ALAMEDA COUNTY TRANSPORTATION COMMISSION

Cost Estimating Guide

February 2011

ALAMEDA CTC BOARD MEMBERS

Chair: Mayor Mark Green, City of Union City

Vice Chair: Supervisor Scott Haggerty, Alameda County District 1

JURISDICTION	MEMBER
AC Transit	Director Greg Harper
Alameda County, District 1	Supervisor Scott Haggerty
Alameda County, District 2	Supervisor Nadia Lockyer
Alameda County, District 3	Supervisor Wilma Chan
Alameda County, District 4	Supervisor Nate Miley
Alameda County, District 5	Supervisor Keith Carson
City of Alameda	Councilmember Beverly Johnson
City of Albany	Mayor Farid Javandel
BART	Director Tom Blalock
City of Berkeley	Councilmember Laurie Capitelli
City of Dublin	Mayor Tim Sbranti
City of Emeryville	Councilmember Ruth Atkin
City of Fremont	Vice Mayor Robert Wieckowski
City of Hayward	Councilmember Olden Henson
City of Livermore	Mayor Marshall Kamena
City of Newark	Councilmember Susan Chang
City of Oakland	Councilmember Larry Reid
City of Oakland	Councilmember Rebecca Kaplan
City of Piedmont	Vice Mayor John Chiang
City of Pleasanton	Mayor Jennifer Hosterman
City of San Leandro	Councilmember Joyce R. Starosciak
City of Union City	Mayor Mark Green

Alameda CTC Executive Director: Art Dao

CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

This Cost Estimating Guide (Guide) is provided by the Alameda County Transportation Commission (Alameda CTC) for sponsors preparing project or program cost estimates for consideration in the Countywide Transportation Plan (CWTP) and/or the Transportation Expenditure Plan (TEP). Sponsors should note that the Metropolitan Transportation Commission (MTC) has issued guidance in the regional Call for Projects that requires the Alameda CTC to provide cost estimating guidance to the local jurisdictions. It is the intent of the Alameda CTC to use this Guide as the cost estimating guide for the current Sustainable Communities Strategy/Regional Transportation Plan (SCS/RTP) call for projects as well as for the CWTP-TEP.

Who should use this Guide?

This Guide is intended for use by people qualified to prepare a cost estimate. The preparer of the cost estimate should be able to provide the basis for their decisions and to defend the specific elements of the cost estimate, if asked.

This Guide may also be used as a primer for stakeholders and other interested parties, to introduce them to the principles and elements of cost estimating for projects and programs. However, this Guide is not intended to provide instruction to an individual inexperienced in estimating costs.

The Purpose of this Guide

The importance to a funding agency of accuracy in cost estimating for projects and programs can not be overstated. The consequences of inaccurate estimates are many; most obviously it can be difficult or impossible to deliver projects that have been programmed and committed to, if early estimates prove to be significantly low. In the current economic climate of greater-than-ever strains on public funds, the pressure to be able to accurately estimate the ultimate cost of a project is increasing.

Historically, it has been difficult to generate cost estimates for transportation projects that remain accurate through the development of the project, particularly when comparing early or concept-level estimates to the actual cost of the completed project. There are many reasons for this and a variety of

solutions have been attempted over the years to improve the accuracy of cost estimates for infrastructure. Much research has been conducted on the matter, and there is broad consensus now that accurate estimates tend to take into account the various risks that a project may face during its development and construction. With that in mind, this Guide seeks to incorporate a simplified approach to considering risks during the preparation of cost estimates that will result in more robust and accurate estimates.

The Guide also establishes a standardized approach to preparing estimates for both projects and programs, thereby providing the opportunity for fair comparisons between projects and programs competing for inclusion in the CWTP and/or the TEP. It lays out "rule-of-thumb" assumptions to use for a variety of the standard cost elements of a project, and helps remind sponsors of the elements that should be considered in order to accurately estimate the costs of any project or program. The intention is to provide a somewhat standardized approach to cost estimating within Alameda County, and to provide tools to make those estimates as accurate as possible.

How the Guide accomplishes this:

This Guide sets out a consistent framework for estimating capital project and program costs at the conceptual and detailed levels. Typical project phases, estimate types, and standard general contingencies are discussed. In addition, the Guide provides a Risk-Based Allowances Approach to help project sponsors evaluate risks that may not be fully developed or quantified. The end result of the approach is a cost estimate that includes allowances for risks that may not have been identified had a more traditional approach been applied.

A variety of sources (i.e. FHWA, Caltrans, WSDOT, links included in the Resources section of the Guide) provide thorough and well detailed documents that describe how to assess and manage risks, however, in the best interest of the Alameda CTC, this Guide provides a streamlined approach that helps identify risks at a conceptual level.

Sponsors are required to conduct a field review to their proposed project site in order to identify possible risks using the Preliminary Risk Assessment Questionnaire. Once identified, the risks are assigned an allowance (percentage) based upon their probability of occurrence. Each risk allowance is multiplied by the appropriate cost estimate line items and eventually added to the total cost.

As a result of incorporating informed Risk-Based Allowances, in some cases the standard design contingencies may be slightly reduced. This is justified in that traditional contingencies were expected to cover everything that was not otherwise specifically accounted for in the estimate, otherwise known as the "unknowns". However, with the use of the Preliminary Risk Assessment Questionnaire, some of those "unknowns" can be identified and more specifically accounted for. Thus, the design contingency should only be expected to cover a smaller pool of truly "unknown unknowns".

Together with the standard line items and general contingency, the development of Risk-Based Allowances makes a more reliable cost estimate.

Cost Estimating for Programs

This Guide also presents guidelines for estimating the costs of programs by presenting the basic elements that comprise typical program costs. Since program types and details may differ broadly, sponsors are encouraged to submit questions to the Alameda CTC. It is most important that programs submitted for inclusion in the CWTP or TEP be well thought out and well documented.

Acknowledgements

Segments of this Guide are used with permission from the Contra Costa Transportation Authority (CCTA). The Alameda CTC would like to thank CCTA for their cooperation and collaboration in this effort.

COST ESTIMATING GUIDE

1.0 INTRODUCTION

This Cost Estimating Guide (Guide) sets out a consistent framework for estimating capital project and program costs at the conceptual and detailed levels. Project and program sponsors are encouraged to use this Guide when preparing cost estimates for Alameda County Transportation Commission (Alameda CTC) funded projects and programs and to be considered for inclusion in the Alameda CTC Countywide Transportation Plan (CWTP) and/or Transportation Expenditure Plan (TEP). Sponsors should note that the Metropolitan Transportation Commission (MTC) has issued guidance in the regional Call for Projects that requires the Alameda CTC to provide cost estimating guidance to the local jurisdictions. It is the intent of the Alameda CTC to use this Guide as the cost estimating guide for the current Sustainable Communities Strategy/Regional Transportation Plan (SCS/RTP) call for projects as well as for the CWTP-TEP.

Sound financial programming requires consistent and reasonable cost estimates. Accurate cost estimates allow project and program sponsors to establish reliable funding plans for their projects and programs and enable the Alameda CTC to program sufficient funding to support sponsors' projects and programs.

1.1Who Should Use this Guide?

This Guide is intended for use by project and program sponsors. Specifically, it is intended for use by people qualified to prepare a cost estimate for a proposed project or program. In the case of a cost estimate for a capital project, it is assumed that the estimate is being prepared by a qualified individual, probably an engineer or other person qualified by training or experience. In the case of a cost estimate for a program, the estimate should be prepared by someone qualified to do so, likely a planner, manager, or someone intimately familiar with the actual costs of the program being proposed. Regardless of the nature of the proposed project or program, the preparer of the estimate should be able to defend the specific elements included in the cost.

This Guide may also be used as a primer for stakeholders and other interested parties, to introduce them to the principles and elements of cost estimating for projects and programs. This Guide is not intended to provide instruction to an individual inexperienced in estimating costs.

1.2 Qualities of a Good Cost Estimate

In general, a cost estimate should answer a series of questions as shown below:

- **Scope:** What is included?
  What is excluded?
  Does the scope of the estimate match the scope of defining documents?
  Any variations must be identified and the reason for the deviation explained.

- **Quantities:** Are the quantities reasonable?
  Is the method clear and easy to follow?
  Has the math been checked?
  Do the totals come forward to the summaries?
  A good technique is to use parametric checks from other experience, i.e. 1000 pounds of reinforcing steel per cubic yard of concrete would be extraordinary.

- **Pricing:** Are the unit prices reasonable?
  Are the explanations reasonable?
  Does the pricing cover the type and quality of materials contemplated?
  Are incidentals like sales tax and freight covered?
  Have unusual working conditions been factored into the pricing?

- **Major items:** The major items of work should be investigated with care. A faulty assumption on a major work item will have a large effect on project cost.

- **Support and Other Soft Costs:** Did you consider work by others?
  Are environmental studies considered?
  Are preliminary engineering and final design included?
  Are the construction staking and construction management covered?

- **Presentation:** Is the estimate presentation clear?
  Is it easy to follow?
  Is the basis of the estimate documented in a concise fashion so that it will be readily understood by an unfamiliar party?

2.0 ESTIMATING METHODOLOGY

This Guide provides a description of two methods to be used in estimate preparation for Alameda CTC projects and programs – Conceptual and Detailed Cost Estimates. These are briefly introduced in the following paragraphs and are explained in greater detail in Section 3.2.

Conceptual Cost Estimates	**Detailed Cost Estimates**
Prepared during the early planning development phases when detailed information about the project or program is unknown.	Prepared for a program or during the design phases of project development when more detailed engineering is being/has been performed.

2.1Conceptual Cost Estimate

A Conceptual Cost Estimate includes the scope of the project or program, general cost categories, basis for quantities, basis for pricing, assumptions, inclusions, and exclusions. In addition, a conceptual cost estimate should consider any possible risks (e.g. Economic Justice, Water Quality Control Act, etc.) and associated costs. Further discussion on risk assessment is described in Section 2.8. Sponsors should take care to document their basis and pricing as accurately and thoroughly as possible. As with any estimate, it should be comprehensively reviewed before being finalized.

2.2 Detailed Cost Estimate

A Detailed Cost Estimate essentially expands a conceptual cost estimate to more accurately reflect the cost needs of a refined and developed project or program. This method adds more defined costs and cost basis within the individual cost categories. Risks associated with the project should be better understood at this point and may be more focused.

2.3 Estimate Format

Cost estimates will vary in format and content depending on whether they are for a program or a capital project. Cost estimates should be easy to read and have a logical form. The Alameda CTC assumes that the sponsor's experience in cost estimating is such that they may have previous cost estimates with which to work from and should able to identify resources to create an effective cost estimate.

2.4 Scope of the Estimate

The project or program should be developed in sufficient detail to support the type of cost estimate prepared. In some cases it may be necessary to do additional work to adequately define the project or program scope. For example, it may be necessary to obtain a preliminary geotechnical report, information on the potential for contaminated soil, or as-built drawings of existing facilities to refine cost estimates. Any estimate should include a summary narrative describing the scope of work upon which the estimate is based.

2.5 Quantity Takeoffs

Quantity takeoffs used in cost estimate categories should be based on available conceptual or detailed engineering. Quantity takeoffs may be calculated on any standard takeoff sheet or Sponsors may wish to use their own spreadsheet. Assumptions should be clearly described in the back-up documentation.

2.6 Pricing

This guide contains guidance for standard units of measure for typical project bid items in Appendix D. It does not, however, provide specific unit prices for specific items. There are several reasons for this. First, there is great variation (potentially over 100%) in the unit price for most items, depending on the quantity required. Second, it is the Alameda CTC's hope that this guide will prove valuable well beyond the timeframe in which it was prepared. Given the fluctuation of construction prices over time, it is important that a cost estimate always be prepared with the most current and accurate cost data available at the time. While no specific unit costs are given here, it is expected that project sponsors use good professional judgment in selecting the prices and that they are prepared to defend those decisions.

Unit pricing should be carefully considered. Prices may vary greatly for the same material in different geographical areas or quantity, and may also shift with economic markets. There are several sources of cost data that can be used to determine appropriate unit prices, some of which are described in Section 6.0, Resources.

The basis for the pricing of all items included in the cost estimate should be well documented and as accurate as possible. Providing thorough descriptions and references are encouraged to help facilitate the understanding of the cost estimate. Estimators may be asked to support the derivation of a unit price or a lump sum item.
The basis for the pricing of all items included in the cost estimate should be well documented and as accurate as possible. Providing thorough descriptions and references are encouraged to help facilitate the understanding of the cost estimate. Estimators may be asked to support the derivation of a unit price or a lump sum item.

2.7 Escalation

As with most things, costs associated with projects and programs tend to increase over time. If an estimate is being prepared for a project or program that will be constructed or implemented at least a year into the future, it is important to include an appropriate escalation factor. This escalation rate should be based on reasonable assumptions regarding market conditions economic outlook, geographical location, and historic data. The Alameda CTC may make a specific recommendation for an escalation rate to use at a specific time or for a specific application. If no particular escalation rate is established by the Alameda CTC, then the preparer of the estimate should be able to defend the rate used.

2.8 Risk Assessment

Risks have the potential to impose impacts on project scope, cost, schedule, and quality. Identifying and understanding the risks associated with a proposed project provides a more accurate and thorough cost estimate, which is especially useful to the Alameda CTC when evaluating conceptual cost estimates.

Sponsors for Alameda CTC funded projects and programs are required to include a cost estimate category titled Risk-Based Allowances, which would consist of identified risk line items. Each risk line item has an appropriate percentage markup, calculated using the Guide's proposed risk assessment methodology in Section 3.4, Development of Capital Project Risks.

3.0 CAPITAL PROJECT COST ESTIMATES

3.1Capital Project Phases

There are typically six basic phases of project development from development of a concept through construction. For each phase leading up to completion of the final design, there may be one or more estimate types associated with it. Figure 1 below illustrates this relationship along a project timeline – phases are shown above the line, milestones at which estimates are prepared are shown below the line.

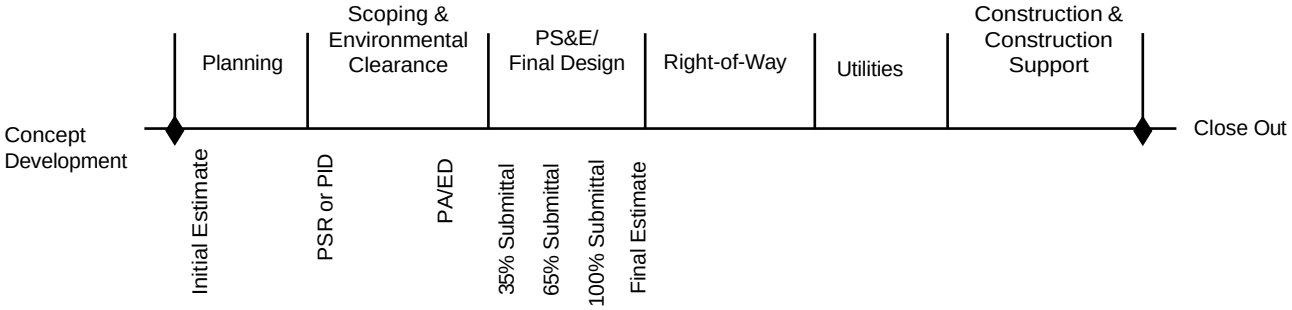

Figure 1- Typical capital project timeline, showing phases and estimates

- Concept Development
  This is not specifically a funded phase, but is the initiation of the project timeline. The need for a project may be determined as the result of a corridor study, major investment study, feasibility study, or by some other means (e.g. the need may have been identified during the development of another project).

- Planning
  This phase covers the project from its identification through preparation of a programming document. In the case of a Caltrans project, this is referred to as a Project Initiation Document (PID) and usually takes the form of a Project Study Report (PSR). An initial estimate is prepared in order to begin programming funds for the project.

- Scoping, Environmental Document & Preliminary Engineering
  During this phase of the project the scope of work is fleshed out, alternatives are considered, and engineering is commenced and usually taken to the level of 10-15% design. Depending on the type of project, it receives CEQA and/or NEPA clearance and usually some type of formal approval to move into the final design phase (in the case of a Caltrans project, this project approval document is called a Project Report). The estimates prepared at this phase should be more accurate than initial estimates because is the project is well defined with more knowledge of impacts and mitigations.

- Final Design – PS&E
  This phase entails the preparation of Plans, Specifications, and Estimates (PS&E)—the final versions of which will become the bid and construction documents. The cost estimates prepared for various submittals during this phase should become increasingly accurate as more of the design details are worked out. Accordingly, cost contingencies intended to account for unknowns are reduced as the design is refined.

- Right-of-Way Services & Acquisition
  Initially, the cost of right-of-way necessary for the project should be approximated using unit prices for comparable land values. Once the proposed take is specifically defined, special expertise is required to develop a more accurate cost. The appropriate detail should be included in the description for this type of work, which may include cost for new easements, temporary construction easements, lay down areas, relocation costs, land acquisition services, hazardous material remediation, and possible contingencies.

- Utilities
  This phase covers any work related to design, accommodation, protection and/or relocation, if necessary, ideally to take place before construction begins.

- Construction Capital
  This phase includes the construction of the project according to the final plans. It includes labor and materials supplied by the contractor, as well as any materials supplied by the owner or others.

- Construction Support
  This phase covers design support during construction (e.g. RFI's, submittals, etc.), as well as construction management.

- Close Out
  This is not a specifically funded phase, but it is part of the end of a project. Close out of a project involves settlement of administrative and project control items and concludes with the transfer of the project from the contractor to the owner.

3.2 Estimate Types

In the previous section, six project development phases were identified for which capital project cost estimates may be prepared. The six types of estimates corresponding to these phases comprise two major types described previously, Conceptual Estimates and Detailed Estimates. These are shown below

Types of Conceptual Estimates
• Initial Estimates • PSR Estimate • PA/ED Estimate

Types of Detailed Estimates
• 35% Submittal Estimate • 65% Submittal Estimate • 100% Submittal Estimate • Final Engineer's Estimate

- Initial Estimate
  An initial estimate, based upon the project concept, is usually the first cost estimate prepared for a new project and typically includes large contingencies. The project may not be sufficiently defined to allow use of the Guide. If the Guide is not used, the sponsor should state how the initial estimate was derived. Even at this early stage, however, sponsors are encouraged to go through Table 2, Preliminary Risk Assessment Questionnaire, included in this Guide and to include Risk-Based Allowances in their estimate.

- Project Study Report (PSR) or equivalent Estimate
  A PSR will generally be required for all projects involving Caltrans facilities.
  Note: Caltrans has a defined Project Study Report Cost Estimate format. This Guide is consistent with that format.

- Project Approval/Environmental Document (PA/ED) or equivalent Estimate
  The PA/ED Estimate is based upon engineering studies prepared in support of the environmental document and project approval document such as a Caltrans Project Report.
  Note: Caltrans has a defined Project Report Cost Estimate format. This Guide is consistent with that format.

- 35% Submittal Estimate
  This estimate is based upon documents prepared for the 35% design submittal and should include major elements of the project.

- 65% Submittal Estimate
  This estimate is based upon documents prepared for the 65% design submittal and should include greater detail for the major project elements, as well as most minor elements. Many specific project risks should be understood at this time and may be reflected in the selection of unit costs.

- 100% Submittal Estimate
  This estimate is based upon documents prepared for the 100% design submittal. Costs evaluated for this submittal address the final design of the project, completed specifications, and a detailed implementation schedule. The estimate should also consider any special terms or conditions in the contract. Almost all of the project risks should be developed at this time. Nonetheless, it may still be appropriate to include Risk-Based Allowances to address likely risks that are not otherwise reflected in the cost estimate.

- Final Engineer's Estimate
  This estimate is based on the advertised contract bid documents and any subsequent addenda, including any review comments, which may have been incorporated into the project since preparation of the 100% estimate. The Final Engineer's Estimate may be the same as the 100% Submittal Estimate if no changes have occurred nor addenda issued. Specific project risks not captured in the 100% Submittal Estimate should be realized at this time and may be reflected in the selection of unit costs. It may still be appropriate to include Risk-Based Allowances to address likely risks that are not otherwise reflected in the cost estimate.

3.3 Below the Line Costs

Items excluded from the total contract cost are termed "Below the Line Costs". These costs may be separate from the prime contract subtotal, but are still included in the total cost for the project. There are several types of "Below the Line Costs", defined as follows:

- Engineering and Management
  Included in this category are pre-design, design engineering, construction staking, and construction management services. Pre-design services include engineering and environmental studies necessary to obtain environmental clearance.

- Construction Contingency
  This is a reserve to cover construction and engineering change orders. Typically, 10% of the total project cost is a reasonable amount to allow for this item. Construction contingency applies only to the final engineer's estimate and should not be confused with the Design Development Contingency, which is carried through all the estimate phases. This percentage may be overridden or adjusted if it is deemed appropriate.

- Work by Others
  Certain items of work may be excluded from the work of the prime construction contract. For instance, relocation of a railroad track or a gas line may be accomplished by force account by the railroad or the local utility, or the owner may procure an item and provide it to the contractor for installation. Detailed information should be provided in the description regarding this type of work.

- Design Development Contingency
  Contingency is an allowance to cover the "unknown unknowns" inherent in design development and imprecision in estimating. The Contingency Guidelines in Table 1 show the contingency that is recommended to be used during each phase of project development as a percentage of estimated construction cost. The contingency decreases as more detailed engineering is performed. This table should be used to determine the appropriate contingency percentage, unless there is justification for deviation from these guidelines.

  Because the Alameda CTC required the use of informed Risk-Based Allowances that should capture some costs associated with "known unknowns", this Guide recommends using an initial design development contingency of 20%. Note that the recommendations below allow for selection of a lower or higher contingency at some of the early phases of project development. The rule of thumb should be to assume the higher value for contingency unless there is some specific justification for reducing it. A small project that is well-defined from the outset may be justified in using 15% contingency at the PR phase, for example.

Table 1 - Contingency Guidelines

Type	Estimate Description	Probable Contingency as to Percentage of Construction Cost
1	Initial *or* PSR	●
2	PSR *or* PR	●
3	PR *or* 35% Submittal	●
4	35% Submittal *or* 65% Submittal	●
5	100% Submittal *or* Engineer's Estimate	●
		20% 15% 10% 5%

- Risk-Based Allowances
  Design development contingencies are established to cover costs associated with truly unforeseeable unknown costs that may arise during project development. Risk-Based Allowances are intended to cover a different sort of unknown cost referred to as “known unknowns”. These are costs that are not yet fully understood or quantifiable, but of which there is some likelihood of occurring. To account for these, project sponsors are required to complete a preliminary field investigation and to give some focused consideration to a list of typical project risk areas that have often been the cause of inaccurate estimates on transportation projects. By completing the Preliminary Risk Assessment Questionnaire (Appendix A), a sponsor will develop a project specific Risk-Based Allowances that should result in a more accurate estimate than those developed only with standard rule-of-thumb contingencies. The next Section 3.4, Development of Capital Project Risks, further describes this approach.

3.4 Development of Capital Project Risks

The level of development for capital project cost estimates depends on whether the estimate is conceptual or detailed. Detailed capital project cost estimates will have more accurate costs and lower contingencies due to the fact that more is known about the project. For this reason, detailed cost estimates may be easier for the sponsor to assess for risk. Conceptual cost estimates will have less information to work with and will need some preliminary investigation and research in order to determine appropriate levels of risk.

- Risk-Based Allowance Approach
  Regardless of whether the cost estimate is detailed or conceptual, it is imperative that sponsors include Risk-Based Allowances to account for “known-unknown” risks. There are several risk-management documents available through a variety of transportation authorities (e.g. Caltrans, FHWA, WSDOT, see Section 6, Resources, for their respective websites) that help sponsors identify, quantify, analyze, and manage risks. Although the guidance provided in these documents produces a well defined and thorough risk assessment, it is in the best interest of the Alameda CTC to have sponsors apply a streamlined approach to assess risks in their cost estimates, as discussed below.

  The Risk-Based Allowance Approach starts with a mandatory field review by the sponsor to the proposed project site. The Alameda CTC requires this for any project to be considered for the CWTP or the TEP. It is at the proposed site that the sponsor identifies risks by answering questions in Appendix A, Preliminary Risk Assessment Questionnaire. Then, a level of probability (low, medium or high) is assigned to each identified risk. Finally, using the identified risks and probabilities, the sponsor can determine the appropriate allowances to apply to their cost estimate. The final outcome of the approach is a separate section within the cost estimate titled “Risk-Based Allowances”, which includes each of the identified risks as line items. The final cost estimate should include a summary page similar to that provided in Appendix B, Project Cost Estimate Summary Template, which shows the Risk-Based Allowances as a separate section.

The approach is outlined in the following steps:

Step 1: Conduct a project field review.

Step 2: Identify risks using the table in Appendix A.

Step 3: Assign low, medium or high probability to each identified risk.

Step 4: Apply the Risk-Based Allowances to the appropriate line items in the estimate.

Step 5: Add the Risks to the Risk-Based Allowances section in your estimate.

- Field Review Requirements and Guidelines:
  Participants in the field review should at least include the project manager, project engineer, and lead environmental planner. Other qualified professional staff may benefit the quality and thoroughness of the effort.

  Plan to spend at least a half day in the field. It may be necessary to obtain the right to enter certain properties, and it is of value to walk as much of the project site as possible. On the other hand, in the interest of trying not to incur undue concern or anxiety on the part of property owners, some discretion may be used in determining which properties will be visited for a specific field review. Take good notes and photographs, preferably with the point of view of each photograph referenced on a map. This can become an invaluable tool in project development. Observe all elements of the project site and conditions.

  Below are some specific suggestions to help you answer the questions in Appendix A, the Preliminary Risk Assessment Questionnaire, but do not limit your observations only to these items. It is impossible to know too much about a site, and it can be surprising how much detail can be gleaned simply through careful observation and documentation.

  1) UTILITIES: Pay close attention to any visible signs of underground utilities such as underground vaults, manholes, junction boxes, valve farms, switch boxes, pump stations, high risk markings, or hydrants. If feasible, you may wish to have the utilities within the project area identified and marked by USA.

  2) GEOTECHNICAL and/or SEISMIC: Observe any signs of earth movement or slides in the area such as heaving of concrete, consistent or unusual fracture patterns across multiple structures, offsets of walls or other structures, unusual moisture patterns, or other physical signs of potentially unstable soils or slopes. Take note of uneven settlement patterns or other problems with pavement within the site.

  3) ENVIRONMENTAL: Take note of any drainage areas (engineered or natural) or other potential wetlands within the site. Observe whether there is any open space in proximity to the project site. If so, it may well host protected plant or animal species. If there are mature trees within the project area – even if they will not be disturbed by the project – provisions to avoid them or maintain a required distance from them during construction may be necessary if they host certain birds or other wildlife. In order to gain a thorough understanding of potential environmental constraints, costs, and mitigations on a site, it is helpful to bring an experienced environmental planner on the field review.

4) SITE ACCESS AND TRAFFIC CONTROL: Take note of the traffic and access conditions in the area of the project. Consider how trucks and equipment will access the project site, both to deliver materials and to construct the project. Observe whether there are likely to be any areas for staging or material storage within or near the project site. If the project involves widening or reconstructing an existing facility, consider how the project might be staged and how existing access and traffic throughput will be maintained. If the project is in a multi-modal corridor, consider how modes other than automobiles (e.g. bike/pedestrian, transit, rail) will be served and impacted.

5) HAZARDOUS MATERIALS: It is most prudent to have a qualified individual perform a records search of the state hazardous materials database prior to preparing the project cost estimate. The Caltrans Hazardous Waste Management website, http://www.dot.ca.gov/hq/env/haz/index.htm, is a good resource that provides guidance and tools for assessing and managing properties that may contain hazardous waste. While a field review may provide additional information, it is not the best way to assess possible hazardous materials concerns that may affect a project's cost. Nonetheless, observe the presence of any gas stations, railroad tracks, material storage areas, automotive shops, or other industrial uses.

6) CONTROVERSY and/or ENVIRONMENTAL JUSTICE: As with Hazardous Materials, a field review is not the best way to assess risks related to controversy and/or environmental justice. However, if there are any indicators that the project is or could become controversial or will require environmental justice assessment, take the opportunity to familiarize yourself with any points of interest within the project site. Take note of the neighborhood or surroundings of the project site. Consider any information you may have regarding public activism in the area and any community involvement in the project to date. All projects tend to have a minimum level of public outreach associated with them, especially during the scoping and environmental clearance phase of development. It should be expected, however, that certain projects will have the need for extensive or intensive outreach that should be budgeted for early on.

7) OTHER ISSUES: Anything that makes a project particularly unique can potentially affect the project budget or schedule. When you are in the field, take note of any unique features or conditions. Think about how they might have an impact on the project's development process and whether there is anything that could translate into a consideration in the cost estimate or schedule. Are property owners under-water in the area? This could skew the costs of right-of-way if the agency who will be acquiring property has a policy about offering owners at least what they owe on a property.

4.0 PROGRAM COST ESTIMATES

4.1Program Cost Categories

Below is a list of the various elements that would comprise a program cost estimate at a particular milestone. Not all elements would necessarily be included in every program estimate.

- Administrative
  Includes document coordination, office management, and various support for sponsor and consultant staff. This element of cost may be limited to a maximum allowable amount by the Alameda CTC.

- Operations
  Includes costs for the actual operation of the program including the following categories.

    - Labor
    - Maintenance
    - Other Operating Costs (e.g. fuel)

- Materials
  This may include costs of various materials necessary for successful implementation of the program.

- Sponser and Consultant Staff
  Includes sponsor and consultant staff costs incurred while working on the program.

- Production
  Includes document reproduction costs (e.g. mass copying, binding, distribution).

- Evaluation
  Includes costs incurred by staff for evaluation of the program.

- Rental/Lease
  Includes costs related to the rental or lease or real estate (e.g. office space) for implementation of the program.

- Outreach
  Includes costs related to raising public awareness of the program, such as conducting polls, distributing informative documents, and holding public meetings.

4.2 Development of Program Costs

Sponsors of programs should be able to demonstrate that their cost estimates are well thought out and well documented. Sponsors requesting funds for new programs need to thoroughly validate the basis of their program cost estimate. In the case of existing programs, the sponsor should be able to provide historical data from similar programs as back-up for their cost estimate. In addition, the program cost estimate should be developed to a level where there is essentially no contingency involved (i.e. there is an “exact” amount known) to implement the program.

5.0 CONCLUSION

In a challenging economic climate, accurate cost estimates for publicly funded transportation project and programs are more important than ever. Realistic estimates are essential for good planning – and effective funding – of a robust multi-modal transportation network. The Alameda CTC also benefits during its calls for projects by having sponsors use similar methodology and assumptions in preparing cost estimates. This Guide is intended to provide a standard approach to cost estimating for transportation projects and programs seeking inclusion in the Alameda Countywide Transportation Plan and/or Transportation Expenditure Plan.

6.0 RESOURCES

The following resources have been updated as of February 2023 and are provided for the convenience of project and program sponsors and were current at the time of this writing. The Alameda CTC is not responsible for any changes to others' websites that might render the information below obsolete or incorrect.

- Caltrans Cost Estimating Resources
  Caltrans provides a number of resources for preparing cost estimates at various stages of project development. For an overview of cost estimating resources, access the Caltrans Cost Estimating webpage, which contains a "…collection of policy, tools, guidance, training, best practices and lessons learned… …to assist in the development of cost estimates that are complete and accurate, reflecting the true scope of work to be performed and reflecting current market trends." https://dot.ca.gov/programs/design/cost-estimating-improvements

- Caltrans Contract Cost Database
  The Caltrans Contract Cost Database is a summary of cost (by item) for highway construction projects. Prices shown in this summary are the mathematically weighted average of the low bidders' prices and are affected by geographical location (Caltrans District Number), time, and quantity, as well as item's significance.

  This Contract Cost Data is published annually by the Department of Transportation, Office of Office Engineer.

  Caltrans also makes the database available online. As of this printing, it can be found at: https://sv08data.dot.ca.gov/contractcost/

- Caltrans Project Risk Management Process
  The Caltrans Project Risk Management Process webpage contains numerous links to Risk Management resources, including the Caltrans ***Project Risk Management Handbook***.

- Federal Highway Administration (FHWA), Office of International Programs
  The FHWA provides a webpage for risk assessment and allocation related to highway construction management. A complete guide for assessing risk titled, ***"Guide to Risk Assessment and Allocation for Highway Construction Management"*** can also be found there. https://international.fhwa.dot.gov/pubs/pl06032/guide_to_risk_assessment_allocation_for_highway.pdf

- Washington State Department of Transportation (WSDOT)
  The WSDOT website has several resources for risk assessment including guidance materials and workshop information. https://wsdot.wa.gov/engineering-standards/project-management-training/project-management/cost-risk-assessment

APPENDIX A: PRELIMINARY RISK ASSESSMENT QUESTIONNAIRE

PRELIMINARY RISK ASSESSMENT QUESTIONNAIRE

Sponsors are required to conduct a field review of the project site and to complete the Preliminary Risk Assessment Questionnaire included in this appendix.

To use the table, first answer the questions in each risk category and mark “Yes” or “No” in the adjacent column. Keep in mind the Field Review Requirements and Guidelines to help assess your project site in addition to anything else that may not be included in the table. Then, for each risk category marked with one or more “Yes”, consider its probability of occurrence and carry down the appropriate allowance into the “Assessed Risk Allowance” row below the risk category. If something is considered over 80% likely to occur, it should be assumed that it will definitely occur and be accounted for in the project estimate with a specific line item, rather than with a percentage from the Preliminary Risk Assessment. Next, apply the risk allowance to the appropriate section(s) of the cost estimate according to the guidance in the table. Finally, add the risk allowances to the total cost of the estimate as well as the cost estimate summary page.

Field Review Requirements and Guidelines:

Participants in the field review should at least include the project manager, project engineer, and lead environmental planner. Other qualified professional staff may benefit the quality and thoroughness of the effort.

Plan to spend at least a half day in the field. It may be necessary to obtain the right to enter certain properties, and it is of value to walk as much of the project site as possible. On the other hand, in the interest of trying not to incur undue concern or anxiety on the part of property owners, some discretion may be used in determining which properties will be visited for a specific field review.

Take good notes and photographs, preferably with the point of view of each photograph referenced on a map. This can become an invaluable tool in project development. Observe all elements of the project site and conditions.

Below are some specific suggestions to help you answer the questions in the Preliminary Risk Assessment Questionnaire, but do not limit your observations only to these items. It is impossible to know too much about a site, and it can be surprising how much detail can be gleaned simply through careful observation and documentation.

1) UTILITIES: Pay close attention to any visible signs of underground utilities such as underground vaults, manholes, junction boxes, valve farms, switch boxes, pump stations, high risk markings, or hydrants. If feasible, you may wish to have the utilities within the project area identified and marked by USA.

2) GEOTECHNICAL and/or SEISMIC: Observe any signs of earth movement or slides in the area such as heaving of concrete, consistent or unusual fracture patterns across multiple structures, offsets of walls or other structures, unusual moisture patterns, or other physical signs of potentially unstable soils or slopes. Take note of uneven settlement patterns or other problems with pavement within the site.

3) ENVIRONMENTAL: Take note of any drainage areas (engineered or natural) or other potential wetlands within the site. Observe whether there is any open space in proximity to the project site. If

so, it may well host protected plant or animal species. If there are mature trees within the project area – even if they will not be disturbed by the project – provisions to avoid them or maintain a required distance from them during construction may be necessary if they host certain birds or other wildlife. In order to gain a thorough understanding of potential environmental constraints, costs, and mitigations on a site, it is helpful to bring an experienced environmental planner on the field review.

4) SITE ACCESS AND TRAFFIC CONTROL: Take note of the traffic and access conditions in the area of the project. Consider how trucks and equipment will access the project site, both to deliver materials and to construct the project. Observe whether there are likely to be any areas for staging or material storage within or near the project site. If the project involves widening or reconstructing an existing facility, consider how the project might be staged and how existing access and traffic throughput will be maintained. If the project is in a multi-modal corridor, consider how modes other than automobiles (e.g. bike/pedestrian, transit, rail) will be served and impacted.

5) HAZARDOUS MATERIALS: It is most prudent to have a qualified individual perform a records search of the state hazardous materials database prior to preparing the project cost estimate. The Caltrans Hazardous Waste Management website, http://www.dot.ca.gov/hq/env/haz/index.htm, is a good resource that provides guidance and tools for assessing and managing properties that may contain hazardous waste. While a field review may provide additional information, it is not the best way to assess possible hazardous materials concerns that may affect a project's cost. Nonetheless, observe the presence of any gas stations, railroad tracks, material storage areas, automotive shops, or other industrial uses.

6) CONTROVERSY and/or ENVIRONMENTAL JUSTICE: As with Hazardous Materials, a field review is not the best way to assess risks related to controversy and/or environmental justice. However, if there are any indicators that the project is or could become controversial or will require environmental justice assessment, take the opportunity to familiarize yourself with any points of interest within the project site. Take note of the neighborhood or surroundings of the project site. Consider any information you may have regarding public activism in the area and any community involvement in the project to date. All projects tend to have a minimum level of public outreach associated with them, especially during the scoping and environmental clearance phase of development. It should be expected, however, that certain projects will have the need for extensive or intensive outreach that should be budgeted for early on.

7) OTHER ISSUES: Anything that makes a project particularly unique can potentially affect the project budget or schedule. When you are in the field, take note of any unique features or conditions. Think about how they might have an impact on the project's development process and whether there is anything that could translate into a consideration in the cost estimate or schedule. Are property owners under-water in the area? This could skew the costs of right-of-way if the agency who will be acquiring property has a policy about offering owners at least what they owe on a property.

Preliminary Risk Assessment Questionnaire

Project Sponsor: _____

Name of Project: _____

Project Location (be as specific as possible):

_____

_____

_____

Date of Field Review: _____

Estimate Type (circle one): Initial 35% Submittal

PSR 65% Submittal

PID 100% Submittal

PA/ED Final Engineer's Estimate

Note: References to applicable cost estimate sections (i.e. Roadway Sections, Section II Structures, and Section III Right-of-Way) are analogous to the groupings in the Caltrans Standard Cost Estimate format.

* If something is considered over 80% likely to occur, it should be assumed that it will definitely occur and be accounted for in the project estimate with a specific line item, rather than with a percentage from the Preliminary Risk Assessment.

No.	Risk	Yes or No	Probability of Occurrence & Allowance [%]*		
			Low (1-12%)	Med (13-32%)	High (33-80%)
1	UTILITIES: 1) Are you aware of ALL utilities that are present within the project footprint? 2) Do you have current utility maps from each utility company that may have facilities in the area? 3) Have utilities been located within the project site by USA? 4) Are there any high-risk utilities (e.g. gas lines, oil lines, high voltage transmission lines) within the project footprint? 5) Are there fiber optic lines within the footprint, and if so, is there any chance the project will conflict with them? 6) If the project is within Caltrans' right-of-way, are there longitudinal utilities that you may be required to relocate as part of the project?	Y/N Y/N Y/N Y/N Y/N Y/N	X%	X%	X%
	Assessed Risk Allowance based on understanding of risks associated with Utilities: (Apply to Section III Right-of-Way)				

No.	Risk	Yes or No	Probability of Occurrence & Allowance [%]*		
			Low (1-12%)	Med (13-32%)	High (33-80%)
2	GEOTECHNICAL and/or SEISMIC: 1) Are there known faults within, or in close proximity to, the project site? 2) Is there a documented history of earth movement in the area? 3) Are there any visible fractures or offsets of existing facilities near or within the project site? 4) Are there current signs of unstable soils or slopes within or close to the project site? 5) If there is existing pavement within the project footprint, does it show signs of uneven settlement or other problems that could be attributable to underground conditions? 6) Is there a high water table within the project vicinity? 7) Are there signs of drainage issues or flooding?	Y/N Y/N Y/N Y/N Y/N Y/N Y/N	X%	X%	X%
	Assessed Risk Allowance based on understanding of risks associated with Geotechnical and/or Seismic issues: (Apply to Roadway Sections 1-4 and Section II Structures)				
3	ENVIRONMENTAL: 1) Is the site likely to affect any known sensitive resources? 2) Is the site within or near any special jurisdictions that will require more coordination than average or issuance of a special permit? 3) Is the site within proximity to open space? 4) Are there mature trees or other mature landscape elements within the footprint or in close proximity to it? 5) Are there known species of concern (plant or animal) in the general area of the project site? 6) Are there sensitive noise receptors in the vicinity that could trigger the need for sound walls? 7) Is there a possibility that there could be a archaeological site within the project footprint? 8) Is there a possibility that there could be a paleontological site within the project footprint?	Y/N Y/N Y/N Y/N Y/N Y/N Y/N Y/N	X%	X%	X%
	Assessed Risk Allowance based on understanding of risks associated with Environmental issues: (Apply to Roadway Section 4 and Section III Right-of-Way)				

No.	Risk	Yes or No	Probability of Occurrence & Allowance [%]*		
			Low (1-12%)	Med (13-32%)	High (33-80%)
4	SITE ACCESS and TRAFFIC CONTROL: 1) Is access to the site free and unconstrained, or is it accessible only from freeway ramps or other controlled facilities? 2) Will it be possible to construct a project at this location while maintaining the existing traffic, including existing lane configurations? 3) Will there be potential impacts to other modes of transportation such as bike/pedestrian, bus, light rail, or rail? 4) Is the project within a particularly congested or constrained corridor that will result in limited work hours/days? 5) Is the project in a corridor that provides the primary access to/from a destination or facility? 6) Will workers be able to construct the project at a safe distance away from traffic, or will there need to be special considerations for worker safety? 7) Will the project require night and/or weekend work (could be due to location, congestion, or other)?	Y/N Y/N Y/N Y/N Y/N Y/N Y/N	X%	X%	X%
	Assessed Risk Allowance based on understanding of risks associated with Site Access and Traffic Control: (Apply to Roadway Sections 1, 5 and 7)				
5	HAZARDOUS MATERIALS: 1) Was a search of the database performed for the project site? 2) Are there records of any hazardous materials present within the project footprint? 3) Are there any gas stations, automotive repair, or other industrial uses that might be associated with hazardous materials within or in close proximity to the project? 4) Is the site on or near an active or past railroad right of way? 5) Are there buildings or other structures on the site that will be disturbed and might contain asbestos or other hazardous materials? 6) Will the project disturb ground that is likely to contain aerially deposited lead?	Y/N Y/N Y/N Y/N Y/N Y/N	X%	X%	X%
	Assessed Risk Allowance based on understanding of risks associated with Hazardous Material: (Apply to Roadway Section 4 and Section III Right-of-Way)				

No.	Risk	Yes or No	Probability of Occurrence & Allowance [%]*		
			Low (1-12%)	Med (13-32%)	High (33-80%)
6	CONTROVERSY and/or ENVIRONMENTAL JUSTICE: 1) Is the project already or likely to become controversial? 2) Is there organized opposition to the project? 3) Has the project been the subject (directly or indirectly) of any lawsuits? 4) Has the project been featured in any press coverage? 5) Will the project be constructed in a neighborhood that will require Environmental Justice evaluation and assessment? 6) Will demolition of an existing structure or facility be required in order to construct the project?	Y/N Y/N Y/N Y/N Y/N Y/N	X%	X%	X%
	Assessed Risk Allowance based on understanding of risks associated with Controversy and/or Environmental Justice: (Apply to the Engineering Studies, Environmental Studies, and Design Engineering costs)				
7	OTHER ISSUES: Are there any unique features of the project or its location that might have an affect the cost or the schedule of the project? If so, describe below, and indicate the likelihood that the issue will affect the project. Use your judgment to determine which elements of the project cost estimate will be affected, and make a reasonable determination about the percent increase on those elements could be incurred if it were to occur. (If applicable, describe other issues in the space below.)	Y/N	X%	X%	X%
	Assessed Risk Allowance based on understanding of risks associated with other issues not listed above: (Determine as appropriate and apply to relevant Section/s)				

Participants in Field Review:	Title or Project Role:
1)	1)
2)	2)
3)	3)
4)	4)

APPENDIX B: PROJECT COST ESTIMATE SUMMARY TEMPLATE

Project Cost Estimate Summary

Project Sponsor: _____

Project Name: _____

Project location and brief description:

_____

_____

_____

Estimate Type (circle one):

Initial	35% Submittal
PSR	65% Submittal
Other PID	100% Submittal
PA/ED	Final Engineer's Estimate

SUMMARY OF PROJECT OUTLAY COSTS

I. ROADWAY
II. STRUCTURES ..... ETCC $ _____

III. RIGHT OF WAY ..... $ _____
IV. CONCEPTUAL ENGINEERING STUDIES ..... $ _____
V. ENVIRONMENTAL STUDIES ..... $ _____
VI. DESIGN ENGINEERING ..... $ _____
VII. DESIGN SERVICES DURING CONSTRUCTION ..... $ _____
VIII. CONSTRUCTION STAKING ..... $ _____
IX. CONSTRUCTION MANAGEMENT ..... $ _____
X. RISK BASED ALLOWANCES ..... $ _____

TOTAL PROJECT COSTS $_____
(Sum of ETCC, p.B8, and Sections III thru X)

I. ROADWAY

1. Total Earthwork $_____
2. Total Pavement Structural Section $_____
3. Total Drainage $_____
4. Total Specialty Items $_____
5. Total Traffic Items $_____
6. Total Planting and Irrigation $_____
7. Total Roadside Management $_____

TOTAL Sections 1-7 $_____

8. Minor Items

$_____ (Total sections 1-7) x (5 to 10%) = $_____

9. Roadway Mobilization

$_____ (Total sections 1-8) x 10% = $_____

10. Roadway Additions:

Supplemental Work

$_____ (Total sections 1-8) x (5 to 10%) = $_____

Roadway Contingency

$_____ (Total sections 1-8) x (see Table 1 for %) = $_____

TOTAL Roadway Additions $

TOTAL SECTION I. ROADWAY $
(Sum of sections 1-10)

II. STRUCTURES

Bridge Type_____

_____ x $_____ = $_____
(total area, SF) (unit price/SF)

Bridge Type_____

_____ x $_____ = $_____
(total area, SF) (unit price/SF)

Bridge Type_____

_____ x $_____ = $_____
(total area, SF) (unit price/SF)

TOTAL SECTION II. STRUCTURES $_____

TOTAL CONSTRUCTION COST (TCC) $_____
(Sum of Sections I and II)

III. RIGHT OF WAY

TOTAL SECTION III. RIGHT OF WAY $_____

ENGINEERING AND MANAGEMENT COSTS

NOTE: Depending on the project's level of development, Sections IV through VI may not be applicable.

IV. CONCEPTUAL ENGINEERING STUDIES

TOTAL SECTION IV. CONCEPTUAL ENGINEERING STUDIES $_____ x 3% = $_____
(TCC, from p.B5)

V. ENVIRONMENTAL STUDIES

TOTAL SECTION V. ENVIRONMENTAL STUDIES $_____ x 3% = $_____
(TCC, from p.B5)

VI. DESIGN ENGINEERING

Percent allowance depends on level of Caltrans involvement.
See Appendix D, p.D11 for guidance.

TOTAL SECTION VI. DESIGN ENGINEERING $_____ x (____%) = $_____
(TCC, from p.B5)

VII. DESIGN SERVICES DURING CONSTRUCTION (DSDC)

TOTAL SECTION VII. DSDC $_____ x 1.5% = $_____
(TCC, from p.B5)

VIII. CONSTRUCTION STAKING

TOTAL SECTION VIII. CONSTRUCTION STAKING $_____ x 2.5% = $_____
(TCC, from p.B5)

IX. CONSTRUCTION MANAGEMENT

TOTAL SECTION IX. CONSTRUCTION MANAGEMENT $_____ x 13% = $_____
(TCC, from p.B5)

X. RISK BASED ALLOWANCES

Copy the identified risk allowances from Appendix A into the table below.

Risk Category	% Allowance from Appendix A
1. Utilities	
2. Geotech/Seismic	
3. Environmental	
4. Site Access & Traffic Control	
5. Hazardous Materials	
6. Controversy and/or EJ	
7. Other Issues	

1. Utilities

$_____ (III) x _____% (% from App. A) = $_____

2. Geotechnical and/or Seismic

$_____ (I.1+ I.2+I.3+I.4+II) x _____% (% from App. A) = $_____

3. Environmental

$_____ (I.4) x _____% (% from App. A) = $_____

4. Site Access and Traffic Control

$_____ (I.1+ I.5) x _____% (% from App. A) = $_____

5. Hazardous Materials

$_____ (I.4+III) x _____% (% from App. A) = $_____

6. Controversy and/or Environmental Justice

$_____ (IV+V+VI) x _____% (% from App. A) = $_____

7. Other Issues

$_____ (applicable sections) x _____% (% from App. A) = $_____

TOTAL SECTION X. RISK-BASED ALLOWANCES $_____
(Sum of 1 thru 7 above)

ESCALATION

1. Anticipated year to begin construction _____
2. Estimated construction duration (in years) _____
3. Number of years to midpoint of construction (N_{Δ}) _____
4. Annual Escalation Rate (AER) _____

Escalate TCC (from pg. 44) to midpoint of construction.

Total Escalation = $(1+AER)^{N_{\Delta}}$

ESCALATED TOTAL CONSTRUCTION COST (ETCC) = TCC x Total Escalation $_____

Example: *Determine $N_{midpt.}$, number of years to midpoint of construction.*

First: Determine the year that construction would be at a midpoint. Divide the estimated construction duration in half and add to the anticipated year that construction will begin.

1. Anticipated year to begin construction 2020
2. Estimated construction duration (in years) 4

$$N_{mid} = \text{Midpoint year} = \frac{4 years}{2} + 2020 = 2022$$

Second: The number of years to midpoint of construction equals the difference between the midpoint year of construction and the current year.

$$N_{\Delta} = N_{mid} - N_{current}$$

APPENDIX C: PROGRAM COST ESTIMATE SUMMARY TEMPLATE

Program Cost Estimate Summary

Program Sponsor: _____

Program Name: _____

Brief program description:

_____

_____

_____

I. ADMINISTRATIVE ..... $ _____

II. OPERATIONS..... $ _____

III. MATERIALS..... $ _____

IV. SPONSOR & CONSULTANT STAFF..... $ _____

V. PRODUCTION..... $ _____

VI. EVALUATION..... $ _____

VII. RENTAL/LEASE..... $ _____

VIII. OUTREACH..... $ _____

IX. OTHER..... $ _____

TOTAL PROGRAM COSTS $_____
(Sum of Sections I thru IX)

APPENDIX D: COST ESTIMATING REFERENCE

COST ESTIMATING REFERENCE
BASIS OF QUANTITY AND UNIT COST MEASURE

This estimating reference includes some standard items used in capital project cost estimates, but is not meant to be exhaustive. The units of measure provided are most effective for conceptual level estimates. Sponsors are encouraged to use a more appropriate unit of measure, if available. This reference is used with permission from the Contra Costa Transportation Authority.

ADVANCE WORK

- Temporary Work (Primarily for maintaining traffic)
  Temporary work, detours, etc., includes all labor materials and incidental costs for the installation and removal of all items necessary to maintain reasonable flow of traffic and safety during construction of the proposed work. The scope includes, but is not limited to, such items as temporary pavement, signs, signals, barriers, striping, traffic control, traffic management plan, etc.

  Unit of Measure: LS (lump sum).
  Guideline Unit Cost: 10% of Total Construction Bid Items

  For freeways, interchanges, or major arterial projects that will require significant detours or construction staging, additional costs may need to be included in the estimate.

- Maintenance of Utilities
  Maintenance of utilities includes all labor, materials and incidental costs for temporary relocations, supports, protection, and restoration of electrical or mechanical utilities located in the work areas as required to maintain service with minimal or no interruption. This does not include utility relocation, which is discussed under land and right-of-way costs.

  Unit of Measure: LS (lump sum).
  Guideline Unit Cost: 3% of Total Construction Bid Items

  Particular attention should be given to these items. Costs could be significantly larger than the percents shown, especially if project requires significant rehabilitation and involves traffic management, detours and construction staging.

- Mobilization
  Mobilization provides reimbursement of cost to the contractor prior to “move in”.

  Unit of Measure: LS (lump sum).
  Guideline Unit Cost: 10% of Total Construction Bid Items

- Clearing and Grubbing
  Clearing and grubbing includes all labor, materials and incidental costs for clearing from the entire area of the construction right-of-way all vegetation, shrubs, trees including the removal of stumps and disposal of the cleared items.

  Unit of Measure: 2.5% of Total Construction Bid Items

- Demolition
  Demolition includes all labor, materials and incidental costs for the removal of all items within the right-of-way that interfere with the construction of the proposed work. Exceptions are those items which are to remain functional during construction and which will be an integral part of the finished project. Demolition includes the cost of hauling and disposing of all demolished items. Removal and disposal of hazardous materials should be included under miscellaneous costs.

  Demolition of Typical Items (Excluding Bridges, Major Structures, & Buildings):

  Unit of Measure: LS (lump sum).
  Guideline Unit Cost: 2% of Total Construction Bid Items

  Demolition of Bridges, Major Structures, & Buildings:

  Unit of Measure: LS (lump sum).

  Removal of buildings and miscellaneous structures can involve significant costs and should be estimated separately.

EARTHWORK

Earthwork includes all labor, materials and incidental costs for all earthwork operations including haulage, testing and disposing of excess excavation, backfill compaction, and grading. Excavation for drainage ditches will be included under "Drainage".

Earthwork (Roadway Excavation) costs can vary significantly between larger and smaller projects. Often for smaller projects, the significant portion of the roadway excavation is associated with grading for the roadway pavement section. This is more labor intensive and therefore more costly than for larger projects with a larger volume of mass earthwork. It is important to use a unit price that is consistent with the size of the project.

- Roadway excavation
  Roadway excavation includes but is not limited to, excavation, embankments using excavated materials, compaction for embankments, haulage, and disposal of over-excavation.

  Unit of Measure: CY (cubic yard) of excavated material

  The unit price per cubic yard is typically based on a cut and fill operation in soft soil. If conditions suggest that rock excavation will be required, an appropriate allowance should be included.

- Imported Borrow
  Imported borrow includes, but is not limited to, imported material, its placement and compaction, including haulage.

  Unit of Measure: CY (cubic yard) of imported borrow in place

(continued on next page)

Typically, the unit price per cubic yard is based on the availability of suitable borrow material within 10 miles. Similar to Roadway Excavation, unit prices for Imported Borrow can vary significantly between smaller and larger volume projects and should be selected to be consistent with the specific project.

- Erosion Control
  Erosion Control includes all slope and unpaved areas that will not be landscaped. It consists of, but is not limited to, placing soil retention netting, hydro-seeding and mulching or, where required. Other methods of erosion control, such as rip-rap, concrete or asphaltic cover need to be estimated separately.

  Unit of Measure: AC (acres) of applicable area

DRAINAGE

Drainage includes all labor, material and incidental costs for providing adequate drainage of the roadway, and all connections to existing storm sewers, modifications to existing catch basins and manholes as required.

- Drainage Ditches
  Drainage ditches include excavation and lining, or seeding as required.

  Unit of Measure: LF (linear feet) of ditch

  Drainage ditches vary in size, and therefore, cost per linear foot. A large ditch might be concrete lined with an average cross section of 3 feet bottom width, 9 feet top width, and 3 feet depth; while a small ditch might be a concrete lined V-ditch with a 1:1 slope and a top width of 4 feet. It is important that the unit price selected is appropriate for the size of ditch that will be required. Roadside ditches would typically only be appropriate in rural or semi-rural settings, as urban projects would normally have curb & gutter.

- Reinforced Concrete Pipe (RCP)
  Reinforced concrete pipe includes manufacturing, hauling, excavation, and placing the RCP, endwalls, all connections and modifications to existing storm drain systems, as required.

  Unit of Measure: LF (linear feet) of RCP

- Drainage Structures (Manholes, Catch Basins)
  Drainage Structures include excavation, furnishing and installing manholes and catch basins (inlets) with covers and grates.

  Unit of measure: EA (each)

  Unit prices vary for Manholes and Catch Basins (Inlets), and for smaller and larger projects.

Box Culverts (RCB)

Box culverts include excavation, furnishing and placing the culvert, and end structures. Because box culverts vary greatly in size, it is important to use a unit cost that is appropriate for the specific project.

Unit of Measure: SF (square feet) of box culvert

PAVEMENT

Pavement includes all labor, materials and incidental costs for compaction, fine grading, and placing sub-base, base, wearing and finish course. Striping and pavement markings, including all delineator buttons and reflectors, will be estimated separately.

Typically city street and arterial projects (non-freeway/expressway) will include curbs & gutters, sidewalks, and sometimes raised medians. Estimate line items are included for these items.

Roadway Pavement Sections and corresponding costs vary significantly between Freeway/Expressways and local streets and arterials. Costs also vary between smaller and larger projects. It is important to select unit costs that consider these variations.

- Asphalt Concrete Pavement (AC)

  Asphalt Concrete pavement should include the area of main road, shoulders, and ramps. Typical road sections might be as follows:

  Local Streets and Arterials:

Asphalt Concrete (Type A)	0.5 ft
Class 3 Aggregate Base	0.75 ft
Class 4 Aggregate Sub-base	1.0 ft

  Freeway:

Asphalt Concrete (Type A)	0.67 ft
Class 3 Aggregate Base	0.83 ft
Class 4 Aggregate Sub-base	1.33 ft

  Unit of Measure: SF (square feet) of asphalt concrete pavement

  The Asphalt Concrete pavement unit price should also include the necessary surface coating(s) such as prime coat and tack coat.

- Portland Cement Concrete Pavement

  Portland Cement Concrete pavement should include the total area of Portland Cement Concrete pavement based on a typical structural section. The structural section below is typical for a Long Life (40-year Design Life) pavement, as the majority of freeways will require it. Normal (20-year Design Life) pavement would be approximately 20% less in unit cost.

Portland Cement Concrete	1.00 ft
Lean Concrete Base (LCB)	0.50 ft
Class 4 Aggregate Sub-base	0.75 ft

  Unit of Measure: SF (square feet) of PCC pavement

- Pavement Striping & Markings
  Pavement striping includes striping with reflective paint, all delineator buttons and reflectors required.

  For Conceptual Pavement Striping & Markings Costs:

  Unit of Measure: 2% of Total of Roadway Pavement (including shoulder)

  For a more detailed Pavement Striping Cost:

  Unit of Measure: LF (linear foot) of Striping

  For a more detailed Pavement Markings Cost:

  Pavement markings will include all markings such as direction arrows, lettering, etc. with reflective paint and all delineator buttons and reflectors required.

  Unit of Measure: SF (square feet) of marked area

- Sidewalk and Curb & Gutter
  Sidewalk, Curb, and Curb & Gutter are assumed to be constructed of PCC.

  Curb or Curb & Gutter:

  Unit of Measure: LF (linear foot) of Curb or Curb & Gutter

  Sidewalk:

  Unit of Measure: SF (square feet) of Sidewalk

STRUCTURES
Structures include all labor, materials and incidental cost for structural earthwork, foundations, and superstructures.

- Bridges
  Bridges include structural excavation and backfill, piles, abutments, foundations, piers, girders and beams, the bridge deck, and cast in place curbs.

  Unit of Measure: SF (square feet) of Bridge Deck

  It is useful to consider bridges as either being “relatively straight forward and uncomplicated” or “more complex”, with the unit price reflecting this assessment. Unique or extremely complex bridges should e examined more closely and unit prices adjusted accordingly.

Retaining Walls

Retaining walls include structural earthwork, piling, footing and stem wall.

Unit of Measure: LF (linear foot) of Retaining Wall

Costs for retaining walls will vary greatly, depending on height. If the project will have multiple or very long walls, you should use different unit costs for sections with significantly different heights. The guide suggests unit prices for Retaining Walls in increments of 5 feet and 10 feet, up to a wall height of 30 feet.

- Sound Walls

  Sound Walls include structural earthwork, piling, concrete base, and reinforced masonry wall, pre-cast or cast in place concrete wall.

  Unit of Measure: LF (linear foot) of Sound Wall

  A unit price should be selected that reflects the height of wall that is likely to be used. For conceptual purposes, a typical sound wall could be assumed to be a 16 feet high, 8 inch thick concrete masonry wall, on a 1 foot-8 inch high concrete base, with 16" drilled piers, at 16 feet center to center.

MISCELLANEOUS ITEMS

Miscellaneous items include all labor, materials, and incidental costs for supply and installation.

- Fencing

  Fencing includes all posts, rails, chain link fabric, and hardware as required.

  Unit of Measure: LF (linear foot) of fence

  Unit prices will vary, depending on fence height, whether there is barbed wire on the top, and the size of the project.

- Railings and Barriers

  Railings and barriers include metal beam guardrails and cast in place or pre-cast concrete barriers. All posts, brackets and hardware are included.

  Unit of Measure: LF (linear foot) of Railing or Barrier

- Traffic Signals

  Traffic signals include, but are not limited to, signals, supports, controllers, and power supply.

  Unit of Measure: INT (intersections)

  Costs for Traffic Signals will differ depending on whether for a Partially Modified Existing System, a New, or a Totally Reconstructed Traffic Signal System, and the size of the intersection.

- Roadway Lighting
  Roadway lighting includes fixtures, posts, cabling and power supply, panels and controls

  Unit of Measure: EA (each) individual street lights/electroliers.

  The specific street light/electrolier spacing requirements for the individual jurisdiction that will operate the roadway should be utilized to estimate the approximate total number of lights/electroliers required.

- Signing
  Signing includes all directional and traffic control signs such as Speed Limit, Do Not Enter, Merge, Yield, etc.

  Unit of Measure: for off ramps: RMP (ramps)
  for on ramps: RMP (ramps)
  for additional highway signs: mi (miles) of roadway
  for truss signs: EA (each)
  for roadside signs: EA (each)

  Signing for on-ramps should be based on 8 signs on wood posts associated with the ramps and freeway merge.

  Signing for off-ramps should be based on 2 truss signs and 10 signs on wood posts associated with the ramps and located both on and off the freeway.

  A good rule of thumb for additional highway signs is to assume 1 additional truss sign and 10 additional signs on wood posts per 5 miles of roadway.

  A typical truss sign is a 48 feet cantilever sign with foundations and lighting.

  Typical roadside signs either have a single wood post or two wood posts.

- Landscaping
  Landscaping includes all seeding, planting of shrubs and trees, fertilizing and mulching, except for hydro-seeding as included under erosion control and irrigation. No provision is made for hardscaping in this unit price.

  Unit of Measure: SF (square feet) of landscaped area

  A typical assumption for freeway / expressway locations is based on 1 shrub or tree per 100 SF, wood chip mulch over the entire area and irrigation. Maintenance period is one year.

  For city street and arterials, roadside or median locations, the average level of treatment is significantly denser than typical freeway landscaping. It may also include some hardscape treatments within the total landscaped area.

- Construction Storm Water BMP's
  Increased legislation concerning handling construction storm water has resulted in the addition of significant construction costs to projects. The guideline costs for this storm water handling provides for the use of construction related Best Management Practices (BMP's) and development of project specific Storm Water Pollution Prevention Plans (SWPPP).

  Unit of Measure: LS (lump sum).
  Guideline Cost: 3.0% of Paved Surfaces including bike paths, ramps, etc.

- Ramp Metering System
  Typically all on-ramps to freeways will require the installation of a Ramp Metering System.

  Unit of Measure: EA (each) lane of an on-ramp lane installation.

WORK BY OTHERS

Work by others shall include all labor, materials and incidental items furnished by companies or agencies other than the construction contractor. Typical items included here are utility construction or relocations provided by a Utility company, force account work by a railroad company, and materials furnished by others (i.e. owner). For State Highways, Caltrans furnishes various items such as signal controllers, Resident Engineer's Office, COZEEP (additional CHP patrols and enforcement in construction zones), monument disks, padlocks, route shields for funding signs, and sign panels.

Unit of Measure: LS (lump sum).

ENGINEERING AND MANAGEMENT

The costs for engineering and management have been broken down into the following categories:

- Engineering Studies
  Engineering studies includes all costs associated with conceptual engineering activities. This may include alternative configuration studies, site investigations, information gathering, and other engineering studies and reports as needed, except as included with Environmental Studies.

  The guideline cost is 3% of estimated Total Construction Cost.

  The stated 3% general allowance should be reviewed for appropriateness for each individual project, as project complexity and size can have dramatic effect on this cost.

- Environmental Studies
  Environmental studies shall include all costs of studies and reports as required to obtain an environmental permit. All consulting fees, regulatory requirements and cost shall be included.

  The guideline cost is 3% of estimated Total Construction Cost.

  The stated 3% general allowance should be reviewed for appropriateness for each individual project, especially for smaller projects. Certain types of environmental studies have a minimum cost, regardless

of the construction value of the project, so their potential cost impact can easily be under estimated for smaller projects.

- Design Engineering
  Design Engineering shall include all engineering costs from preliminary engineering to final construction drawings, including right-of-way engineering. All consulting fees, fieldwork necessary for design, and coordination costs with regulatory agencies and authorities shall be included. The extent of approval requirements associated with Caltrans makes it appropriate to have a varying allowance for Design Engineering depending on the degree of Caltrans involvement.

Caltrans Involvement	Design Engineering Allowance
Category 1: Having No Direct Involvement	12% of Total Construction Cost
Category 2: Requiring a Encroachment Permit	13% of Total Construction Cost
Category 3: Having Direct Involvement and Approval	14% of Total Construction Cost

- Design Services During Construction
  Construction Engineering includes all design services during construction (i.e. review of shop drawings and contractor submittals, responding to Requests for Clarifications, and the preparation of construction Record Drawings).

  The guideline cost is 1.5% of estimated Total Construction Cost.

- Construction Staking
  Construction Staking includes all staking costs for the location of the proposed structure.

  The guideline cost is 2.5% of estimated Total Construction Cost.

- Construction Management
  Construction Management includes all supervision, inspection, administrative support and materials testing necessary to ensure the work is being constructed to the appropriate standards.

  The guideline cost is 13% of estimated Total Construction Cost.

LAND AND RIGHT-OF-WAY

Land and right-of-way shall include all costs associated with purchase of land, easements and right-of-way such as purchase price, cost of relocating current businesses or residences, right-of-way engineering, and acquisition services. All units of measure are lump sum. Backup documentation is required for all costs identified in this category.

Unit of Measure: LS (lump sum).*

- Land Costs
  Land costs are to include the purchase price of land, easements and right-of-way. These costs are particularly sensitive and fluctuate with time and the economy. For these reasons, land costs should be prepared by an experienced right-of-way estimator.

- Relocation Costs
  Relocation costs shall include all costs associated with the relocation of a current tenant and may include locating a suitable replacement property, interest payments during a construction of the replacement property as well as all costs associated with relocating all movable property to the replacement property.

- Acquisition Services
  Acquisition services include the costs of all services necessary to bring the purchase of land, easements and Right-of-Way to a satisfactory conclusion. This includes legal services, title searches, appraisal preparation, negotiations with current owners, financial and real estate consultants, etc.

- Right-of-Way Engineering
  Right-of-way engineering includes developing plans for land requirements, reapportionment of assessment districts, surveying, documenting the land and easement limits. For Caltrans facilities, services include preparation of right-of-way appraisal maps and record of surveys.

- Utility Relocation Costs
  Include all utility relocation costs, excluding any costs for maintenance of utilities, which are included under advance work.