AS 3725 Supplement 1—1989

Loads on buried concrete pipes—Commentary

(Supplement to AS 3725—1989)

This Australian Standard was prepared by Committee WS/6, Concrete Pipes. It was approved on behalf of the Council of Standards Australia on 11 September 1989 and published on 15 December 1989.

The following interests are represented on Committee WS/6:

Australian Construction Services
Board of Works, Melbourne
Confederation of Australian Industry
Engineering and Water Supply Department, S.A.
Hobart City Council
Municipal Association of Victoria
National Association of Australian State Road Authorities
Public Works Department, N.S.W.
Railways of Australia Committee
Rural Water Commission, Vic.
State Electricity Commission, Vic.
Water Board, Sydney
Water Resources Commission, Qld

This Standard was issued in draft form for comment as DR 86014.

AS 3725 Supplement 1—1989

Loads on buried concrete pipes—Commentary

(Supplement to AS 3725—1989)

First published as AS 3725 Supp1—1989.

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

ISBN 0 7262 5946 2

PREFACE

This Commentary was prepared by the Standards Australia Committee on Concrete Pipes. It is intended that it be read in conjunction with AS 3725, *Loads on buried concrete pipes*, but does not form part of that Standard.

In revising CA33—1962 the committee considered it desirable that only necessary requirements be detailed in the new Standard and that any additional explanations, advice or comments (based on experience gained over the years) be brought to the attention of the design engineer and other users of the Standard by this Commentary.

It is not intended that the Standard should be interpreted as preventing the use of methods of load assessment other than those specified, as indeed such alternative methods will possibly be required for circumstances not covered by the Standard. However, the committee considers that in the more usually encountered situations, the methods outlined in the Standard are those most acceptable to all concerned, due to their relative simplicity and the length of satisfactory experience so far obtained in their application.

For ease of cross-reference, clause numbers and titles used in the Commentary are the same as those used in the body of the Standard but are prefixed with the letter C. Figures, however, are designated C1, C2 etc, and do not correspond to those in the Standard.

The clause numbers of this document are not sequential because if no commentary is required the clause has been omitted.

References noted in the Commentary text are listed at the end of the Commentary.

Appendix A of the Commentary contains a number of examples illustrating the application of the Standard to the selection of an appropriate pipe from AS 1342 or AS 1392. The examples are in the form of typical selection problems each followed by a worked solution.

CONTENTS

		Page
C1	SCOPE AND GENERAL	3
C4	DEFINITIONS	3
C5	NOTATION	4
C6	VERTICAL LOADS ON PIPES	4
C8	COMPACTION	9
C9	PIPE SUPPORT AND BEDDING FACTORS	10
C10	TEST LOADS	12
	REFERENCES	14
	APPENDICES	
A	EXAMPLES OF THE APPLICATION OF PROVISIONS OF AS 3725	15
B	UNIFIED SOIL CLASSIFICATION SYSTEM	25

STANDARDS AUSTRALIA

Australian Standard

Loads on buried concrete pipes—Commentary (Supplement to AS 3725—1989)

C1 SCOPE AND GENERAL. The main purpose of the Standard is to provide an agreed basis for determining the vertical working loads on installed reinforced and unreinforced concrete pipes and to relate this to the loads applied to sample pipes in the standard load tests, so that an appropriate 'strength class' of pipe can be selected from AS 1342 or AS 1392, as applicable, which will be suitable for the particular field application.

Designers should be aware that installed pipes may also be subjected to non-vertical loads of considerable magnitude (e.g. at the toe of a slope). The vertical and horizontal components of such loads should be carefully assessed and appropriate action taken to ensure that they can be resisted by the pipes and adequately transferred to the foundations.

A secondary purpose of the Standard is to reduce the large variety of likely installation conditions and bedding choices to a small number of representative types.

Like AS CA33—1962, the Standard is based on the work of Spangler (Reference 3) and others of the Iowa Engineering Experimental Station, in relation to trench conditions. The more recent work of the California Department of Transportation has been utilized for embankment assessments and this is reflected in higher bedding factors in the Standard compared with AS CA33—1962. Bridge design rules published by ANZRC in 1974 (Reference 1) and NAASRA in 1976 (Reference 2) and their general acceptance since then, have allowed fuller treatment of railway and highway live loads to be presented here.

The most recent research in the United States and elsewhere has centred on computer-aided methods of mathematical modelling and finite-element analysis for both load and pipe stress assessments. Although this appears to be the future direction of analysis and design, there are as yet insufficient practical data available to justify incorporating the results of these assessments in a Standard of this nature.

Methods of pipe laying and bedding preparation are not stipulated in the Standard because the continuing and rapid development of specialized earthmoving equipment and procedures would soon render such requirements obsolete. However in Paragraph C8, detailed procedures for haunch compaction are outlined, as experience has indicated this to be one of the most difficult aspects of circular pipe bedding. Attention is also drawn to Reference 15 which contains much useful information on the subject.

Compaction percentages have been included in an attempt to be more specific with regard to bedding and backfill compaction requirements. For sidefill the compaction percentages have been given for both cohesive and cohesionless soils to emphasize that some measure of cohesiveness is acceptable in the select fill. This policy has been adopted having regard to the high cost of imported material and to the ever-increasing range of compaction equipment which makes it possible to use effectively a wider range of materials.

Bedding shaped to fit the outside diameter of the pipes, which was specified in AS CA33—1962, has now been omitted as there has been a definite trend away from this in Australia.

C4 DEFINITIONS.

Bedding. See Clause C9.

Bedding factor. See Clause C9 for derivation and Clause C10 for application.

Fill. The term 'fill' is used throughout with a qualifier indicating particular requirements as follows:

(a) *Backfill or embankment fill.* The Standard deals with the backfill and embankment fill from the aspect of pipe performance only. In installations involving road and railway embankments, or trenches through urban areas, the stability criteria for the finished surface above the pipes may impose more restrictive requirements on the fill specification.

(b) *Ordinary fill.* The restrictions on size and percentage of stones in ordinary fill are to facilitate compaction in restricted areas and to limit damage to the pipes during placement and compaction.

(c) *Select fill.* The relevant classification information from Appendix D of AS 1726 has been reproduced as Appendix B of this Supplement. Select fill covers material classed as 'coarse-grained soils' in the 'Unified soil classification' with the exclusion of the silty-soil classes GM (silty gravels) and SM (silty sands). Such materials contain more the 50% of hard granular material (usually sand or gravel particles greater than 0.075 mm diameter) and less than 50% of clay materials.

Closer grading limits are given in Clause 9.2 for select fill suitable for use in the pipe support zones.

Foundation. Pipelines are installed for many purposes and in a variety of naturally occurring conditions. The foundation material must be able to support the loads placed on it and should be carefully graded or excavated to provide an even bed and maintain alignment of the pipes. The trench width should be the minimum necessary to permit the pipes to be properly laid and the fill compacted.

Very soft or expansive clays, irregular or fragmented rock, and saturated soils, particularly those containing aggressive groundwaters, are all unsuitable foundations and should be avoided. Where avoidance is impracticable, most of these situations may usually be overcome by adequate drainage of groundwater, removing the unsuitable material and replacing it with compacted select borrow material, cement-treated soils, or concrete. Where some or all of such actions are not possible, it may be necessary to have recourse to piling (see Clause C9.3).