14,000 ea/day

Writing Specifications

Specifications are used to describe work for construction of a project in coordination with project plans and estimate. Caltrans provides Standard Specifications and SSP's to use on projects. The SSP's may only be edited as directed in their instructions. Edits that are not allowed in instructions will trigger the "Approval Requirements." It is important to understand the basic structure, components, and Department policy to consider when writing new or non-standard specifications. Further references are available from the Ready To List (RTL) Guide and the Landscape Architecture Program (LAP) website available at: <http://www.dot.ca.gov/hq/LandArch/index.htm>

The most common issues found regarding the writing or editing of specifications are:

1. Use of Proprietary Items. Department policy shall be followed.
2. Consistency/Inconsistency between plans, SSP's, and Standard Specifications.
3. Sufficient information for project to be biddable.
4. Measurement – the work must be measurable.
5. Payment – the method of payment must be clear.

Overview of SSP Structure

All specifications, including NSSP's, should provide a description of the work in the following structure:

- Introduction/overview of the work
- Materials
- Installation/Construction
- Measurement & Payment
- Pay Clauses
- Contract Item
- Lump Sum
- Full Compensation
- A Final Pay item MUST show an (N), meaning Not a payment item - for information only on any Summary Table where item is shown.

In the specification, do the following:

- Ensure that the RE is the only agent in charge of the project.
- Ensure that the working days specified are adequate to perform the work.
- Avoid the use of proprietary language and trade names.
- The specification should not directly or indirectly limit the bidders to any particular product. If proprietary items cannot be avoided, FHWA Public Information Finding (PIF) form is required. For more information – see the RTL Guide.
- Only specify a Construction window if absolutely necessary.
- Ensure the work specified is biddable. Show limits of work on the plans and provide quantities.

Non-Standard Special Provisions

To put it simply, It is department policy to only use NSSP's as a last resort.

When non-standard work is being considered, the LAP District Coordinator should first be consulted. If it is determined that the work cannot sufficiently be covered by a SSP, the draft NSSP will be submitted for concurrence by the SSP Sponsor. For work in Section 20 of the specifications, the NSSP will require approval from LAP and District Construction. For direction on the preparation and request for approval of NSSP's go to: <http://www.dot.ca.gov/hq/LandArch/policy/index.htm>

Estimate of Cost

General

The Estimate of Cost serves two purposes:

- Estimates the fair and reasonable price the State 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.
- Identifies all funding sources and segregations that will be used on the project and identifies funding participation levels.

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 bid summaries, contract items by item number report, annual cost data books and California Construction Cost Index published by Division Engineering Services - Office Engineer (DES-OE). Contact your District BEES Coordinator to obtain copies of these materials.

Consider factors which might affect bid prices, such as: project location and accessibility, project terrain, effect of existing traffic on the Contractor's operations, if night work may be required, 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 or the "Minor" limit 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 re-advertisement.

Estimates are prepared using the Basic Engineering Estimating System (BEES). This system:

- Provides the data files required for the Project Information Systems and Analysis (PISA)
- Provides the data needed by the Bid Opening and Progress Pay System
- Produces segregated estimates according to fund source.

Just before listing the project for advertisement, HQOE "locks" the BEES. After the file is "locked", only HQOE can alter it. If changes to the BEES are needed after it has been locked, contact the Project Management Unit in HQOE. HQOE will review the request and will make the changes or, if timing is such that it is practical, will arrange for unlocking the BEES to allow the District and/or Structures to make the changes.

The District Cost Estimate is comprised of the following:

- [Contract Items](#) (page 10–4)
- [Supplemental Work](#) (page 10–9)
- [State-Furnished Materials and Expenses](#) (page 10–10)
- [Contingencies](#) (page 10–11)

Contract Items

Contract items are the bid items of work used in the Engineer's Estimate and are the items the Contractor bids on.

List the items of work in numerical sequence by Item Code number. The item description should be exactly as shown in the BEES Coded Item List published, maintained and updated by ESC-OE. A copy of the coded item list may be requested through the District BEES Coordinator.

Non-Standard Contract Items

When work does not fit an established item, insert a non-standard item into the estimate. 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.

Insert the non-standard item with similar items of work or list it according to the sequence of events.

For non-standard items, add an alpha character to any six-digit standard item code number. The six-digit portion of the number determines the numeric position of the non-standard item in the estimate (Example: 204015A PLANT (GROUP S) ACORNS). During review, HQOE will assign a one-time number based on the above information. These non-standard assigned numbers are job specific and are not

Non-Standard Contract Items continued

to be reused in later projects. Only standard six-digit numbers and standard numbers with an added alpha character should appear in the preliminary estimate of cost.

The abbreviations used for Unit of Measure should be those listed in the user instructions for BEES. If abbreviations are needed for non-standard units of measure, HQOE must add them to the BEES approved list before incorporating a final estimate into the bid opening file.

Mobilization

The Mobilization item reimburses the Contractor for costs incurred before and during “move in.” Use the Mobilization item on Minor “A” and Major projects when the number of working days for the project is 50 or more (excluding plant establishment working days). Mobilization item may be included for projects consisting primarily of structures work even though the project’s number of working days is less than the criteria stated above.

When Structure Office Engineer (SOE) has included the Mobilization item, as described above, the District shall include the Mobilization item. The Mobilization item will be 10 percent of the sum of all contract item costs, including the item of Mobilization.

It is not necessary to enter a dollar amount. Enter “.1” in the BEES estimate for the Mobilization item price, and BEES will automatically calculate the mobilization cost.

Specialty Contract Items

The Department requires the Contractor to perform, with the Contractor’s own organization, contract work amounting to not less than 50 percent of the original total contract price after deducting the cost of any designated “Specialty Items” (see Standard Specifications Section 8-1.01). This requirement ensures that the Contractor is performing a substantial portion of the contract work.

Specialty Work is work that the Department expects the Contractor to subcontract. Specialty Work requires equipment and expertise not normally possessed by the Contractor. Specialty Items of work are to be designated in the Engineer’s Estimate using (S) or (S-F) as appropriate for the item involved. (S-F) denotes that the item is both a specialty item

and a final pay item. Show the appropriate denotation (S) or (S-F) in the Item Code column of the Engineers Estimate under the item code number for that item.

The following guidelines apply when designating Specialty Items:

- Designate the item or items as Specialty Items when a project contains work that is different than the primary work in the contract and typically has been performed by a specialty Contractor in prior contracts. If the work is likely to be performed by the Contractor’s own organization, do not designate the work as Specialty Work. If in doubt, leave the specialty designation out.
- If the Engineer’s Estimate is less than \$500,000, each Specialty Item should have a value of \$2000 or more.
- If the Engineer’s Estimate is greater than \$500,000, each Specialty Item should have a value of \$5000 or more.
- Group related items (for example, striping, pavement markings, and pavement markers) to meet the value criterion.
- If it is anticipated that the awarded Contractor will be a General Engineering Contractor (Class A License), limit Specialty Items to those listed in Table 10 -1.
- If the awarded Contractor is expected to be other than a General Engineering Contractor, designate work that would not be done by the awarded Contractor as Specialty Items.
- If an item listed in Table 10 -1 is a majority of the contract work, do not designate it as a Specialty Item.
- When a highway project involves the construction, alteration or modification of an off-highway building structure, designate items of building work as Specialty Items.
- Items with the word “Furnish” in their description, such as “furnish steel piling” or “furnish sign structure”, and work plans and safety plans are usually not designated as Specialty Items. This rule does not apply to “furnish precast concrete bridge” items.
- Items with prefixes such as temporary, removal, salvage, adjust, remodel, relocate, and reconstruct which are similar to the approved Specialty Items listed in Table 10 -1 should also be designated as Specialty Items. Examples are “temporary traffic stripe” and “reconstruct metal beam guard railing”.

Table 10-1 Highway Planting Projects Specialty Items

Table lists items that are to be designated as Specialty Items for highway planting projects. Other items may also apply to highway planting projects (see Table 7-1 of the RTL Guide). Assume a C-27 licensed Contractor will be the Prime Contractor for highway planting contracts.

<i>Item Code</i>	<i>Specialty Items</i>
0740--	PREPARE STORM WATER POLLUTION PREVENTION PLAN, PREPARE WATER POLLUTION CONTROL PROGRAM
120090	CONSTRUCTION AREA SIGNS
120100	TRAFFIC CONTROL SYSTEM
12----	TRAFFIC CONTROL DEVICES SUCH AS PORTABLE CHANGEABLE MESSAGE SIGN
19----	EARTHWORK
20----	EROSION CONTROL, PLANTING, IRRIGATION, AND PLANT ESTABLISHMENT WORK
26----	AGGREGATE BASE
39----	HMA AND ASPHALT CONCRETE
40----	PORTLAND CEMENT CONCRETE PAVEMENT
68----	DRAINAGE FACILITIES
73----	CONCRETE CURBS AND SIDEWALKS
7500--THRU 7505--	MISCELLANEOUS METALS
8000--THRU 8099--	FENCES
8601--THRU 8690--	SIGNALS, LIGHTING, AND ELECTRICAL SYSTEMS

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

Final Pay Quantities

Items of work, which would prove difficult for the Engineer to measure for payment during construction, are designated as Final Pay items. **Final Pay quantities are to be designated on Engineer's Estimate using (F) or (S-F) as appropriate for the item involved. Do not identify Final Pay items on the plans.**

Payment for Final Pay items will be made for the exact quantity shown on the Engineer's Estimate unless the Engineer orders a change in the dimensions of the work. The Contractor will not be provided additional payment for quantities which exceed those shown on the estimate, so it is important that Final Pay item quantities are accurate. Do not round Final Pay items in the Engineer's Estimate. Show the appropriate denotation (S) or (S-F) in the Item Code column of the Engineers Estimate under the item code number for that item.

Items Generally Designated as Final Pay for Highway Planting projects

Item

Pipe (Supply Line)

Verification of final pay quantity calculations is to be included in the space provided on the PS&E Cover Memo of the PS&E Submittal.

Finally Paid or Final Pay?

What does “final pay” mean?

- A. The last progress payment on the project that a Resident Engineer (RE) will make to the Contractor.
- B. You are finally getting a well-deserved pay raise.
- C. The sum total on the Engineer’s Estimate to be paid for that particular item, unless the RE orders a change in the dimensions of the work.

The correct answer unfortunately is not B, but is C.

A typical item on the estimate is paid at the unit price bid by the Contractor. “Fairness” and “flexibility” is built into the Caltrans system because the RE can increase or decrease up to 25% the quantity of any item without having to renegotiate a unit price for that item.

When we mark an item on the estimate with that innocuous looking little “F”, the Contractor will only receive their bid amount for that item whether the quantity is correct or not. Final pay (F) is an inflexible method of pay for the RE, and therefore is not fair to the Contractor when quantities are inaccurate. If our quantities are incorrect, we mislead the Contractor into indicating a price on their bid that may be much less than what is required to complete the work.

What should we mark final pay on the estimate? Supply line generally is the only good candidate. Supply line is typically installed over a long period of time in such large quantities that it is not possible for an inspector to be available at all times to measure it. Out of necessity, we will usually mark supply line as a final pay item.

When projects arrive in DES-Office Engineer, we often see final pay items on the estimate for plants from flats, stamped concrete, irrigation crossovers, and mulch. An inspector can measure these items. Therefore, these items **should not be marked final pay!**

If you are unsure of the quantities that will be required for an item of work, do not mark it final pay. Marking this item final pay will make an already bad situation much worse, because we’ve taken away the RE’s ability to make quantity adjustments without having to renegotiate the unit price. Final pay quantities should be the most accurate quantities on the estimate.

Just what is extra work?

Almost every designer that has ever done a highway planting project has come across this term. It is referenced numerous times in the Standard Specifications and Standard Special Provisions used for a given project. By definition 'extra work' is new and unforeseen work that is determined by the Engineer to not be covered by any of the various items for which there is a bid price or by combinations of those items. The event portions of this work are determined by the Engineer to be covered by some of the various items for which there is a bid price or combinations of those items, the remaining portion of the work will be classed as extra work. Extra work also includes work specifically designated as extra work in the plans or specifications.

In order to facilitate payment to the Contractor for doing extra work, a contract change order must be written. The change order specifies the method of payment to the Contractor, the amount to be paid, and addresses the need for adjusting the contract time because of the extra work performed.

Within the Construction Program there is a payment hierarchy that has been established in determining the method of contract change order compensation. The first choice is using a contract item with an already established bid price or adjusting the existing bid price of a specific bid item to cover the cost of the new work. The second choice is to develop an 'agreed price' with the Contractor; either a lump sum or a unit item amount. Sometimes this is difficult to obtain since the 'price' the Contractor wants for doing the extra work and the 'price' that we have determined is force account payment because of the amount of administration needed in providing for this method of payment.

In force account payment, the Contractor is paid the direct costs for labor, materials, and equipment used in performing the work plus predetermined mark-ups. For labor, the actual wages paid to workers include health and welfare, pension, vacation, etc., subsistence and travel allowance, and the added labor surcharge for all payments imposed by State and Federal Laws. To the total of all of these items is added a 33% mark-up. To the total cost of materials used in performance of the work is added a 15% mark-up. And to the total cost of the equipment used, based upon rates shown in the Caltrans Labor Surcharge and Equipment Rental Rates booklet is added a 15% mark-up. Keep in mind, if the forces of a Subcontractor are being used, the prime Contractor is to be

paid an additional 5% mark-up on top of everything else that was just mentioned. In force account payment, daily diaries must be kept itemizing all labor, equipment and materials used on a given day. This diary is in addition to the normal daily records kept by construction personnel during the course of the work. In order to pay the Contractor, an extra work bill must be submitted by the Contractor to the Engineer again itemizing the same information shown on the daily extra work diary completed by State personnel. If everything checks out, the Contractor gets paid! This procedure has to be done for every day that work is performed on a change order that is to be paid for on a force account basis.

Whenever extra work is called out to be done in either the Standard Specifications or the Special Provisions please consider all of the above. At the very least, provide the necessary and realistic funding for the various 'extra work' call-outs throughout the specifications under Supplemental Work in the Engineers Estimate. Keep in mind the true nature of the costs. \$500 or \$1,000 doesn't really get much accomplished given business operating costs. Maybe rather than doing the work as 'extra work' consider developing another specific item that the Contractor can submit a price for in his/her bid.

Supplemental Work

Supplemental Work is work that is anticipated within the scope of the contract but is of such an uncertain nature that it cannot be quantified as a pay item. Item codes for this category of work must begin with “066” (i.e., 066XXX) to be properly calculated in the BEES.

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 provide extra funds in addition to contingencies by adding items or amounts in excess of what can be reasonably anticipated.
- To perform work which should be funded from other sources, such as maintenance. Note that maintenance work is not eligible for federal participation.
- For contract funds to be paid to anyone other than the Contractor who performs the work, such as railroad inspection. Include these funds under State-Furnished Materials and Expenses.

Funds for Extra Work specified in the Standard Specifications or contract special provisions shall come from contingencies. When Standard Special Provision instructions call for Extra Work with the addition of a Supplemental Work item, create a Supplemental Work pay item in the Engineer's Estimate or it shall be paid for from contingencies.

The total allotment for Supplemental Work on each project is limited to 3 percent of the contract item total cost on Major projects and major maintenance projects, and 5 percent of the contract item total cost on Minor projects. Ten standard Supplemental Work items have been pre-approved for Federal participation. FHWA requires that the costs estimated for these items be justified in a separate letter or memo and submitted with the PS&E. The ten items are:

066015	FEDERAL TRAINEE PROGRAM
066070	MAINTAIN TRAFFIC
066094	VALUE ANALYSIS
066595	WATER POLLUTION CONTROL MAINTENANCE SHARING
066596	ADDITIONAL WATER POLLUTION CONTROL ITEMS
066597	STORM WATER SAMPLING AND ANALYSIS
066610	PARTNERING
066666	COMPENSATION ADJUSTMENT FOR PRICE INDEX FLUCTUATIONS OF PAVING ASPHALT
066845	INCENTIVE FOR ASPHALT CONCRETE (QC/QA)
066920	DISPUTES REVIEW BOARD

If Federal participation is requested for additional Supplemental Work items, a letter of justification for the need and cost of each item is required to be submitted with the PS&E to DES-OE. A “Public Information Finding” (PIF) is not required.

The Division of Construction updates the list of Federal participating Supplemental Work items.

Additions to the listed Supplemental Work items or higher allotment limits require written request by the District Director to the Chief, Division of Construction for approval. Approvals for exceptions must be provided with the PS&E submittal.

State-Furnished Materials and Expenses

Items to be listed under this component consist of:

- Work to be done by State forces or others concurrently with contract construction operations.
- Materials to be purchased and charged against the project but to be paid for directly by the State, not the Contractor.

Item codes for this category of work must have a 066 prefix (066XXX) to be properly calculated in the BEES. State-Furnished materials and expenses are to be subtotaled and included as part of the total cost of the project.

FHWA has approved the following materials as being in the public interest for the Department to furnish to the Contractor as State-Furnished materials on Federal aid projects. A PIF is not required for these items (however, letter of cost justification is required):

- Permanent sign panels and mounting hardware.
- Types N, P, and R object marker panels and reflectors.
- Laminated wood box posts and metal caps.
- 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.
- Light emitting diode (LED) signal modules (Red, Amber, Green, and Arrows) and LED pedestrian signal face modules (Upraised Hand & Walking Person) for traffic signals.
- 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, which must be grown or obtained for specific projects.

Any State-Furnished material not on the approved list requires a PIF and FHWA approval on a project-by-project basis. Submit the PIF and obtain FHWA approval during PS&E development. All PIF requests must be processed through the Federal Resources Office to obtain approval. Full Oversight projects require FHWA approval. State Authorized projects require the Federal Resources Office's approval.

FHWA has approved the following State expenses as eligible for Federal reimbursement. A PIF is not required for these items (however, a letter of cost justification is required).

- Resident Engineer's office rental cost. This is normally included when:
 1. A single project cost exceeds \$300,000 and the project time limit is 50 or more working days, or when
 2. There are several projects in the same area and the total funds for these projects exceed \$300,000, and the time required to complete all of the projects will probably exceed 50 days. In this case, the cost of the office should be distributed proportionally among the projects involved according to their estimated use of the office.
- Railroad Work – work to be done by railroad agency.
- Transportation Management Plan – includes TV, radio, newspaper, news bulletin or any other press information expenses.
- Construction Zone Enforcement Enhancement Program (COZEPP) – safety enforcement work to be provided by the California Highway Patrol.
- Electrical Service – expenses necessary to provide power supply to temporary facilities needed to complete the contract, and for utility company to install meter and service conductors to the service cabinet.

When Federal participation is requested for additional State-Furnished material and expenses to that listed above, an approved project-by-project PIF is required.

When the U.S. Forest Service requires payment for merchantable timber, the Department should pay the Forest Service directly. Include an item in "State-Furnished Materials and Expenses" to provide payment from construction funds.

Contingencies

The next-to-last category of the Project Estimate of Cost is contingencies. Contingencies are automatically calculated and added to the estimate by BEES. Typically, the amount for Contingencies will be a nominal 5 percent of the subtotal of the cost of Contract Items, Supplemental Work, and State-Furnished materials and expenses. The contingency amount is included in the grand total of the final estimate to allow for unforeseen costs.

The BEES system automatically allows for a contingency of 5 percent, but any amount may be entered, either by percent or by specified dollar amount. The BEES adjusts the contingency amount automatically to give a rounded grand total, except when the contingency is entered as a specific dollar figure. Approval from the Chief Engineer must be provided with the PS&E Submittal when a contingency of other than 5 percent is used in the final estimate.

Supplemental Work, State-Furnished Materials and Expenses, and Contingency Requirements

<i>Project Funding</i>			
	No Federal Funds	Federal Funds State Authorized*	Federal Funds Full Oversight
Supplemental Work (Pre-Approved Items)	7	1	1
Supplemental Work (Non-Standard Items)	7	2	2
Major Project (SW>3%) or Minor Project (SW>5%)	3	3	3
State-Furnished Materials and Expenses (Pre-Approved Items)	7	7	7
State-Furnished Materials and Expenses (Non-Standard Items)	7	4	5
Contingencies Other than 5%	6	6	6

SW = Supplemental Work

See FHWA pre-approved list of Supplemental Work items and State-Furnished items.

PS&E Submittal to DES-OE & to Federal Resources Branch must include copies of all required approvals.

- 1 Provide justification of **cost** for each item to Office of Federal Resources, Div of Budgets. Request memo signed by District Director.
- 2 Provide justification of **need** and **cost** for each item to Office of Federal Resources, Div of Budgets **AND** to FHWA. Request memo signed by District Director.
- 3 District Director requests approval from Chief, HQ Construction.
- 4 Provide PIFs for approval by Federal Resources Branch (Office of Budgets).
- 5 Provide PIFs for approval by FHWA.
- 6 District Director requests approval from Chief Engineer.
- 7 Standard procedures, reviews and approvals apply.

* Project with Federal funds from **ANY SOURCE**, including local Federal Funds.

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 additional project funding for the District.

Most overruns are due to conditions that existed at the time the estimate was initially prepared, but were not considered. Estimators should consider the following factors which experience has shown would affect the bid prices on construction projects.

Fluctuation of Costs

Review and update estimates as near to project “Listing” for advertisement as possible. Include an updated BEES estimate with the District Response Memo.

When the District submits the PS&E as a “Qualified” project, the estimate in the PS&E Submittal becomes the final, updated estimate. If DES-OE performs a telephone review or lists the project shortly after PS&E delivery, the BEES estimate submitted with PS&E will suffice. BEES Item Price and Quantity Reports contain dates when item prices and quantities were last updated.

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.

Review and update unit prices and estimates as conditions change. Estimates must be current at the time the project is ready to list. The District should review and update the estimate if the California Construction Cost Index is rising or falling frequently and rapidly.

Projects are usually listed for advertising when DES-OE has received the District response to requests for additional information and all advertising constraints are clear.

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.

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.

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. If the order of work or scattered locations of work require portions of a work unit to be constructed as separate operations, each requiring separate move-in and move-out costs, then the unit prices should 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 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 - "Quarterly Report "Contract Items by Item Numbers." This report **contains all contract items** with quantities and prices used in the past quarter, listed by item code number.

BEES "Item Price Menu" - This computer file is accessible through the BEES and contains District and Statewide averages for contract item quantities and prices for the previous twelve months. Data can be extracted by typing item numbers or item description keywords. This system is useful in analyzing which item codes have been used successfully and what the average prices are. In addition, this menu offers "Preliminary Cost Review Report", which compares prices in an existing BEES file with five years of historical data according to user-selected criteria. Access this menu by typing "RUN BEES" at the VM/CMS ready prompt, then selecting item #3 "Item Price Menu". Contact your District BEES Coordinator if you have any questions.

Previous Bid Prices Method continued

Annual Contract Cost Data Book - This book contains District and Statewide average prices by contract item number for contracts in a particular calendar year. HQOE maintains a distribution list. To be placed on the list, contact your District BEES Coordinator.

BEES Program - If information is available in the BEES and the price field is left blank, the BEES program will automatically input the average price of an item when the item is first used.

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 Maintain Existing Planted Areas and Plant Establishment Work.

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
- 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.

Plant Establishment Cost Considerations

(Note: The following costs are accurate enough for estimating purposes)

Establishment of Ground Cover areas

(includes the following items)

- 4 workers with one Truck @ \$2,100/day: 2 days/week/mile for 1st year, 1 day/week/mile for 2nd & 3rd years
- \$1000/acre/yr for chemicals (pre-emergent & contact killers)
- 2 workers trash pick-up/mile/week @ \$800/week

Establishment of Shrub/Mulch Areas

(includes the following items)

- 1 worker with truck & sprayer: 2-3 acres/day @ \$550/day/every 3 months 1st year, winter months only in 2nd and 3rd years
- 2 workers trash pick-up/mile/week @ \$800/week

Estimating — Conditions Which Affect Project Cost

(Note: The following costs are accurate enough for estimating purposes)

Estimating is building a job on paper

- Estimating is the life's blood of any company
- Estimator must take in all factors in a job - Critical
- Mistakes can bankrupt a company
- Minor mistakes and unknowns can change a good job to bad
- Contractors are in business to make a profit, but must cover overhead and must profit to stay in business

Methods

- Estimating Labor, Equipment and Materials – Correct Method
- Unit Prices based on historical data
- Guesstimating-taking the Published Budget, trying to calculate the Engineer Estimate and filling in the blanks

Site Observation

- Soil conditions
- Topography of the job
- Existing conditions
- Location
- Traffic conditions
- Subcontracts - must take into account what is to be built
- Visualization
- Ugly jobs - increase the bid

Plan Takeoff

- Must be accurate
- Use of Cost Breakdown as units

Material

Exactly what material and labor is required must be taken into account for each item:

- For example Backflow Preventer Assembly:
 1. Type of Backflow
 2. Nipples
 3. Gate Valves
 4. Wye Strainer
 5. Pad
 6. Backflow Enclosure
 7. Testing
- Specialty items – don't have use of "or equals"
- Note: Consideration for Caltrans Maintenance in stock items
- Cost of material - Tax + 15% markup = Total

Equipment

- Determining type of equipment to be used and hours required
 1. Existing Conditions
 2. Availability - Owned or Rented
- Equipment - Cost + 15%

Labor – The biggest factor in Estimating

Cost of Labor

1. Prevailing wage - Laborers rate is \$28.00 per hour
 - Contractors direct cost for Social Security, FICA, Workman's Compensation between 22% and 30% of base rate = \$35.50
 - Our labor markup = 57% of base rate to cover overhead and operating expenses = \$44.00 without profit
 - 8 hours for 4 men and pickup truck = \$1,475.00 per day to break even
 - With Material a 4-man crew must complete a minimum of \$1,500 to \$2,000 of work installed each day
2. State Wage Rates
 - Allow for the use Labor Tenders @ \$12.50 at 1 to 1 ratio
 - Allow for the use of Landscape Irrigation Tradesman @ \$12.50 per hour.
 - Average cost of labor = \$32.00
3. Federal Wage Rates - allow for use of Group 1 and LI journeyman
 - Cost of labor = \$44.00

Estimating — Conditions Which Affect Project Cost

continued

(Note: The following costs are accurate enough for estimating purposes)

Extra Work

Traffic Control/Working Hours

- Safety - our number one concern
- Accessibility for trucks & equipment
- Are the shoulders wide enough for shoulder closures - minimal cost
- Lane closures - up to \$1,000.00 per closure plus 1 hour of lost production
- Ramp closures
- Traffic Control requirements
 1. Contractors must comply with the Traffic Control Charts of the special provisions
 2. Dictate the hours we can work
 - A. Workers need to be paid 40 hr. per week in order to maintain competent staff
 - B. The company needs to have 8 hrs. of productive work for 8 hrs. of pay
- Shortened Work Days
 1. If working hours are limited to 9:00 to 3:00 due to traffic considerations 6 hrs. minus .5 hrs. for traffic control (shoulder closures) and .5 hr. for lunch = Total productive time of 5 hours. Labor cost is now \$70.13
 2. Moving to other side of the traveled way = 1 hour lost production = 6 to 6.5 hours productive time. Labor is now = \$58.29

Night Work

- Lighting
 1. Cost of Lights - rental
 2. Constant monitoring - 1 man & truck for 8 hours
 3. Poor visibility in trench lines and on the backside of slopes
 4. Increased risk for fall and traffic accidents
 5. Loss of Production
 6. Suppliers
 - A. Irrigation suppliers are not open – if additional material is required it is unavailable = Lost production for 1 fitting.
 - B. Concrete and Material suppliers charge up to \$1,2500.00 for Plant opening fees and a premium on material of \$5.00/yard (Landscape does not require large pours). Concrete can cost \$215.00/yard for one truckload.

Mobilization

- Place to put bond
- Used as “slush”

Irrigation

- Pipe Installation
 1. Machine trench on flat ground = \$1.26 per foot
 - Average 1,500 ft per day installed
 - Backfill with trencher
 2. Machine trench on slopes = \$1.89 per foot
 - 600 ft. per day installed
 - 2 Machines required, one to hold the other on slope
 - Backfill by hand
 - Must have access to top of slope for machine to hold the trencher on grade
 3. Hand trench
 - How many feet of trench can 1 man dig and backfill in 8 hours? Soil conditions critical - Between \$2.30 and \$3.00 per foot
- Heads - Impacts vs. Rotors
- Valves
- Control and neutral conductors
- Irrigation controllers
- Welded steel pipe

Planting

- Layout 2 times, once for irrigation and once for planting
- Prepare hole
- Root protectors
- Basins
- Mulch
 1. Erosion protection
 2. Better than Jute Mesh
 3. Weed suppression
 4. Attractive

Clear & Grub/Roadside Clearing

- Hard to quantify
- Dump Fees are increasing
- How does Caltrans justify a number?

Plant Establishment

- Extended Plant Establishment on Federal/State Jobs
- What is required for SWPPP?

Estimating — Conditions Which Affect Project Cost continued

(Note: The following costs are accurate enough for estimating purposes)

SWPPP / WPCP

- Most Contractors guess at costs and just plug in a number.
- San Diego has plan and bid items for bid purposes. Really great idea; eliminates guesswork.

Closing

- The budget for the project directly affects the quality of the project, allowing required changes.
- If the budget is too high, Companies, which do the best estimate, will generally get the work.
- Final user - Maintenance.

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 in the Proposal and 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 in the BEES file 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.

For example: 1,103 would be rounded to 1,110.
And 2,234,541 would be rounded to 2,234,600.

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

For example: 426 would be rounded to 430.

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 cubic yards of Minor Concrete (Minor Structure) cannot be rounded up to 2 cubic yards or down to 1 cubic yard 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. Decimal units can be shown to only one decimal place because of limitations in BEES. Volumetric or weight quantities of 5 or greater are to be rounded to the nearest whole number.

Guidelines for Rounding Quantities continued

Sometimes it is possible to avoid the use of decimal quantities by changing the unit of measure. For example, use 1000 LB of commercial fertilizer instead of 0.5 ton.

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

Calculated quantities should usually be rounded up in the BEES file.

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 yards, linear feet, 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

Projects having funding sources other than, or in addition to, State funding must have a segregated BEES estimate identifying the sources and levels of funding. Enter all segregated estimates into the BEES during project design. Segregated estimates must be complete when the District submits the PS&E to DES-OE. It is the District's responsibility to segregate the BEES file including Office of Structure Design items.

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 Headquarters Budgets Program, Office of Federal Resources, or the FHWA District Reviewer.
- Structures -- Separate each structure by component level. Funding segregations used in highway work are not applicable to structure 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, counties, 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 State contract but outside of the Federal Aid project limits).

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

The information needed to prepare the Federal segregated estimates generally is available to the Project Engineer before the District completes the PS&E. All funding sources and levels should be determined prior to PS&E submittal to HQOE and that information should be reflected in the BEES estimate.

The District must submit the BEES Federal segregated estimates and the draft Form FNM-76 to the Headquarters Office of Federal Resources either:

- At the time the District responds to HQOE's request for additional information
OR
- With PS&E submittal if the District is submitting the project as "Qualified".

District and County Segregated Estimates

Separate estimates are required to segregate between Districts and between north and south counties. Separate estimates are not required to detail other projects in more than one county. However, a cost distribution (in percent) by counties is to be provided in the BEES "narrative report".

Segregate BEES estimates may be segregated by District, by North and South, and by County using the location code to identify quantities that must be included. Designate location codes at the time of entry into BEES.

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 is required, which identifies each contributing agency. If there is a cooperative agreement on a project, a copy of the agreement must be included with the copy of the PS&E package sent to Headquarters Office of Federal Resources.

Highway Planting — Estimate Check List

This check list provides a method to ensure the preliminary estimate properly identifies most of the important items of work for highway planting projects and highway construction projects with planting and/or irrigation work. Also, the list gives the Landscape Architect a method of checking the estimate against the special provisions and plans to ensure consistency and accuracy.

In most cases, "Construction" projects (planting, irrigation or erosion control work performed with highway construction) are to be paid for by the applicable lump sum (LS) items: "Highway Planting", "Maintain Existing Plants", "Irrigation System", or "Plant Establishment Work". "Erosion Control" and "Wild Flower Seeding" are to be paid for by the appropriate units of measure (e.g., square foot, acre, pound or ton). "Irrigation Crossover" and "Extend Irrigation Crossover" are to be paid for by the lineal foot. In addition, the Landscape Architect should provide all appropriate Supplemental Work and State-Furnished Materials items to the Project Engineer to be combined with the roadway items to complete the estimate.

On "Highway Planting" projects the Landscape Architect is to develop the complete estimate, itemizing each of the major contract items (i.e., >\$1,000) for the appropriate planting or irrigation work, and entering it into the BEES system. In addition to Supplemental Work and State-Furnished Materials items, 5% contingencies are to be included.

Generally, the following should be followed when preparing estimates:

- Unit prices are based on bid prices from the "Contract Cost Data" book or recent bid summary reports for projects similar in nature (smaller quantities or remote locations will increase unit prices).
- Quantities are rounded to 3 significant figures.

- Quantities are listed in whole numbers (convert units of measure for Acre to Square Yard and TON to Pound to avoid using decimals)
- Item descriptions are consistent with the corresponding descriptions shown in the "Contract Item Code List"
- Method of payment for ALL WORK is covered in the Special Provisions or the Standard Specifications by contract item full compensation or extra work
- Unit of measurement is consistent with pay clauses in the Special Provisions or the Standard Specifications

Contract Items (Important items to be checked)

- CONSTRUCTION AREA SIGNS (paid for as lump sum item, use SSP 12-000 Check SSP #and include Standard Plan S41-3)
- ROADSIDE CLEARING (paid for as lump sum item, cost based on total acres of planting and amount of weed control, trash and debris removal and the number of shrub and tree removal specified in SSP 20-400)
- MULCH (paid for by the cubic yard, calculation based on per plant quantity shown on the Plant List and/or cubic yard area call outs on the Planting Plans and includes green material, tree bark, wood chips, shredded bark, or combination of wood chips and tree bark)
- COMMERCIAL FERTILIZER (GRANULAR)/(SLOW RELEASE) (paid for by the pound, calculation based on Plant List application rate applied during planting, DON'T include fertilizer applied during plant establishment in the estimate)
- COMMERCIAL FERTILIZER (TABLET) (paid for by the tablet, calculation based on Plant List application rate applied during planting)
- PLANT GROUP () (paid for as each, calculation based on quantities shown on the Plant List)
- DUFF (paid for by the cubic yard, calculation based on the areas shown on the plans and all work specified in SSP 20-005)
- EROSION CONTROL (BLANKET) (paid for by the square yard, which includes the various materials involved, e.g., seed, fertilizer, straw, calculation based on the areas shown on the plans and all work specified in SSP 20-010)
- EROSION CONTROL (NETTING) (paid for by the square yard, which includes the various materials involved, e.g., seed, fertilizer, straw, netting, calculation based on the areas shown on the plans and all work specified in SSP 20-015)

Contract Items (Important items to be checked) continued

- MOVE-IN MOVE-OUT (EROSION CONTROL) SSP 20-020 (Move-In/Move-Out (erosion control) will be determined as units from actual count as determined by the Engineer. For measurement purposes, a move-in followed by a move-out will be considered as one unit).
- EROSION CONTROL (TYPE C) (paid for by the square yard or acre which includes the various materials involved, e.g., seed, fertilizer, straw, calculation based on the areas shown on the plans and all work specified in SSP 20-030)
- EROSION CONTROL (TYPE D) (paid for by the square yard or acre which includes the various materials involved, e.g., seed, fertilizer, compost, fiber, straw, stabilizing emulsion, calculation based on the areas shown on the plans and all work specified in SSP 20-040)
- EROSION CONTROL (Type BFM) (paid for by the square yard or acre which includes the various materials involved, seed, fertilizer, boned fiber matrix, calculation based on the areas shown on the plans and all work specified in SSP 20-041)
- EROSION CONTROL (Type Hydraulic Matrix) (paid for by the square yard which includes seed, hydraulic matrix, calculation based on the areas shown on the plans and all work specified in SSP 20-047)
- EROSION CONTROL (DRILL SEED) (paid for by the square yard or acre] which includes the various materials involved, e.g., seed, fertilizer, compost, fiber, stabilizing emulsion], calculation based on the areas shown on the plans and all work specified in SSP 20-050)
- EROSION CONTROL (COMPOST BLANKET) (paid for by the cubic yard which includes the various materials involved, seed and compost, calculation based on the areas shown on the plans and all work specified in SSP 20-055)
- COMPOST, INCORPORATE (paid for by the square yard which includes the compost and incorporation, calculation based on the areas shown on the plans and all work specified in SSP 20-056)
- FIBER ROLLS (paid for by the linear foot, calculation based on the areas shown on the plans and all work specified in SSP 20-060)
- WILD FLOWER SEEDING (paid for by the square yard or acre, calculation based on areas shown on Planting Plans and all work specified in SSP 20-530)
- PLANT ESTABLISHMENT WORK (paid for as lump sum item, cost based on work specified in SSP 20-550 including fertilizer applied during plant establishment period)
- CONTROL AND NEUTRAL CONDUCTORS (paid for as lump sum, cost based on total linear feet of conductors and current price per foot)
- WATER METER (paid for as each by size, quantities equal corresponding totals shown on Irrigation Quantities sheet)
- ELECTRICAL SERVICE (paid for as lump sum, cost based on quote from utility company and markup by Contractor)
- ELECTRIC REMOTE CONTROL VALVE (paid for as each by size, quantities equal corresponding totals shown on Irrigation Quantities sheet. This total is to include the Remote Control Master)
- STATION IRRIGATION CONTROLLER (paid for as each by number of stations, quantities equal corresponding totals shown on Irrigation Quantities sheet)
- PLASTIC PIPE (PR 200) (SUPPLY LINE) (paid for as linear foot, use the pay item for the size of pipe being installed. Shown as a final pay item in the Engineers Estimate)
- PLASTIC PIPE (PR 315) (SUPPLY LINE) (paid for as linear foot, use the pay item for the size of pipe being installed. Shown as a final pay item in the Engineers Estimate. Not installed in an irrigation crossover)
- GALVANIZED STEEL PIPE (SUPPLY LINE) (paid for as linear foot, use the pay item for the size of pipe being installed. Shown as a final pay item in the Engineers Estimate. NOTE: The supply line between the point of connection and the water meter is galvanized but it's paid for as part of the water meter)
- WELDED STEEL PIPE CONDUIT (paid for as linear foot, use the pay item for the size of conduit being installed)
- IRRIGATION CROSSEOVERS (paid for as linear foot, use the pay item for the type and size of conduit being installed) (This includes the Waterline Crossover (Plastic Pipe Supply Line PR315) and Sprinkler Conduit with the Control and Neutral Conductors installed within the conduit)
- EXTEND IRRIGATION CROSSEOVERS (paid for as linear foot, use the pay item for the type and size of conduit being installed)

Contract Items (Important items to be checked) continued

- WATER SUPPLY LINE (BRIDGE) (paid for as linear foot, use the pay item for the type and size of PIPE being installed)
- BACKFLOW PREVENTER ASSEMBLY (paid for as each, use the pay items for the various sizes of backflow preventer assemblies being installed, quantities equal corresponding totals shown on Irrigation Quantities sheet, cost based on components that include backflow preventer, wye strainer, gate valve, GSP fittings and pipe, thrust blocks, concrete pad and plug. When an enclosure is also to be installed the enclosure may be included in the cost of the Backflow Preventer Assembly or paid for separately. When the enclosure is paid for separately then the concrete pad is included as part of the enclosure estimate)
- BACKFLOW PREVENTER ASSEMBLY ENCLOSURE (paid for as each, quantities equal corresponding totals shown on Irrigation Quantities sheet, cost based on components that include backflow preventer assembly enclosure, including concrete pad,)
- SPRINKLER (TYPE []) (paid for as each, quantities equal corresponding totals shown on Irrigation Quantities sheet)
- GATE VALVE (paid for as each use, the pay items for the various sizes of gate valves being installed, quantities equal corresponding totals shown on Irrigation Quantities sheet by size of each gate valve)
- BALL VALVE (paid for as each use, the pay items for ball valve (no size), quantity equals total of all sizes shown on Irrigation Quantities sheet)
- IMPORTED TOPSOIL (paid for by the cubic yard, calculation based on the areas shown on the plans and all work specified in SSP 20-005)
- TOPSOIL (paid for by the cubic yard, calculation based on the areas shown on the plans and all work specified in SSP 20-005)
- MAINTENANCE VEHICLE PULLOUTS (paid for as square yard, when more than one MVP and they are not the same size or shape or by each when one or if all are the same size and shape)
- ASPHALT CONCRETE (paid for by the square yard, calculation based on the areas shown on the plans and all work specified in SSP 39-250)
- MAINTAIN EXISTING PLANTS (paid for as lump sum item, use SSP 20-252)

- MOBILIZATION (paid for as lump sum item, cost based on 10 percent of the sum of all contract item costs BEES automatically calculates cost when percentage figure is entered)

List of the most common BEES errors

- Quantities with more than one decimal place
- Incorrect use of units of measure
- Use of abbreviations
- Use of obsolete item code numbers
- Incorrect calculations for mobilization and contingency
- Standard item code numbers masqueraded as non-standard numbers
- Re-use of one-time item code numbers
- Not rounded to nearest whole dollar in subtotal
- Consecutive numbering scheme with alpha characters ending in ABCs
- Standard items in supplemental work
- Incorrect placement of Supplemental Work and/or State-Furnished Items
- Price discrepancy between highway and bridge files
- Non Lump Sum items in Supplemental Work and/or State-Furnished Material