



Standard Practice for Measuring Cost Risk of Buildings and Building Systems and Other Constructed Projects¹

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1. Scope

1.1 This practice covers a procedure for measuring cost risk for buildings and building systems and other constructed projects, using the Monte Carlo simulation technique as described in Guide E1369.

1.2 A computer program is required for the Monte Carlo simulation. This can be one of the commercially available software programs for cost risk analysis, or one constructed by the user.

2. Referenced Documents

2.1 *ASTM Standards*:²

E631 Terminology of Building Constructions

E833 Terminology of Building Economics

E1369 Guide for Selecting Techniques for Treating Uncertainty and Risk in the Economic Evaluation of Buildings and Building Systems

E1557 Classification for Building Elements and Related Sitework—UNIFORMAT II

E2103 Classification for Bridge Elements—UNIFORMAT II

E2168 Classification for Allowance, Contingency, and Reserve Sums in Building Construction Estimating

3. Terminology

3.1 *Definitions*—For definitions of general terms used in this guide, refer to Terminology E631; and for general terms related to building economics, refer to Terminology E833.

4. Summary of Practice

4.1 The procedure for calculating building cost risk consists of the following steps:

- 4.1.1 Identify critical cost elements.
- 4.1.2 Eliminate interdependencies between critical elements.
- 4.1.3 Select Probability Density Function.
- 4.1.4 Quantify risk in critical elements.
- 4.1.5 Create a cost model.
- 4.1.6 Conduct a Monte Carlo simulation.
- 4.1.7 Interpret the results.
- 4.1.8 Conduct a sensitivity analysis.

5. Significance and Use

5.1 Measuring cost risk enables owners of buildings and other constructed projects, architects, engineers, and contractors to measure and evaluate the cost risk exposures of their construction projects.³ Specifically, cost risk analysis (CRA) helps answer the following questions:

5.1.1 What are the probabilities for the construction contract to be bid above or below the estimated value?

5.1.2 How low or high can the total project cost be?

5.1.3 What is the appropriate amount of contingency to use?

5.1.4 What cost elements have the greatest impact on the project's cost risk exposure?

5.2 CRA can be applied to a project's contract cost, construction cost (contract cost plus construction change orders), and project cost (construction cost plus owner's cost), depending on the users' perspectives and needs. This practice shall refer to these different terms generally as "project cost."

6. Procedure

6.1 *Identify Critical Cost Elements*:

6.1.1 A project cost estimate consists of many variables. Even though each variable contributes to the total project cost risk, not every variable makes a significant enough contribution to warrant inclusion in the cost model. Identify the critical elements in order to simplify the cost risk model.

6.1.2 A critical element is one which varies up or down enough to cause the total project cost to vary by an amount greater than the total project cost's critical variation, and one

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ This practice is based, in part, on the article, "Measuring Cost Risk of Building Projects," by D.N. Mitten and B. Kwong, Project Management Services, Inc., Rockville, MD, 1996.