

## Cost Estimating

The purpose of this module is to provide guidance for Geotechnical Services' participation in the cost estimating process for project delivery. Caltrans Project Cost Estimate components consist of a base estimate, known risks, escalation, and adjustments (up or down) for unknown risks. GS does not develop final cost estimates for Caltrans assets, however GS may be requested to provide draft cost estimates for geotechnical assets on a project. Situations where GS may provide the client assistance include when:

1. developing the cost estimate certification for the project;
2. estimating cost for Major Damage projects; and/or
3. performing a cost comparison when providing geotechnical recommendations.

### Cost Estimate Certification

Caltrans Districts and DES (led by PPM&OE) are responsible for developing cost estimates early in project development, during preparation of the Project Initiation Document (PID), primarily in the K-phase. The PID provides a rough cost estimate, scope, and schedule that are used for initial programming of the project. Caltrans has implemented a series of best practices and policies to assist in developing more accurate cost estimates including:

- Estimate certification by the District Director prior to being allocated by the California Transportation Commission (CTC)
- A quality control/quality assurance process for estimates
- Quarterly cost estimating forums

Caltrans monitors and revises policies to develop complete and accurate cost estimates. During later phases of a project, additional information and risks may become apparent. This may lead to adjustments in scope, schedule, or budget from the originally conceived project programmed from the PID. Any requests to change the scope, schedule, or costs of a project are scrutinized by a formal management review prior to approval. In rare cases, GS may be requested to assist the District in developing cost estimates for the PID Cost Estimate Certification, PA&ED Cost Estimate Certification, and the PS&E Cost Estimate Certification. In these situations, GS staff should develop a cost estimate that includes:

- a detailed breakdown of costs,
- references where the costs were derived, and
- a list of assumptions and any affiliated risks associated with the costs.

The cost estimate must be reviewed by the Branch Chief and the Office's project resource management designee prior to being sent to the client.

### Major Damage Projects

The District Major Damage Restoration Coordinators (DMDRC) are responsible for providing cost estimates to the Director within a few days of the major damage event. The DMDRC may request GS assistance with developing cost estimates for the mitigation measures, typically for unfamiliar or uncommon mitigations/recommendations for the project assets. When requested, GS should develop a cost estimate that includes:

- a detailed breakdown of costs,
- references where the costs were derived, and
- a list of assumptions and any affiliated risks associated with the costs.

The cost estimate must be reviewed by the Branch Chief and the Office's project resource management designee prior to being sent to the client.

Prior to delivery of the cost estimate, forward the cost estimate to the appropriate client (Structure Design and/or District) and request their review and concurrence.

### Cost Comparisons

Perform qualitative cost comparisons when considering preferred alternatives and providing geotechnical recommendations for Caltrans assets. For some projects, there may be more than one suitable geotechnical design alternative, and selection of the preferred alternative may be dependent on relative costs between alternatives. If there are clear differences in cost between foundation alternatives (i.e. spread footing versus pile foundations or standard plan piles vs Cast-In-Steel Shell piles), then discuss those items in the geotechnical recommendations.

It is not recommended that the detailed cost estimates be provided with the recommendations in the reports since detailed cost estimates are developed by other functional units in Caltrans.

### **Definitions**

Cost Estimate: A predication of quantities, cost, and or price required by the scope of an asset or project. An estimate must address risks and uncertainties. Cost estimates are determined based on experience, past projects, and the forecasting of future costs within an established timeframe. Cost estimates are typically used as inputs for budgeting, cost or value analysis, decision making/asset/project planning, and project costs.

Top-down (high-level Analogous Estimating): Estimating that is based on the actual cost of a previous similar project using experts and expenditures to estimate the cost of a current project.

Parametric Estimating: Generating support cost estimates based on correlation with one of several project parameters such as capital costs using historical information.

Bottom-up Estimating: Establishing individual estimates at the lowest possible work package level in accordance with the scope and combining/rolling up to higher levels to generate estimates at the project level.

Risk Budget Estimating (A.K.A. Known Risks): Establishing identified risks that may affect the project's ability to achieve its objectives. This method applies to both support and capital costs.

Contingency: A percentage of the subtotal of the cost of contract items, supplemental work, and state-furnished materials and expenses, which is included in the grand total of the District Cost Estimate to allow for unforeseen increases.

Base Estimate: A sum of both the capital and support cost estimates; consists of the construction capital costs, Right of Way Capital Costs, and Project Resource and Schedule Management (PRSM) workplan support costs.

Project Resource and Schedule Management (PRSM): An on-line library that contains the latest PRSM information and knowledge in one place. PRSM workplan support costs are derived using a combination of bottom-up and top down estimating methods.

Escalation: The changes in the cost or price of specific goods or services in a given economy over a period.

Adjustments: Apply to both support and capital costs, provides funds held at the programmatic level to account for unpredictable cost impacts such as unknown risks.

## **Cost Estimating for both Structure and District Design**

### Contract Cost Database

A database of historical bid prices received by bidders on past Caltrans projects (from 1993 to present). The database is searchable by item code/description, District, year, quantity, and more. All results include the Contract Number from which the data originated, as well as a link to the advertised bid documents (plans, specifications, etc.).

Link: <http://sv08doweb2.dot.ca.gov/contractcost/>

### Basic Engineering Estimating System (BEES)

The BEES system is used for cost estimating during the Plans, Specifications, and Estimates (PS&E) and advertising phases of the project. The BEES system

incorporates input from various functional units, including the District Project Engineer and the Structure Estimating Branch. Geotechnical Services does not have the authority to directly provide input to the BEES.

Link:

[https://it.onramp.dot.ca.gov/downloads/it/files/legacy\\_forms/Basic%20Engineering%20Estimating%20System%202017.pdf](https://it.onramp.dot.ca.gov/downloads/it/files/legacy_forms/Basic%20Engineering%20Estimating%20System%202017.pdf)

### District and Structure Design Contacts

Table 1 provides a list of the potential contacts when assisting District Design, Structure Design, or District Major Damage Restoration Coordinators with geotechnical cost estimates. The descriptions in this table should assist GS staff with communication between disciplines/roles.

Table 1. District and Structure Design Contacts

<b>District/Structure Design Contact</b>	<b>Their Role</b>	<b>GS Interaction Regarding Cost Estimating</b>
District Project Manager (PM)	Reviews and approves all project cost estimates. Reviews and sign program change requests.	In rare instances, the PM may request that the Geotechnical Services (GS) staff assist with developing the project Cost Certification during the PS&E phase.
District Project Engineer (PE)	Prepares, revises, and updates project cost estimates during the K-, 0- and 1-phases of projects, which involves incorporating new or revised cost data from various functional units (e.g. Structure Design, Right-of-Way). (Note: In some Districts, the District Office Engineer provides these estimates, rather than the District PE.)	The District PE may ask the GS staff for input on cost estimates for items that may not be familiar to them or unusual (e.g. rockfall protection system). While it is not the GS staff's role to prepare detailed estimates and/or select unit costs for bid items, the GS staff may assist the District PE by researching past projects that utilized the items in question, and providing these Contract Numbers to the District PE; all GS prepared cost estimates are to be reviewed and approved by the appropriate client.
Cost Estimate Certifiers	Assist District PE's/PM's with determining unit costs. Certify the cost estimate at RTL.	Typically, the Cost Estimate Certifier will work with the District PE/PM (not the GS staff). However, in rare cases, the GS staff may develop costs of geotechnical-related alternatives, and the Cost Estimate Certifiers can assist with unit cost prices that the District PE may not have. Contact information for Cost Estimate Certifiers may be found at the link provided previously for Division of Design – Cost Estimating. All GS prepared cost estimates are to be reviewed and approved by the appropriate client.

<p>Structure Design (SD)</p>	<p>SD is part of Division of Engineering Services (DES). They are responsible for preparing, revising, and updating structure cost estimates. The estimates themselves are prepared by Division of Structure Office Engineer - Estimating Branch (SOE-Estimating Branch). SOE-Estimating provides the Structure estimate in BEES to the District.</p>	<p>SD utilizes the SOE-Estimating Branch for structure cost estimates and thus does not ask GS staff for input on structure costs. However, in rare instances, a project may have both structural and non-structural alternatives (e.g. a MSE wall versus a GRE), and the GS staff may be involved in conversations with the Structure Design PE and the District PE on relative costs between alternatives. All GS provided cost estimates are to be reviewed and approved by the appropriate client.</p>
<p>Structure Architecture</p>	<p>Division of Engineering Services, Office of Transportation Architecture (DES-OTA) prepares the detail estimate for all building projects and provides the Building estimate in BEES to the District.</p>	<p>Structure Architecture utilizes DES-OTA for building project estimates and thus does not ask GS staff for input on structure costs. However, in rare instances, a project may be comparing alternatives for which at least one alternative involves a solution that is geotechnical in nature (e.g. a deep building foundation versus a shallow foundation on improved soil), and the GS staff may be involved in conversations with Structure Architecture and the District PE on relative costs between alternatives. All GS provided cost estimates are to be reviewed and approved by the appropriate client.</p>
<p>District Major Damage Restoration Coordinators</p>	<p>Advisor for SHOPP Emergency (130, Permanent Restoration (131) and Protective Betterment (150) Programs. Provides guidance to various District functional units to maximize Caltrans' response in restoring the State Highway System damaged from catastrophic events. Responsible for the development and preparation of the Director's Orders for Emergency projects related to catastrophic events. Creates Permanent Restoration Projects in the Asset Management Tool and prepares the appropriate portion of Project Initiation Proposal (PIP).</p>	<p>The District Major Damage Restoration Coordinator may ask the GS staff to assist with an initial disaster assessment during or soon after a major disaster (e.g. landslide, flash flood). This may include determining scope of repair work and cost estimates of repair. All GS cost estimates are to be reviewed by the appropriate client (Structure Design and or District Design) before providing to the client. See the Emergency Response module for more information.</p>

## Contingency/Risk

Total contingency includes quantified risk-based contingency from the risk register, scope refinement, and undefined risks. The typical contingency for the Project Initiation Document (PID) phase is 25%, the Project Report phase is 15% and Final PS&E phase is 5%. Risk-based contingency is obtained from the Risk Register/Risk Management Plan Tool. Consideration of the project alternatives and associated costs based on available data, modification of good data with good judgement, and using past cost estimating experience so that the cost estimates can be used with confidence. Assumptions and risks should always be documented when providing cost estimates. Quantifying risks are typically captured in the Risk Register Tool. Estimating Risk Budget hours and dollars for the Risk Register Tool should not involve a thorough cost estimate calculation because the time consumed in performing a complete analysis is not a cost-effective use of staff time; approximate numbers are sufficient. The qualitative risk can be assessed to account for the magnitude of potential issues that may arise throughout all phases of the project. The risk should be qualitatively described as either Low, Medium, or High and be reported with the cost estimate. GS staff are sometimes requested to assist with development of the PID during Phase K and are requested to provide alternatives for the project. Report the alternatives and include any affiliated risks. Report to the Project Manager any geotechnical risk items to be added to the Risk Register Tool during throughout all phases of the project.

## Resources

### Cost Estimating Training

The objective of this training is to train potential estimators to produce reliable construction estimates throughout project planning, development, and the delivery process. This course may be completed as either a 2-hour self-guided training or an 8-hour instructor-led training.

Link: <https://design.onramp.dot.ca.gov/node/381>

### Construction Contract Awards

Construction Contract Awards opens bids and awards construction contracts over \$333,000 to the lowest responsive and responsible bidder; maintains standard contract item codes and descriptions lists; generates contract cost data.

Link: <https://des.onramp.dot.ca.gov/office-engineer/construction-contract-awards>

### Office of Structure Office Engineer

Structure Office Engineer (SOE) produces contract special provisions and cost estimates for the construction of bridges, retaining walls, tunnels, and other transportation-related structures.

Link: <https://des.onramp.dot.ca.gov/des-structure-design/office-structure-office-engineer-oe>

### Contract Cost Data – Links to Other Resources

Links that provide other resources that may be useful in preparing an Engineer's estimate.

Link: <http://sv08doweb2.dot.ca.gov/contractcost/links.php>

### Cost Estimating Improvement Initiative (CEII)

Includes tools, training modules, and reference material designed to assist Capital Outlay Support staff with estimating and management of both support and capital costs.

Link: <https://projmgmt.onramp.dot.ca.gov/cost-estimating-improvement-initiative-ceii>

### Division of Design – Cost Estimating

Links to cost estimating training, guidelines, templates, policy, etc. used by Division of Design. Also, the page lists contact information for Cost Estimate Certifiers and Subject Matter Experts.

Link: <https://design.onramp.dot.ca.gov/cost-estimating>

### Major Damage Restoration and Director's Orders (MDRDO)

MDRDO is a branch of the Caltrans Office of Emergency Management. MDRDO implements Director's Order objectives by accelerating contracts on Emergency Openings, Permanent Restorations, and Protective Betterment Projects.

Link: <https://maintenance.onramp.dot.ca.gov/directors-orders/major-damage-restoration-and-directors-orders>

### Total Project Cost Estimates – Guidance Memorandum

A manual developed to provide guidance to facilitate the Department's support and capital cost estimating using best practices.

Link:

[https://projmgmt.onramp.dot.ca.gov/downloads/projmgmt/files/CEII/Cost\\_Estimating\\_Component\\_Guidelines.pdf](https://projmgmt.onramp.dot.ca.gov/downloads/projmgmt/files/CEII/Cost_Estimating_Component_Guidelines.pdf)

### Useful Spreadsheets

Provides the 11- Page Preliminary Cost Estimate Templates discussed in the Cost Estimating Section in addition to other spreadsheets.

Link: <https://design.onramp.dot.ca.gov/useful-spreadsheets>

Risk Management/Risk Register Tool

A process that is intended to result in the effective management of project risks and opportunities during the entire project life cycle – from project inception to completion of construction.

Link: <https://projmgt.onramp.dot.ca.gov/risk-management>