



# Standard Practice for Applying Analytical Hierarchy Process (AHP) to Multiattribute Decision Analysis of Investments Related to Buildings and Building Systems<sup>1</sup>

This standard is issued under the fixed designation E 1765; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## INTRODUCTION

The analytical hierarchy process (AHP) is one of a set of multi-attribute decision analysis (MADA) methods that considers nonmonetary attributes (qualitative and quantitative) in addition to common economic evaluation measures (such as life-cycle costing or net benefits) when evaluating project alternatives. Building-related decisions depend in part on how competing options perform with respect to nonmonetary attributes. This practice complements existing ASTM standards on building economics by incorporating the existing economic/monetary measures of worth described in those standards into a more comprehensive standard method of evaluation that includes nonmonetary (quantitative and nonquantitative) benefits and costs. The AHP is the MADA method described in this practice.<sup>2</sup> It has three significant strengths: an efficient attribute weighting process of pairwise comparisons; hierarchical descriptions of attributes, which keep the number of pairwise comparisons manageable; and available software to facilitate its use.<sup>3</sup>

## 1. Scope

1.1 This practice presents a procedure for calculating and interpreting AHP scores of a project's total overall desirability when making building-related capital investment decisions.<sup>3</sup>

1.2 In addition to monetary benefits and costs, the procedure allows for the consideration of characteristics or attributes which decision makers regard as important, but which are not readily expressed in monetary terms. Examples of such attributes that pertain to the selection of a building alternative (and its surroundings) are location/accessibility, site security, maintainability, quality of the sound and visual environment, and image to the public and occupants.

## 2. Referenced Documents

### 2.1 ASTM Standards:

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E-6 on Performance of Buildings and is the direct responsibility of Subcommittee E06.81 on Building Economics.

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<sup>2</sup> For an extensive overview of MADA methods and a detailed treatment of how to apply two MADA methods (one of which is AHP) to building-related decisions, see Norris, G. A., and Marshall, H. E., *Multiattribute Decision Analysis: Recommended Method for Evaluating Buildings and Building Systems*, National Institute of Standards and Technology, 1995.

<sup>3</sup> This practice presents a stand-alone procedure for performing an AHP analysis. In addition, an ASTM software product for performing AHP analyses has been developed to support and facilitate use of this practice. *User's Guide to AHP/Expert Choice for ASTM Building Evaluation*, MNL 29, ASTM, 1998.

- E 631 Terminology of Building Constructions<sup>4</sup>
- E 833 Terminology of Building Economics<sup>4</sup>
- E 917 Practice for Measuring Life-Cycle Costs of Buildings and Building Systems<sup>4</sup>
- E 964 Practice for Measuring Benefit-to-Cost and Savings-to-Investment Ratios for Buildings and Building Systems<sup>4</sup>
- E 1057 Practice for Measuring Internal Rate of Return and Adjusted Internal Rate of Return for Investments in Buildings and Building Systems<sup>4</sup>
- E 1074 Practice for Measuring Net Benefits for Investments in Buildings and Building Systems<sup>4</sup>
- E 1121 Practice for Measuring Payback for Investments in Buildings and Building Systems<sup>4</sup>
- E 1334 Practice for Rating the Serviceability of a Building or Building-Related Facility<sup>4</sup>
- E 1480 Terminology of Facility Management (Building-Related)<sup>4</sup>
- E 1557 Classification for Building Elements and Related Sitework—UNIFORMAT II<sup>4</sup>
- E 1660 Classification for the Serviceability of an Office Facility for Support for Office Work<sup>4</sup>
- E 1661 Classification for the Serviceability of an Office Facility for Meetings and Group Effectiveness<sup>4</sup>
- E 1662 Classification for the Serviceability of an Office Facility for Sound and Visual Environment<sup>4</sup>
- E 1663 Classification for the Serviceability of an Office Facility for Typical Office Information Technology<sup>4</sup>

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 04.11.