American Association of State Highway and Transportation Officials
AASHTO
The Voice of Transportation

PRACTICAL GUIDE TO COST ESTIMATING

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Summary

AASHTO "PRACTICAL GUIDE TO COST ESTIMATING"

A state department of transportation's (DOT) ability to successfully manage and deliver its program is largely dependent on an ability to develop realistic estimates of project cost. Cost estimating involves not only the collection of relevant factors relating to the scope of a project and the cost of resources, but it also requires anticipating cost impacts that may occur due to changes in project scope, available resources, and national and global market conditions.

Responding to this need for accurate cost estimates, the American Association of State Highway and Transportation Officials (AASHTO) Technical Committee on Cost Estimating (TCCE) was charged with developing "practical" guidance on preparing estimates. Once their work began, it became apparent that little existing guidance was available to aid their efforts. The TCCE had to prepare guidance from scratch calling on the expertise of the various members and their agencies to document the best practices in use by DOTs.

At the same time the TCCE began its work, the National Cooperative Highway Program (NCHRP) was focusing on the issue of project cost escalation and published Report 574. That Report, *Guidance for Cost Estimation and Management for Highway Projects During Planning, Programming, and Preconstruction,* provides appropriate strategies, methods, and tools to develop, track, and document realistic cost estimates during each phase of the project development process. It is a strategic view of how to produce project estimates.

Since the publication of the NCHRP Report 574, two other NCHRP estimating projects have produced reports on the subject. NCHRP Report 625, *Procedures Guide for Right-of-Way Cost Estimation and Cost Management* and NCHRP Report 658, *Guidebook on Risk Analysis Tools and Management Practices to Control Transportation Project Cost.* Both reports provide special topic information that supports development of accurate and reliable cost estimates.

All of these parallel cost estimating guidance efforts and knowledge bases were married together to produce this "practical" guidance that serves those charged with the development of DOT cost estimates and with the management of the estimating process. This guidebook has two parts. Part I focuses on key cost-estimate techniques and Part II focuses on cost management activities.

KEY ESTIMATE TECHNIQUES

Part I of this guide covers in separate stand-alone chapters the following cost estimating techniques:

- Conceptual Estimating
- Bid-based Estimating
- Cost-based Estimating
- Risk-based Estimating

Conceptual or parametric estimating techniques are primarily used to support development of planning or early scoping phase estimates when minimal project definition is available. Statistical relationships or non-statistical ratios, or both, between historical data and other project parameters are used to calculate the cost of various items of work (i.e., center lane miles or square foot of bridge deck area).

Historical bid-based estimating relies heavily on element or bid items, or both, with quantities and good historical bid data for determining item cost. The historical data normally is based on bids from recent projects. The estimator must adjust the historical data to fit the current project characteristics and location. The historical data must also be adjusted to reflect current dollars. With the use of historical bid data, estimators can easily and quickly prepare estimates.

Cost-based estimating considers seven basic elements: time, equipment, labor, subcontractor, material, overhead, and profit. Generally, a work statement and set of drawings or specifications are used to "take off" material quantities required for each discrete work task necessary to accomplish the project bid items. From these quantities, direct labor, materials, and equipment costs are calculated based on calculated or assumed production rates. Contractor overhead and profit are then added to this direct cost.

Risk-based estimating combines (1) traditional estimating methods for known items and quantities with (2) risk analysis techniques to estimate uncertain items, uncertain quantities, and risk events. The risk-based portion of the estimate typically focuses on a few key elements of uncertainty and combines Monte Carlo sampling and heuristics (rules of thumb) to rank critical risk elements. This approach is used to establish the range of total project cost and to define how contingency should be allocated to critical project elements.

Each of these four techniques is discussed in detail in Chapters 2, 3, 4, and 5, respectively.

COST MANAGEMENT

Cost estimating is closely tied to cost management. Part II of this guide covers the following topic areas:

- Inflationary considerations
- Letting strategies for cost control
- Analysis of contractor bids
- Performance measures for cost estimating

Inflation is critical to estimating costs in the future. Inflation covers changes in cost over time. Adjustments for inflation include converting historical data to current dollars. Adjustments for inflation also include converting current dollars to future dollars based on a rate of inflation and the midpoint of construction expenditures. Indexing uses several tools such as cost indices, statistical analysis, and other modeling techniques. Experts in economics should be consulted when establishing future inflation rates.

Letting strategies are an important component of the estimating process. The use of both short- and long-term strategies will improve project bids and the validity of cost estimates. Long-term strategies are fundamental changes in the bid letting process and include timing of lettings, balancing of lettings, and packaging of projects for letting. Short-term strategies include such actions as contractor-selected packaging of projects, contractor self-imposed award limits, flexible notice to proceed, and contractor use of construction alternatives.

Analysis of contractor bids by a state department of transportation is a significant component of the competitive bidding process. To ensure a competitive contracting environment, agencies must have effective and consistent bid review and award recommendation procedures. The procedures must be transparent in a manner that is publicly understandable, economically efficient, legally defensible, and socio-politically acceptable.

Performance measures entail the use of tools to better understand and control cost estimating outcomes. Cost estimating performance measures track the attainment of cost estimating and project delivery functions. Tracking and evaluating cost estimating data allow efficient allocation of estimating resources while assisting in the development and justification of budgets and project proposals.

AUDIENCE

This guide offers comprehensive, consistent, and proven guidance on structured approaches to project cost estimation. It sets forth practical steps for preparing estimates during the planning and preconstruction phases of project development, and summarizes information from the main findings of the previous NCHRP studies combined with the information provided by the AASHTO TCCE.

The intended primary users of this guide are estimators that prepare estimates during specific project phases or across the entire project development process. An estimator would use Chapters 2, 3, 4, and 5. Managers involved in project development should review Chapter 1 to gain an overall perspective of project cost estimating. Further, there may be others who require knowledge of the cost estimating process but do not necessarily prepare cost estimates. As such, the guide is a resource for professionals involved in project development.

Agency management and project managers should read Chapter 7 to determine bidding strategies that will aid in controlling costs. Chapter 8 should be of interest to construction engineers and estimators, as evaluation of bids can aid in cost control as well as provide valuable information for estimating future projects. Finally, agency management would be interested in Chapter 9, which provides insights into program and project management by providing concepts around performance measures.