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ASCE STANDARD

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Air-Supported Structures

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Abstract:

This Standard provides minimum criteria for the design and operation of air-supported membrane structures whether independent of or attached to another structure. Specifically, it discusses such topics as: 1) Materials and their properties; 2) building systems such as fire protection; 3) design criteria; 4) erection and inflation; and 5) operation and maintenance.

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STANDARDS

In April 1980, the Board of Direction approved ASCE Rules for Standards Committees to govern the writing and maintenance of standards developed by the Society. All such standards are developed by a consensus standards process managed by the Codes and Standards Activities Committee. The consensus process includes balloting by the balanced standards committee, which is composed of Society members and nonmembers, balloting by the membership of ASCE as a whole, and balloting by the public. All standards are updated or reaffirmed by the same process at intervals not exceeding five years.

The following Standards have been issued.

ANSI/ASCE 1-82 N-725 Guideline for Design and Analysis of Nuclear Safety Related Earth Structures

ANSI/ASCE 2-91 Measurement of Oxygen Transfer in Clean Water

ANSI/ASCE 3-91 Standard for the Structural Design of Composite Slabs and ANSI/ASCE 9-91 Standard Practice for the Construction and Inspection of Composite Slabs

ANSI/ASCE 4-86 Seismic Analysis of Safety-Related Nuclear Structures

ACI 530-95/ASCE 5-95/TMS402-95 Building Code Requirements for Masonry Structures

ACI 530.1-95/ASCE 6-95/TMS602-95 Specifications for Masonry Structures

ANSI/ASCE 7-95 Minimum Design Loads for Buildings and Other Structures

ANSI/ASCE 8-90 Specification for the Design of Cold-Formed Stainless Steel Structural Members

ANSI/ASCE 9-91 listed with ASCE 3-91

ANSI/ASCE 10-90 Design of Latticed Steel Transmission Structures

ANSI/ASCE 11-90 Guideline for Structural Condition Assessment of Existing Buildings

ANSI/ASCE 12-91 Guideline for the Design of Urban Subsurface Drainage

ASCE 13-93 Standard Guidelines for Installation of Urban Subsurface Drainage

ASCE 14-93 Standard Guidelines for Operation and Maintenance of Urban Subsurface Drainage

ASCE 15-93 Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)

ASCE 16-95 Standard for Load and Resistance Factor Design (LRFD) of Engineered Wood Construction

ASCE 17-96 Air-Supported Structures

ASCE 18-96 Standard Guidelines for In-Process Oxygen Transfer Testing

ASCE 19-96 Structural Applications of Steel Cables for Buildings

ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations

ASCE 21-96 Automated People Mover Standards—Part I

FOREWORD

The material presented in this Standard has been prepared in accordance with recognized engineering principles. This Standard should not be used without first securing competent advice with respect to its suitability for any given application. The publication of the material contained herein is not intended as a representation or warranty on the part of the American Society of Civil Engineers, or of any other person named herein, 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 from such use.

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This Standard was prepared through the consensus standards process by balloting in compliance with procedures of ASCE's Codes and Standards Activities Committee. Those individuals who serve on the Air-Supported Structures Standards Committee are:

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Contents

1.0 General

1.1 Scope

This Standard provides minimum criteria for the design and operation of air-supported membrane structures whether independent of or attached to another structure.

This Standard does not apply to tents or air-inflated (dual wall) structures where the occupied space is not pressurized.

Air-supported structures shall comply with the requirements of the applicable Building Code.

1.2 Definitions

The following definitions apply in this Standard.

Air Pressures

Design Maximum Internal Pressure: the greatest pressure that the inflation system is capable of developing within the structure.

Maximum Operating Pressure: the greatest pressure permitted with immediate and continuous supervision of the pressure control system.

Minimum Operating Pressure: the lowest pressure at which the structure is designed to operate.

Normal Operating Pressure: the range of operating pressures specified when special methods are not necessary to accommodate unusual loads.

Residual Pressure: the pressure used to determine the deflation index D_i. This pressure is to be determined under the required design load combinations.

Air-supported structure: structure consisting of a membrane that achieves and maintains its shape and support by air pressure within the occupied space.

Approved: approved by the authority having jurisdiction.

Authority having jurisdiction: the organization, political subdivision, office, or individual charged with the responsibility of administering and enforcing the provisions of this Standard.

Deflation index: a calculated value used to ensure a margin of safety for emergency egress.

Design strength: the product of the nominal strength and a resistance factor.

Fabrics

Coated fabric: a base fabric to which is bonded a supplementary coating. The base fabric carries the membrane stresses.

Laminated fabric: a flexible material composed of superimposed layers firmly united by bonding or impregnating with an adherent polymeric material to one or more surfaces. One or more of these layers is a textile fabric.

Factored load: the product of the nominal load and a load factor.

Fan: an air-moving device, including axial, centrifugal, or propeller fans or blowers.

Films: unreinforced flexible sheets made of a single layer or laminated multiple layers of PVC, polyethylene, or other materials.

Inflation system: all necessary components of a mechanical system required for inflation and operation of an air-supported structure; this may include, but is not limited to, fans, motors, back-draft dampers, relief dampers, heaters (where required), housings, ducts not fully contained in the pressurized space, standby power, and controls.

Life-cycle factor: a factor which recognizes that the strength of a material decreases with time because of the effects of continuous loading, environmental exposure, and aging.

Limit state: condition in which a structure or component becomes unfit for service and is judged either to be no longer useful for its intended function (*serviceability limit state*) or to be unsafe (*strength limit state*).

Load effects: forces and deformations produced in structural members and components by the loads.

Load factor: a factor that accounts for unavoidable deviations of the actual load from the nominal value, its statistical variation, and uncertainties in the analysis that transform the load into a load effect.

Loads: forces or other actions that affect structural systems such as the weight of all materials, occupants, and their possessions; internal pressure; environmental effects; differential settlement; and restrained dimensional changes.

Membrane: the pliable structural fabric or film of the air-supported structure.

Membrane liner: an interior fabric or film used for decorative, acoustical, thermal insulation, or other nonstructural purpose.

Nominal loads: the loads as specified in ASCE 7.

Nominal strength: the capacity of a structure or component to resist the effects of loads, as determined by computations using specified material strengths and dimensions and formulas derived from accepted principles of structural mechanics or by field tests or laboratory tests of scaled models,