ASCE STANDARD

ASCE/SEI

59-22

Blast Protection of Buildings

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AMERICAN SOCIETY OF CIVIL ENGINEERS

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CONTENTS

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PREFACE

The material presented in this publication has been prepared in accordance with recognized engineering principles. This standard and commentary should not be used without first securing competent advice with respect to their suitability for any given application. The publication of the material contained herein is not intended as a representation of warranty on the part of ASCE or of any person named herein, or that this information is suitable for any general or particular use or promises freedom from infringement of any patent or patents. Anyone making use of this information assumes all liability for such use.

The intent of the committee that prepared this standard was to present current practice in the analysis and design of structures for blast resistance. To accomplish that goal, the committee called on its collective experience in the practice of blast resistant design and also consulted persons not on the committee. As such, this is a consensus document and does not reflect the specific practice of any individual.

This is the second edition of this standard. Its need had been identified in advance of the events of September 11, 2001. In fact, key individuals of the original nucleus of the committee and the Structural Engineering Institute (SEI) were on a conference call to discuss development of this standard as the events of that day began to unfold. In the months following SEI's announcement that a committee would be formed to prepare this standard, numerous experts stepped forward to volunteer for the effort. Hence, this standard represents approximately 20 years of dedicated work by a knowledgeable committee.

The process started with subcommittees preparing "white papers" covering the information to be included in the standard. Once circulated for comment, those documents were reformatted into the first drafts of chapters of the mandatory and commentary sections of the standard. Then, throughout the development process the full committee reviewed and balloted numerous drafts of the standard. At each ballot cycle, subcommittees proposed resolutions for members' comments, ultimately leading to the full committee's approval of the text in ASCE/SEI 59-11. The same basic process has been followed to prepare and incorporate the revisions that resulted in this volume.

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CHAPTER 1
GENERAL

1.1 SCOPE

This voluntary standard provides minimum planning, design, construction, and assessment requirements for new and existing buildings subject to the effects of individual accidental or malicious explosions, including principles for establishing appropriate threat parameters, levels of protection, loadings, analysis methodologies, materials, detailing, and test procedures. However, this standard is not applicable for the mitigation of multiple explosions, intentional explosions such as weapons testing, or potential accidents involving ammunition or explosives during their development, manufacturing, testing, production, transportation, handling, storage, maintenance, modification, inspection, demilitarization, or disposal.

This standard is intended to supplement and not supersede the requirements of the governing building code and other applicable standards and laws. The omission of any specific material or system does not necessarily preclude its use in accordance with this standard, as long as all applicable provisions are satisfied. This standard does not prescribe requirements or guidelines for the mitigation of progressive collapse or other potential postblast behavior.

1.2 DEFINITIONS

The following definitions apply to the provisions of the entire standard.

Aggressor: Person or organization that may initiate an attack against an asset.

Approved: Acceptable to the authority having jurisdiction.

Asset: Unit or collection of people or property that requires protection.

Attack: Attempt by an aggressor to cause the loss or compromise of an asset or group of assets.

Authority Having Jurisdiction (AHJ): Organization, political subdivision, office, or individual charged with the responsibility of administering and enforcing the provisions of this standard. It shall be permissible for the AHJ to be established by contractual agreement, when appropriate.

Average Strength Factor (ASF): Factor applied to nominal material strengths to account for the difference between the specified minimum and expected actual values. Also known as a **Static Increase Factor (SIF)**.

Balanced Design: Controlled failure of a system with an established hierarchy of component failures, where connections are designed for the maximum strength of the connecting components and members supporting other members are designed for the maximum strength of the supported members. For window systems, the glazing shall fail before all other components.

Blast: Synonym for **Explosion**.

Building Envelope: Exposed elements on the exterior of the building, including (but not limited to) exterior walls, roofs, fenestration, exterior columns, spandrel and cantilever beams, and the exposed underside of occupied floors.

Buildings: Structures, usually enclosed by walls and a roof, constructed to provide support or shelter for an intended occupancy.

Component: Part of an architectural, mechanical, electrical, or structural system of a building.

Compression Member: Member that carries an axial compression load greater than 10% of its axial compression strength. The factored load resulting from effects other than blast shall be determined in accordance with Section 3.5.3, and the effective strength shall be determined in accordance with Sections 3.5.1 and 3.5.2.

Connection: Link that transmits actions from one component or element to another component or element, categorized by type of action (moment, shear, or axial). Steel connections are assemblies that include, but are not limited to, welds, bolts, rivets, angles, and plates. Reinforced concrete connections are often integral, consisting of the concrete and the reinforcement at the end of one component or element and extending into the other.

Consequence Factor: Numerical measure of the relative impact of the loss or compromise of a specific asset within a building, including its occupants, often expressed in terms of quantity or cost.

Constrained Fragment: Secondary fragment whose velocity in an airblast is reduced by the amount of energy required to tear it from its connected component or element.

Daylight Installation: Retrofit method for existing windows where security window film is applied to the interior vision surface of the glass without any additional attachment at the edges.

Dead Load (D): Weight of materials of construction incorporated into the building including, but not limited to, walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding, and other similarly incorporated architectural and structural items, and fixed service equipment including the weight of cranes.

Design Basis Threat: Explosive type and charge size for which the building is intended to provide a specified level of protection.

Diagonal Tension Shear: Shear associated with the flexural response of a member and the formation of diagonal cracks in reinforced concrete or masonry sections.

Direct Shear: Shear associated with the nearly instantaneous reaction force at the interface between connected members in response to blast loading.

Ductile Flexural Member: Member that develops its plastic moment capacity and is capable of reliably sustaining deformation at or above this load level.