AS 4678—2002
(Incorporating Amendment Nos 1 and 2)

AS 4678—2002

Australian Standard®

Earth-retaining structures

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- Association of Consulting Engineers, Australia
- Australian Industry Group
- Australian Geomechanics Society
- AUSTROADS
- Cement and Concrete Association of Australia
- Concrete Institute of Australia
- Concrete Masonry Association of Australia
- Construction Industry Advisory Council
- Institution of Engineers Australia
- Master Builders Australia
- University of New South Wales
- University of Technology, Sydney

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PREFACE

This Standard was prepared by the Standards Australia Committee, CE-032, Reinforced Soils and Retaining Structures, in response to a call from the building industry for the establishment of a Standard on earth-retaining systems, including reinforced soils.

This Standard incorporates Amendment No. 1 (July 2003) and Amendment No. 2 (August 2008). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to provide designers of earth-retaining structures with design criteria and guidance for use in design applications.

The terms 'informative' has been used in this Standard to define the application of the appendix to which it applies. An 'informative' appendix is only for information and guidance.

As far as practicable, this Standard has been made consistent with the approach taken in the loading code for structures, AS 1170, *Minimum design loads on structures*. This enables the Standard to be used in combination with structure design Standards such as AS 1720, *Timber Structures*, AS 3600, *Concrete Structures*, AS 4100, *Steel Structures*, and AS 3700, *Masonry structures*. Some specific applications are covered by other Standards and documents. For example, HB 77, *Australian Bridge Design Code*, should be used to design earth-retaining structures associated with road bridges.

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements and recommendations relating to the design and construction of structures required to retain soil, rock and other materials. It also includes requirements and recommendations for the reinforcement of soil and rock materials.

This Standard does not prescribe specific methods of analysis.

NOTE: Various organizations and authorities may develop detailed guides and specifications based on the principles set out in this Standard.

This Standard is in limit state format.

This Standard does not provide requirements and recommendations for 'revetment type' structures, which are sometimes used to retain soil, rock and other materials at slopes steeper than that which the soil, rock or other material would naturally assume.

The retaining structures encompassed by this Standard are indicated in Figure 1.1.

A1 Facings constructed up to 800 mm high in a Type 3 structure application are not covered by this Standard.

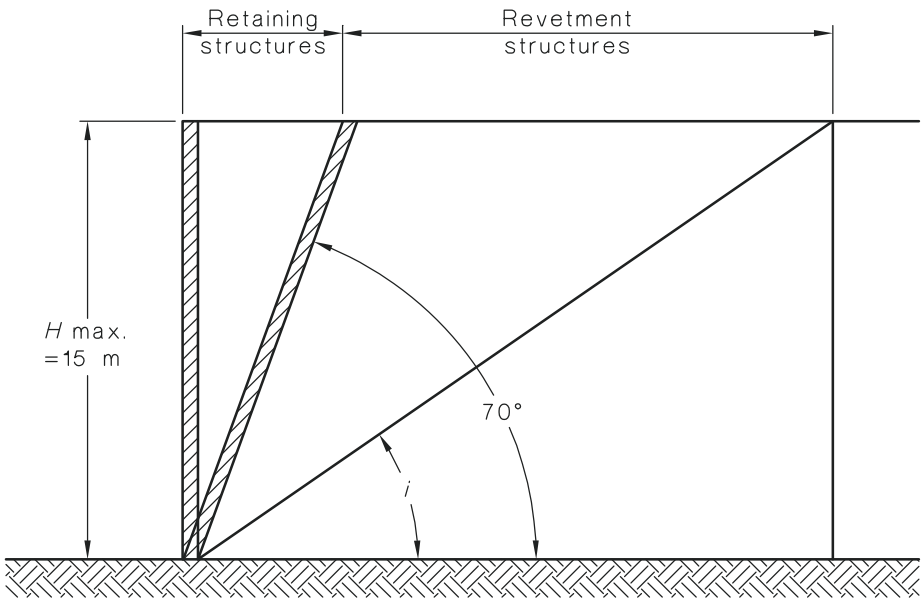

FIGURE 1.1 RETAINING AND REVETMENT STRUCTURES

A1

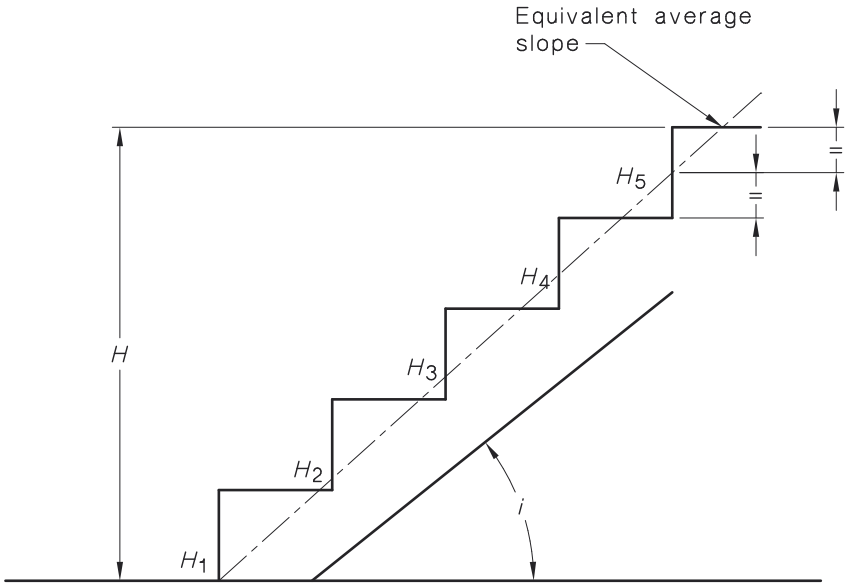

FIGURE 1.2 TERRACED STRUCTURES

1.2 APPLICATION

1.2.1 General

This Standard is applicable to retaining structures and reinforced soil structures that are commonly constructed for engineering works and infrastructure. Such structures are typically up to 15 m in height.

Structures of unusual shape, of large retained heights (in excess of 15 m) or founded in unusual ground conditions (such as soft ground, land slips, steep sides or deeply inclined gullies), together with structures subject to sustained cyclic loading, are outside the provisions of this Standard.

This Standard does not apply to the design and construction of water-retaining structures (such as dams and reservoirs) or bridge structures.

1.2.2 Structure classification

Structures shall be classified in accordance with Table 1.1.

A1 **NOTE: 'Not applicable'**

TABLE 1.1

STRUCTURE CLASSIFICATION

Classification	Examples of structures
C	Where failure would result in significant damage or risk to life
B	Where failure would result in moderate damage and loss of services
A	Where failure would result in minimal damage and loss of access

NOTES:

1 Classification B includes structures not covered by Classifications A or C

2 For more information on structure classification, see Appendix A.

Structures where failure would result in minimal damage and loss of access where the wall height (H) is greater than 1.5 m are deemed to be classification B structures.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1170	Minimum design loads on structures (known as SAA Loading Code)
1170.1	Part 1: Dead and live loads and load combinations
1170.2	Part 2: Wind loads
1170.4	Part 4: Earthquake loads
1289	Methods of testing soils for engineering purposes
1289.6.3	Method 3: Determination of the penetration resistance of a soil
1720	Timber Structures (all parts)
1726	Geotechnical site investigations
2159	Piling—Design and installation
2439	Perforated plastics drainage and effluent pipe and fittings (all parts)
2870	Residential slabs and footings
2870.1	Part 1: Construction
3500	National Plumbing and Drainage Code (set)
3600	Concrete structures
3700	Masonry structures
4100	Steel structures
SAI	
HB 77	Australian Bridge Design Code
BS	
8006	Code of practice for strengthened/reinforced soils and other fills

1.4 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.4.1 General

1.4.1.1 *Action*

A cause of stress, dimensional change, or displacement in a structure or component of a structure.

1.4.1.2 *Action effect*

The internal force, moment, deformation, crack, or the like effect caused by one or more actions.

1.4.1.3 *Batter*

A slope of a cut or fill.

1.4.1.4 *Characteristic value*

Representative value of a soil, rock or a material property.

NOTE: For soil properties, the characteristic value is a cautious estimate, that is, close to but not greater than, of the mean value, (see Clause 5.2.3). The strengths of materials, such as concrete, steel, plastic and masonry, are contained in the appropriate Standards.

1.4.1.5 *Dead load*

The load determined in accordance with this Standard imposed by the components of the self-weight of the structure and retained soil or rock.

1.4.1.6 *Design life*

The intended period of time over which the structure is required to fulfil its function and remain in a serviceable state.

1.4.1.7 *Design load (action)*

The appropriate combination of loads (actions) and load factors as specified in this Standard.

1.4.1.8 *Ground anchor*

A tensile reinforcement, wire or bar, and its associated components that transmit force into soil or rock through bond over part of its length.

NOTE: Appendix B gives guidance on design of ground anchors.

1.4.1.9 *Limit state*

Any limiting condition for which structures are designed.

NOTE: The limit states design criteria considered in this Standard are strength limit state, stability limit state and serviceability limit state.

1.4.1.10 *Live load*

The load as defined in this Standard assumed to arise from the intended use of the structure including distributed, concentrated, impact and inertia loads, but excluding wind, snow, and earthquake loads.

1.4.1.11 *Load factor*

A factor specified in this Standard for structural design to be used with the loads (or actions) in deriving design loads (or design actions).

1.4.1.12 *Resistance effect*

The characteristic strength multiplied by the appropriate reduction factors for ultimate or serviceability limit state analysis.

1.4.1.13 *Rock bolt*

A tensile reinforcement, typically a bar of 15 to 50 mm in diameter, of steel or high strength polymer, which is inserted into a drill hole in rock and fixed in position by grout or mechanical anchorage.

NOTE: An initial tension is applied equal to or greater than 5%, and usually about 50% to 60%, of the ultimate tensile strength of the bar.

1.4.1.14 *Rock dowel*

As for rock bolt except that the applied tension is less than 5% of the ultimate tensile strength of the material used in the bar.

1.4.1.15 *Serviceability limit state*

A limit state for acceptable in-service conditions.

1.4.1.16 *Stressed ground anchor*

A tensile reinforcement, typically high tensile steel strand or wire or bar, and its associated components that transmit force into soil or rock through bond over part of its length. An initial tension is applied and the minimum capacity is usually checked by proof loading.

1.4.1.17 *Soil dowel*

A relatively stiff structural element used to take load in soils principally by shear action.