Appendix A.7
Capital Cost Methodology

Overview of Capital Cost Methodology

Definitions

Rough-Order-of-Magnitude Cost Estimate: an estimate prepared during the pre-design stage when the project is between 0 and 5 percent design development.

Construction Costs: Costs to construct the project, including the labor, equipment, and material costs; subcontractors' overhead and profit; and the general contractor's overhead and profit.

Project Costs: Complete project cost, including the construction costs, right-of-way acquisitioning, design, construction and project management fees, and professional services.

Escalation: An adjustment factor that is meant to account for annual labor and commodity increases in construction materials, labor, and professional services.

Allocated Contingency: Also known as design contingency, this is an allowance carried in the estimate detail that accounts for expected design development and unknowns at the time of the estimate.

Unallocated Contingency: Also known as construction contingency, this is an allowance carried at the executive summary level to account for unexpected changes that may occur during construction, including unknown or undocumented site conditions.

Urban Rail: Passenger transportation on rail in urban areas, including light rail transit and heavy rail transit (BART and LA Metro.) Only specific urban rail projects that are considered to be significant regional connectors are included in the State Rail Plan.

Intercity Rail (Also referred to as Regional Rail and Commuter Rail): Passenger transportation on rail that connects two or more cities, typically longer distances than Urban Rail (Amtrak, Metrolink, Caltrain.)

High-Speed Rail: Passenger transportation on HSR infrastructure. This includes projects in the California High Speed Rail (CSRP) and the Xpress West project (XpressWest). The State Rail Plan contains the entire CSRP program, including Phase 1 under construction, Phase 1 planned, and

Phase 2 planned. The XpressWest project includes two segments: the Victorville to Las Vegas segment published by Xpress West, and a connection from Victorville to Palmdale.

Introduction

This document is an Independent Cost Estimate and Cost Methodology Report prepared by AECOM for the 2018 California State Rail Plan. This estimate is a high-level rough-order-of-magnitude estimate based on an assortment of projects that are at the 0 percent design stage. The costs provided in this estimate are at the corridor level, and are not meant to represent individual projects. It is expected that these corridor-level totals will be subdivided into projects and phases as part of project implementation planning and design development. No design has been performed at this time at the project level.

This technical memorandum is intended to meet the following goals as defined by Caltrans and AECOM:

- Document the methodology and criteria used to complete the capital cost estimate.
- Present the rough-order-of-magnitude capital cost estimate figures.
- Provide detailed assumptions, project elements, unit prices, and pricing sources for review by the Caltrans team.

Purpose

This document presents the rough-order-of-magnitude capital costs for the proposed infrastructure improvements associated with the 2018 Rail Plan. This document presents the methodology used in preparing the costs, as well as the estimate criteria, pricing sources, and assumptions. This estimate is representative of the most realistic price under stable bidding conditions for a project with the given assumptions and criteria. Any variance to the assumptions listed in this report could be the cause for a variance in the design and construction costs for the corridor improvements. This estimate is not intended to be a prediction of an under-designed system or a low-bid estimate. Likewise, this estimate is not intended to be a prediction of an over-designed system or open ended contract.

This document was prepared with the intended purpose of providing a strategic planning overview of the estimated probable capital cost of completing the program of projects needed to achieve the vision of an integrated passenger rail network and improved freight rail system supporting the stated goals of the California Transportation Plan 2040.

Estimate Methodology and Criteria

Estimate Methodology

Estimate Level

The estimates of probable capital costs at this stage include planning-level estimates of cost that take into consideration factors such as complexity, environment, geographic location (urban, suburban, rural), proximity to active tracks, and other such factors that may significantly influence the costs. Therefore, planning-level estimates of probable cost are gross-order-of-magnitude estimates intended to be indicative and inform the prioritization of investment decisions, and are not to be interpreted as engineer estimates.

Estimate Format

The estimate of probable cost is presented with totals listed by corridor-level improvements. These costs are summarized into improvements by region. Key quantities are given for each corridor to identify the essential project elements. Corridor estimates are based on either sourced information, or built up using a capital cost unit price catalog. This catalog follows the FRA Standardized Cost Categories (SCC), with unit costs for typical elements identified based on an average project cost. For unique high-cost improvements such as intercity stations, local stops, regional terminals, and major iconic intermodal hubs, maintenance yards, shops, and administrative buildings, a lump sum opinion of cost is assumed based on a range of low, medium, and high comparable costs derived from recent projects of similar scope.

Estimate Procedure

Step 1 – Capacity Charts/Network Graphs:

The 2040 Strategic Service Plan service type, frequency (system pulse), required average line speed, departure and arrival times, and route nodes used to develop corridor-specific improvements and build related capital cost estimates. This service plans were used to identify capacity requirements at the corridor level throughout the state. These capacity requirements are the primary basis for all project descriptions and assumptions in this estimate.

Step 2 – Corridor Investigation:

The corridors were investigated by a visual survey of the existing infrastructure using a combination of Google Earth mapping and consulting team professional knowledge of the existing conditions. The existing infrastructure was compared with future capacity requirements from the Capacity / Network charts. The planning team then compared the existing infrastructure to the future capacity requirements to identify the specific project components.

Step 3 – Pricing Research and Create Corridor Estimates:

An estimate of probable capital cost was prepared for each corridor by using sourced data or building up a cost estimate by using sourced information, or using a capital cost unit price catalog.

The cost catalog identified a "menu" of prototypical improvements, consisting of approximately 30 elements. Unit costs were developed for each element, using historical cost data from other projects. Cost factors, mark-ups, and adjustments were added as needed to develop pricing for new impacts not previously included in estimates, and / or adjust prior cost estimates to reflect a consistent cost estimate system.

For costs that are not sourced, corridor estimates were built up using the cost catalog. The corridor estimate applied unit costs to the programmatic project developments identified in Step 2. Measurements were taken to determine lengths (in route miles) of guideway type with assumptions for at-grade, aerial, or underground alignment.

Estimate Criteria

Pricing Sources and Standard Cost Categories

Sourced Projects

- 2016 Draft CAHSRA Business Plan (2016)
- Capitol Corridor 2014 Vision Plan Update Final Report (2014)
- Redlands Passenger Rail Project Fact Sheet (2015)
- XpressWest Media Kit (2011)

Cost Catalog

Unit costs have been developed from historical cost data, both internal and gathered from due diligent research. Many unit prices are based on the average or more conservative higher-end of the statistical averages. All costs have been appropriately adjusted with location and escalation factors to be comparable to California in the Plan Year of 2018.

10 Track Structures & Track – includes elevated structures (bridges and viaducts), embankments and open cuts, retaining wall systems, tunnels, culverts and drainage, track (ballasted and non-ballasted), and special trackwork. Unit costs are averages based on cost estimates and bid results from Caltrain, Metrolink, BART, and LA Metro. Pricing is included for new single track, new double track, and relocation of existing track.

20 Stations, Terminals, Intermodal – includes rough grading, excavation, station structures, enclosures, finishes, equipment; mechanical and electrical components including heating, ventilation, and air conditioning; station power, lighting, public address/customer information systems; and safety systems such as fire detection and prevention, security surveillance, access control, and life safety systems. Unit costs are averages based on cost estimates and bid results from Caltrain, Metrolink, BART, and LA Metro. A range of costs has been used depending on the intent of the design, with a range from low, medium, and high, to iconic. Iconic refers to a major hub such as Los Angeles Union Station or San Francisco's Transbay Terminal.

30 Support Facilities: Yards, Shops, Administration Buildings – includes rolling stock service, inspection, storage, heavy maintenance and overhaul facilities and equipment, as well as associated yard tracks and electrification. In addition, maintenance-of-way facilities are also included in this cost category. Unit costs are averages based on cost estimates and bid results from Caltrain, Metrolink, BART, and LA Metro. A range of costs has been used, depending on the intent of the design, ranging from low to and high.

40 Sitework, Right-of-Way, Land, Existing Improvements – includes cost of demolition, hazardous materials removals, environmental mitigation, utility relocations, noise mitigation, intrusion protection, grade separations, roadway improvements, acquisition of real estate, and temporary facilities and other indirect costs.

50 Systems – includes all costs of implementing Automatic Train Control (ATC) systems, inclusive of Positive Train Control (PTC) and intrusion detection, where it is applicable. Includes costs of traction power supply system such as supply, paralleling, and switching substations, as well as connections to the power utilities; and traction power distribution system in the form of Overhead Contact System (OCS). Unit costs are averages based on cost estimates and bid results from Caltrain, Metrolink, BART, and LA Metro. Unit costs are averages based on cost estimates and bid results from Caltrain, Metrolink, BART, and LA Metro. A range of costs has been used depending on the geography of the design, ranging from rural and suburban to urban. A sitework cost has been included for every mile of at-grade, aerial, and underground construction.

60 Right-of-Way – Land acquisition purchase required for guideway, stations, and facilities. Unit costs are based on the California High Speed Rail Authority's Business Plan. Urban right-of-way is estimated at 90 percent of the costs for the San Francisco to San Jose segment. Suburban right-of-way costs are 67 percent of the San Francisco to San Jose cost. Rural San Francisco to San Jose costs are estimated at 25 percent of the San Francisco to San Jose cost.

70 Vehicles – includes costs for acquisition of the trainsets (design, prototype unit, and production and delivery of trainsets to the project site on an annual basis). This estimate excludes all rolling stock.

80 Professional Services – includes all professional, technical, and management services related to the design and construction of infrastructure (Categories 10 through 60) during the preliminary engineering, final design, and construction phases of the project/program (as applicable). A 30 percent mark-up has been used to account for all professional services.

Contingency

Allocated Contingency (or Pre-Construction Design Development)

Allocated contingency represents a percentage of unknown or undeveloped scope that has not been implemented into the design documents. Because there is no design on any project, this estimate uses the maximum of 30 percent contingency. This contingency is expected to be reduced when the projects are designed.

Unallocated Contingency (or Change Order Contingency)

Unallocated contingency added to the construction and professional services costs at 10 percent of the estimate. Unallocated contingency represents costs above and beyond in the project budget, for such changes that are likely to occur during the construction. The construction contingency allowance carried by the owner in the project budget should remain constant throughout the design process.

Contract Procurement & Construction Fee

No assumptions have been made regarding contract procurement and delivery method. The unit costs include appropriate allowances to cover contractor fees, overhead, general conditions, and general requirements. The FRA format does not include a specific location for the contractor's General Conditions; therefore, the contractor's General Conditions have been included throughout the estimate at the unit cost level.

Cost Basis Year

AECOM established 2018 as the base year of all the cost estimates prepared for the 2018 Rail Plan. Any previous data that have a different base year—for example, Sepulveda Pass Final Compendium Report (2012), Capital Corridor 2014 Vision Plan Update Final Report, and 2016 Draft CAHSRA Business Plan—have been adjusted to match the base year established for the 2018 Rail Plan.

Cost Escalation Methodology and Calculations

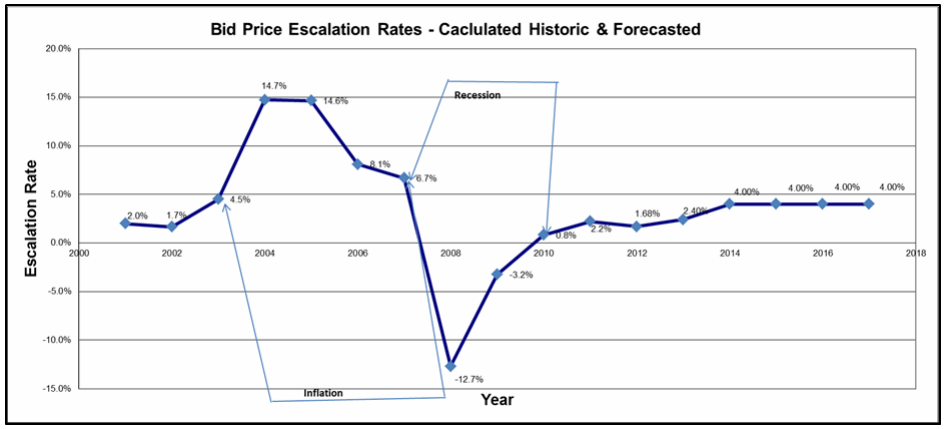
The regional rail/commuter rail unit prices in the estimate detail are priced in 2018 value. Any sourced project data have been escalated from the published report date to the year 2018. An

adjustment for cost escalation has been added to account for the anticipated cost increases between the published date and the 2018 cost basis year.

The HSR unit prices in the estimate detail are also priced in future value of the cost basis year. However, the adjustment for cost escalation has been performed at the summary level to account for the anticipated cost increases between the CAHSRA report year (2016) and the cost basis year (2018). The sum of the main elements has been escalated by 4 percent annually.

Escalation adjustment is meant to account for normal market growth across the state. The long-range annual escalation factor has been calculated by aggregating escalation procured from several government and consulting sources, including California Department of Transportation, American General Contractors, Turner Construction, Cumming Corporation, Davis Langdon, Engineering News Record, and the Los Angeles Bureau of Engineering. The average escalation factor calculated when aggregating the data is 3.99 percent. This estimate rounds the escalation rate up to 4 percent per year for long-range estimating purposes. Table A.29 depicts the reference long-term escalation rates, sources, and the average escalation rate of all the reference sources.

The following graph shows the average annual escalation data during the past 12 years, and the projected escalation rates through 2018.



Sources: Escalation rates have been calculated by aggregating long-range historic trends and forecasts from the following sources: Caltrans Average Highway Contract Prices 2000-2012, ENR- LA BCI & CCI 2000-2012, AGC Construction & Materials Outlook, May 1, 2013.

Qualifications

- This estimate should be used for high-level visioning purposes only, and not for grant applications or other decision making for specific projects.
- Any flaws or errors in the ridership modeling or production of the network graphs are carried through, and affect the estimate totals.
- Actual project costs could range +/- 30 percent.