



Standard Practice for Applying Analytical Hierarchy Process (AHP) to Multiattribute Decision Analysis of Investments Related to Projects, Products, and Processes¹

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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, product, and process alternatives. Investment 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.² 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.³

1. Scope

1.1 This practice presents a procedure for calculating and interpreting AHP scores of a project's/product's/process' total overall desirability when making capital investment decisions.³ Projects include design, construction, operation, and disposal of commercial and residential buildings and other engineered structures.⁴ Products include materials, components, systems,

and equipment.⁵ Processes include procurement, materials management, work flow, fabrication and assembly, quality control, and services.

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 among project/product/process alternatives are: a construction project's building alternatives whose nonmonetary attributes are location/accessibility, site security, maintainability, quality of the sound and visual environment, and image to the public and occupants; building products based on their economic and environmental performance; and sustainability-related issues for key construction processes that address environmental needs, while considering project safety, cost, and schedule.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

¹ This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.81 on Building Economics.

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² 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.

³ 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. *Software to Support ASTM E1765: Standard Practice for Applying Analytical Hierarchy Process (AHP) to Multiattribute Decision Analysis of Investments Related to Buildings and Building Systems*, MNL 29, ASTM, 1998.

⁴ Projects also include analytical studies that identify alternative means for achieving organizational objectives as well as research and development activities that support the deployment of new products and processes.

⁵ Typical construction-related products for each product type are: (1) materials—concrete; (2) components—structural steel members; (3) systems—heating, ventilating, and air-conditioning system; and (4) equipment—heat pump.