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UDC 624.154/.155

Australian Standard 2159–1978

SAA PILING CODE

STANDARDS ASSOCIATION OF AUSTRALIA
Incorporated by Royal Charter

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THE FOLLOWING SCIENTIFIC, INDUSTRIAL AND GOVERNMENTAL organizations and departments were officially represented on the committee entrusted with the preparation of this standard:

Association of Consulting Engineers Australia

Bureau of Steel Manufacturers

Civil Engineering Contractors

Department of Construction

Experimental Building Station

National Association of Australian State Road Authorities

Universities

This standard, prepared by Committee CE/18, Piling, was approved on behalf of the Council of the Standards Association of Australia on 27 February 1978, and was published on 1 June 1978.

To keep abreast of progress in industry, Australian standards are regularly reviewed. Suggestions for improvements to published standards, addressed to the head office of the Association, are welcomed.

This standard was issued in draft form for public review as DR 75020.

1.6 NOTATION. Unless a contrary intention appears elsewhere in the Code, the notation shall have the following meanings:

A_b = plan area of the base

A_p = cross-sectional area of pile

A_s = surface area of pile used in calculation of pile capacity

C = pile circumference

C_1 = moment factor tabulated in Appendix A, Table A6(A)

C_2 = moment factor tabulated in Appendix A, Table A6(B)

$\bar{c}_b$ = average undrained shear strength of the clay within a depth of two pile base diameters below the level of the base

$\bar{c}_u$ = average undrained shear strength of the clay over the depth of the pile

d = average pile shaft diameter or width

d_b = diameter of pile base

E_p = Young's modulus of elasticity of the pile material

E_s = Young's modulus of elasticity of the soil

e = eccentricity of applied load above ground line

F = adhesion factor depending on the type of pile and soil

F'_c = characteristic compressive strength of concrete at 28 days

f_b = net ultimate resistance per unit area of base

f_n = maximum negative skin friction developed along the pile shaft

f_s = skin friction for non-cohesive soils

$\bar{f}_s$ = average skin resistance per unit area of the shaft at the condition of full mobilization

H = applied horizontal force at ground line

H_u = ultimate lateral resistance of pile

I = settlement influence factor

I_p = minimum moment of inertia of pile section

$I_{\rho H}$, $I_{\rho M}$, $I_{\rho F}$ = dimensionless pile deflection factors which are a function of length/diameter ratio L/d

$I_{\theta H}$, $I_{\theta M}$ = dimensionless pile rotation factors which are a function of length/diameter ratio L/d

J_R = dimensionless unsupported length
$= L_u/R$

J_T = dimensionless unsupported length
$= L_u/T$

K = pile stiffness factor

K_R = pile flexibility factor with uniform soil modulus with depth

K_N = pile flexibility factor with linearly increasing soil modulus with depth

K_1, K_2 = buckling factors depending on boundary conditions at head and toe of the pile

k_s = modulus of subgrade reaction if constant with depth

k_1 = modulus of subgrade reaction if linearly increasing with depth

L = embedded length of pile

L_s = equivalent free length of embedded portion of pile

L_u = unsupported pile length

L_1 = a characteristic length of the portion of the pile embedded in the consolidating layer

M = applied moment at ground line

M_R = movement ratio, i.e. ratio of pile settlement to settlement of the pile as a free-standing column

M_{max} = maximum bending moment in the pile

M_y = yield moment of pile section

N_c = bearing capacity factor derived from the cohesion of the soil

N_h = rate of increase of Young's modulus of soil with depth

N_q = bearing capacity factor due to overburden pressure

n = number of piles in the group

n_h = horizontal coefficient of subgrade reaction

P = applied axial load

P_{cr} = critical load

P_N = maximum downdrag force

P_u = ultimate bearing capacity of a single pile

P_{uu} = ultimate uplift capacity of a single pile

P_o = overburden pressure at level of base

q_u = unconfined compressive strength

R = pile flexibility factor

$$= \sqrt[4]{\left(\frac{E_p I_p}{k_s d}\right)}$$

R_A = area ratio of pile
= ratio of area of pile section to gross area bounded by the outer circumference of pile

R_S = ratio of settlement of pile group to settlement of single pile

R_{16} = settlement ratio for a 16-pile group

R_{25} = settlement ratio for a 25-pile group

S = settlement of a single pile

S_G = settlement of a pile group

S_R = dimensionless embedded pile length
$= L_s/R$

S_T = dimensionless embedded pile length
$= L_s/T$

T = pile flexibility factor

$$= \sqrt[5]{\left(\frac{E_p I_p}{n_h}\right)}$$

m = mass

W = weight of the pile (less buoyancy effect)

Z = depth below ground surface

Z_L = a limiting depth depending on the relative density of the sand

α = reduction coefficient

γ = bulk unit mass of the soil

λ_s = factor defined in Appendix A, equation A4.1(A)

λ_L = factor defined in Appendix A, equation A4.1(B)

ρ = ground-line deflection

θ = ground-line rotation

ϕ = angle of internal friction of soil

ϕ_d = drained angle of internal friction of soil

σ_{max} = yield stress of pile material

σ'_v = vertical effective stress

σ'_{vL} = vertical effective stress at the limiting depth Z_L

σ'_{vb} = vertical effective stress at level of base.

AUSTRALIAN STANDARD

RULES FOR THE DESIGN AND INSTALLATION OF PILING

known as the

SAA PILING CODE

AS 2159–1978

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PREFACE

This standard was prepared by the Association's Committee on Piling at the request of the SAA Committee on Timber Engineering Codes. The standard is intended for use in the design, appraisal and installation of piling installations.

Because this standard might be adopted by reference in building regulations it has been drafted in mandatory terms. At the same time the committee has recognized the need to supplement the mandatory requirements with material to explain the requirements and to assist in their correct interpretation. Where the explanatory material is discursive or otherwise not suitable for building regulations, it has been placed either at the end of the relevant section or in an appropriate appendix.

This standard may require reference to the following standards:

AS 1012 Methods for the Testing of Concrete
AS 1129 Fly Ash for Use in Concrete
AS 1130 Code of Practice for Use of Fly Ash in Concrete
AS 1131 Dimensions of Hot-rolled Structural Steel Sections
AS 1163 Welded and Seamless Steel Hollow Sections for General Structural Purposes
AS 1204 Structural Steels—Ordinary Weldable Grades
AS 1205 Structural Steels — Weather Resistant Weldable Grades
AS 1227 General Requirements for the Supply of Hot-rolled Steel Plates, Sections, Piling and Bars for Structural Purposes
AS 1250 SAA Steel Structures Code
AS 1302 Steel Reinforcing Bars for Concrete
AS 1315 Portland Cement
AS 1317 Blended Cements
AS 1336 Code of Practice for Industrial Eye Protection
AS 1337 Industrial Eye Protection
AS 1338 Protective Filters against Optical Radiation in Welding and Allied Operations
AS 1450 Circular and Non-circular Carbon Steel Tubes for Mechanical and General Engineering Purposes
AS 1465 Dense Natural Aggregates for Concrete
AS 1466 Metallurgical Furnace Slag Aggregates for Concrete
AS 1470 Code of General Principles for Safe Working in Industry
AS 1480 SAA Concrete Structures Code
AS 1481 SAA Prestressed Concrete Code
AS 1554 SAA Code for Welding in Building
AS 1579 Arc Welded Steel Pipes for Water and Gas
AS 1715 Code of Practice for Respiratory Protection
AS 1720 SAA Timber Engineering Code
AS 1726 SAA Site Investigation Code
AS 1800 Code of Practice for Selection, Use and Care of Industrial Safety Helmets
AS 1801 Industrial Safety Helmets
AS 1832 Malleable Iron Castings
AS 1891 Industrial Safety Belts and Harnesses
AS 2074 Steel Castings for General Engineering Purposes
AS CA23 SAA Explosives Code
AS CZ18 Rules for Underwater Air Breathing Operations
SAA Int. 365 Piles (Eastern Australian Hardwoods)

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
RULES FOR THE DESIGN AND INSTALLATION OF PILING

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. These Rules (hereinafter referred to as 'the Code') apply to the design and installation of piles other than sheet piles and patented piles.

1.2 STANDARDS AND MATERIAL SPECIFICATIONS. The requirements of the Code are based on adherence to the Australian standards listed in the Preface, and unless otherwise noted a standard referred to in the Code is the latest edition thereof.

1.3 NEW MATERIALS AND METHODS. The Code shall not be interpreted to prevent the use of materials or of methods of design or construction not specifically referred to herein.

Information on materials other than those specified, and/or methods of design and construction not covered by the Code may be submitted to the SAA Committee on Piling for an expression of opinion as to compliance with the intent and spirit of the Code, and thereafter to the appropriate Building Authority or Authorities for approval.

NOTE: The Building Authority must always make the ultimate decision as to whether or not a material or method of design or construction may be used.

1.4 SUPERVISION.

1.4.1 General. The construction of all piles shall be carried out under the direction of the Supervising Engineer so as to ensure compliance with the Code.

1.4.2 Records. The information required in the Code shall be recorded and kept by the Supervising Engineer or the Superintendent (see Rules 4.1.7 and 5.1.3).

1.5 DEFINITIONS. For the purpose of the Code the definitions listed below apply. Terms not defined below shall have their ordinary accepted meanings or such meanings as the text implies.

1.5.1 Administrative Definitions.

1.5.1.1 *Approved* — approved by the Building Authority, or approved by the Designer (or supervisor) and the Building Authority.

1.5.1.2 *Building Authority* — a body having statutory powers to control the design and erection of buildings or structures in the area in which the building or structure is to be erected.

1.5.1.3 *Contract drawings* — the drawings forming part of the documents which specify the work to be executed.

1.5.1.4 *Designer* — the person responsible for the design of the piles.

1.5.1.5 *Qualified Engineer* — a person qualified for Corporate Membership of The Institution of Engineers, Australia, practising in the civil or structural field.

1.5.1.6 *Supervising Engineer* — a Qualified Engineer who is responsible for the supervision of construction.

1.5.1.7 *Superintendent* — the supervisor of the manufacture or installation of the pile acting under the direction of the Supervising Engineer.

1.5.1.8 *Specification* — the documents in which is set out the work to be executed.

1.5.2 Technical Definitions.

1.5.2.1 *Allowable load* — the load which may be safely applied to a pile after taking into account its ultimate capacity, pile spacing, pile settlement and other factors affecting its capability for developing resistance against the loads to which it will be subjected and allowing for a factor of safety in accordance with the Code.

1.5.2.2 *Bond anchor* — a tendon anchored into the ground by bond and used for test loading piles.

1.5.2.3 *Bored cast-in-place pile* — a pile, with or without a casing, formed by excavating or boring a hole in the ground and subsequently filling it with plain or reinforced concrete.

1.5.2.4 *Cased pile* — a pile formed in the ground by installing a casing and filling it with plain or reinforced concrete.

1.5.2.5 *Constant rate of penetration pile test* (CRP) — a load test whereby the pile is subjected to a constant rate of downward movement at the point of application of the load, and the load is continuously measured.

1.5.2.6 *Constant rate of uplift* (CRU) — a load test whereby the pile is subjected to a constant rate of uplift at the point of application of the load, and the load is continuously measured.

1.5.2.7 *Driven cast-in-place pile* — a pile formed by driving a casing, which is either permanent or temporary, and filling it with plain or reinforced concrete.

1.5.2.8 *Dolly* — a block of hardwood or other suitable material placed in the top of the helmet to transmit the blows of the hammer.

1.5.2.9 *Driven pile* — a prefabricated pile subsequently installed in the ground by driving.