Australian Standard®

PLASTICS PIPELAYING DESIGN

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The following interests were represented on the committee responsible for the preparation of this standard:

Department of Public Works, New South Wales

Engineering and Water Supply Department, South Australia

Federated Master Plumbers of Australia

Hunter District Water Board

Melbourne and Metropolitan Board of Works

Metropolitan Water Sewerage and Drainage Board, New South Wales

Plastics Institute of Australia Incorporated

Queensland Water Resources Commission

State Rivers and Water Supply Commission, Victoria

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PREFACE

This standard was prepared by the Association's Committee on Rigid PVC Pipe under the authority of the Plastics Standards Board. It constitutes the revision and metrication of AS CA68—1972, with editiorial updating, and which it accordingly supersedes. The ISO system of nomenclature with respect to pipe diameter has been adopted in conformity with changes made in recently published Australian standards.

The general design principles in this standard are based on Marston and Spangler's work at the Iowa Engineering Experiment Station on underground conduits. The general format and much of the data incorporated in AS CA33* have been used in the preparation of this standard. The committee considered the feasibility of presenting safe burial depths for pipes in tabular or graphical form. This approach was not possible because of the large variations of design factors to be incorporated in each calculation. The standard, however, enables calculation of the safe burial depth of all plastics pipes. The method of calculation is illustrated in Appendix C.

Only one formula for calculating the total vertical load acting on the pipe has been used in the standard, on the assumption that there is little difference in the load-sharing between the pipe and the side fill for the three types of laying conditions specified. Soil box tests have supported the calculations in the standard and long-term field testing has confirmed them.

Temperature derating factors have been given for E_c and Y, but it will be seen by calculation (and has been confirmed experimentally in soil box tests) that within the range of deflection (up to 5 percent), material temperature (up to 40°C) and values for modulus of soil reaction (up to 7 MPa) covered by this standard, the effect of temperature does not have a very great effect on deformation performance.

By using criteria and values set out in this standard, it is possible to design for the wide range of conditions likely to be met in practical situations. The design sequence for two such installations is illustrated in Appendix C.

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* AS CA33, Code of Recommended Practice for Concrete Pipe Laying Design.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard for PLASTICS PIPELAYING DESIGN

1 SCOPE. This standard sets out design practice for calculating loads, safe bedding depths, and vertical deflections for plastics pipes laid under a number of specified standard underground installation conditions. It applies to pipes with outside diameter 75 mm and above and vertical deflection not greater than 5 percent of the outside diameter. For pipe sizes below this, the safe burial calculated by this standard for the 75 mm outside diameter pipe size may be used.

This standard applies to the use of smooth circular pipes made from UPVC or polyethylene. It can also apply to pipes of other plastics materials by the substitution of appropriate values in Tables 1, 2, 3, 5, and 6 for the particular pipe material.

2 APPLICATION. This standard provides a basis for assessing the loads on plastics pipes under various installation conditions and for selecting the appropriate pipe class for the particular installation from the standards applicable to the installation for a maximum allowable vertical deflection of 5 percent of the pipe outside diameter.

3 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

AS 1159 Polyethylene (Polythene) Pipe for Pressure Applications

AS 1289 Methods of Testing Soils for Engineering Purposes
1289.E1.1 — Part E — Soil Compaction and Density Tests — Determination of the Dry Density/Moisture Content Relation of a Soil Using Standard Compaction — Standard Method

AS 1477 Unplasticized PVC (UPVC) Pipes and Fittings for Pressure Applications
Part 1 — UPVC Pipes for Pressure Applications

4 DEFINITIONS. For the purpose of this standard, the following definitions apply:

Pipe — a single length of pipe.

Superimposed load — a load, concentrated or distributed, static or dynamic, applied at the surface of the fill material.

Diametral deflection — the change in diameter of the pipe.

Earth — all natural material other than rock.

Rock — an unyielding natural foundation.

Bedding material — soil of $K\mu$ value not less than that assumed in the laying conditions design (see Tables 1, 2 and 3) with moisture content as appropriate to the degree of compaction required, substantially free from rock or other hard particles that would be retained on a 13.2 mm sieve and free from lumps of soil having any dimension greater than 75 mm. The bedding material may comprise selected fill material or may require to be imported, should the excavation material be unsuitable.

Compaction — consolidation of fill material. (See Clause 6.1.)

5 NOTATION AND VALUES OF VARIABLES. The following notation shall apply in this standard:

B = width of trench, measured at the level of the top of the pipe, in metres

NOTE: For trench of unknown width, see Clause 6.6.

C_t = a coefficient used in the calculation of the vertical load on a pipe due to the weight of fill material when the pipe is installed under trench conditions (see Fig. 2).

C_e = a coefficient used in the calculation of the vertical load on a pipe due to the weight of fill material when the pipe is installed under positive projection embankment conditions (see Fig. 3)

NOTE: The original reference article for methods of calculating C_e is Bulletin 170, IOWA Engineering Experiment Station (1950).

C_n = a coefficient used in the calculation of the vertical load on a pipe due to the weight of fill material when the pipe is installed under negative projection embankment conditions (see Figure. 4)

NOTE: The original reference article for methods of calculating C_n is by M.G. Spangler in Highway Research Board (U.S.) Proceedings (1950).

C_u = a coefficient used in the calculation of the vertical load on a pipe due to a uniformly distributed superimposed load when the pipe is installed under trench conditions (see Fig. 5)

C_p = a coefficient used in the calculation of the vertical load on a pipe due to concentrated superimposed loads when the pipe is installed under any of the conditions (see Fig. 6)

D_e = the nominal diameter of the pipe, in metres

D_m = the mean outside diameter of the pipe, in metres

D = mean diameter of the pipe, in metres
= $D_m - T$