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Standard Guide for General Principles of Sustainability Relative to the Built Environment¹

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1. Scope

1.1 There are three general principles of sustainability: environmental, economic, and social. This guide covers application of the fundamental concepts and associated characteristics for each of the general principles of sustainability to the built environment.

1.2 This guide identifies general methodologies associated with the decision-making process used in pursuing sustainability.

1.3 The general principles identified in this guide are applicable to all life-cycle stages of design and construction within the built environment.

1.4 A variety of tools and standards exist that qualify and quantify impacts of the built environment in terms of the general principles of sustainability. It is not within the scope of this standard to recreate or replace these tools.

1.5 This guide does not provide direction as to the specific implementation of the general principles; nor does it provide direction as to the specific weighting of principles necessary for achieving balance between competing goals.

1.6 Applying the principles in this guide will require professional judgment. Such judgment should be informed by experience with environmental, economic, and social issues as appropriate to the use, type, scale, and location.

1.7 This guide offers an organized collection of information or a series of options but does not recommend a specific course of action. This document cannot replace education, experience, or community dialogue. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects.

¹ This guide is under the jurisdiction of ASTM Committee E60 on Sustainability and is the direct responsibility of Subcommittee E60.01 on Buildings and Construction.

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1.8 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E631 Terminology of Building Constructions

E917 Practice for Measuring Life-Cycle Costs of Buildings and Building Systems

E2114 Terminology for Sustainability

2.2 *ISO Standard:*³

ISO 14040 Life Cycle Assessment

3. Terminology

3.1 *Definitions:*

3.1.1 For terms related to building construction, refer to Terminology E631.

3.1.2 For terms related to sustainability, refer to Terminology E2114.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *built environment, n*—structures, infrastructure, and landscapes constructed or modified for human purposes.

3.2.1.1 *Discussion*—The built environment includes all structures and other areas manipulated for the purposes of human activity including, but not limited to, housing, commerce, manufacturing, and recreation. The built environment includes all infrastructure, utility, and other systems

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 Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

designed or otherwise installed for the service and support of structures and areas accommodating human activity.

3.2.2 *carbon sinking, n*—an approach to offset carbon dioxide emissions through the absorption potential of forests and other vegetation.

3.2.3 *Design for the Environment (DfE), n*—the systemic consideration of design performance with respect to environmental, health, and safety objectives over the full product life cycle.

3.2.4 *external costs/benefits, n*—economic impact associated with the action of a party that is not borne by that party, but rather by a third party or parties.

3.2.4.1 *Discussion*—This is intended to include economic costs and benefits associated with environmental and social impacts arising out of the action.

3.2.5 *green roof system, n*—an assembly that supports an area of planting/landscaping, built up on a waterproofed substrate at any level that is separated from the natural ground by a human-made structure.

3.2.6 *heat island effect, n*—a phenomenon in which urban air and surface temperatures are higher than nearby rural areas due to the replacement of natural land cover with pavement, buildings, and other infrastructure.

4. Significance and Use

4.1 The built environment has environmental, economic, and social impacts. These impacts occur at all life-cycle stages in multiple ways and on local, regional, and global scales. It is imperative to understand the nature of these impacts and their relationship to the general principles of sustainability in order to address the opportunities and challenges they present.

4.1.1 It is necessary to identify the environmental impacts in order to promote the positive and mitigate the negative.

4.1.2 It is necessary to quantify the economic impacts in order to improve life-cycle costs and benefits.

4.1.3 It is necessary to identify the social impacts in order to contribute to a positive quality of life for current and future generations.

4.2 The general principles of sustainability—environmental, economic, and social—are interrelated. Decisions founded on the opportunities and challenges of any of the principles will have impacts relative to all of the principles. However, to facilitate clarity in the presentation of the general principles, they are discussed individually in Section 5.

4.3 The practical application of the general principles of sustainability relies upon balancing environmental, economic, and social impacts and committing to continual improvement. Section 6 discusses this balancing of environmental, economic, and social impacts in pursuit of sustainability.

4.4 This guide provides an overview of sustainability, as it is applicable to the built environment. This guide provides general guidance but does not prescribe a specific course of action.

4.5 This guide is intended to inform professionals associated with the building industry.

4.5.1 The general principles identified in this guide are intended to assist users in making decisions that advance sustainability.

4.5.2 The general principles identified in this guide are intended to inform the development and refinement of tools and standards to qualify and quantify impacts of the built environment.

5. Principles of Sustainability Relative to the Built Environment

5.1 *Environmental Principles*—Raw materials sourcing, production of components, construction, day-to-day operations, periodic maintenance, and the final disposition of the components, impact on the environment. Environmental impacts affect ecosystems, biodiversity, and natural resources. In order to advance sustainability, it is necessary to identify environmental impacts, mitigate negative environmental impacts, and promote positive environmental impacts.

5.1.1 *Fundamental Concepts:*

5.1.1.1 *Ecosystems*—Ecosystems provide critical services that support life on the earth and the continued viability of a large range of flora and fauna. Sustainability protects existing ecosystems and strives to restore damaged ecosystems.

5.1.1.2 *Biodiversity*—Biodiversity provides environmental options, both known and unknown, that contribute to the genetic resilience of the earth's flora and fauna. Sustainability protects or enhances the biodiversity and interdependencies of species.

5.1.1.3 *Natural Resources*—Natural resources provide the basic requirements of life and the material/energy from which all human-made material/energy is derived. Sustainability balances the use of earth's renewable, non-renewable, and perpetual resources in order to preserve these resources for future generations.

5.1.2 *Associated Characteristics:*

5.1.2.1 *Ecosystems*—Sustainable construction integrates features that protect or enhance local, regional, and global ecosystems. For example, energy efficiency features, both active and passive, can reduce the amount of energy used by a building. This approach can reduce the regional impacts associated with air emissions from electric power generation facilities and reduce the local impacts of the heat island effect.

5.1.2.2 *Biodiversity*—Sustainable construction integrates features that protect or enhance species' habitats. For example, a green roof system can retain and utilize stormwater through the use of climate-appropriate plants. This approach can reduce the amount of polluted stormwater runoff and creates new habitats within the built environment.

5.1.2.3 *Natural Resources*—Sustainable construction maximizes effective use of resources by maintaining or improving the balance between resources and their rate of consumption. For example, water resource stewardship approaches such as water-efficient, native landscaping, and permeable surfaces can reduce the use of water and help to naturally filter contaminants. These approaches can assist in recharging groundwater resources. Similarly, wood building products obtained from sustainably managed forests can contribute to the preservation