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Guide to the structural design of buried pipelines

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The following BSI references relate to the work on this standard:
Committee references B/505, B/504
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Summary of pages
This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 60, an inside back cover and a back cover.

Publishing information

This British Standard is published by BSI and came into effect on 31 March 2010. It was prepared by Technical Committee B/505, *Wastewater engineering* in consultation with Technical Committee B/504, *Water supply*. A list of organizations represented on these committees can be obtained on request to their secretaries.

Relationship with other publications

This British Standard is complementary to BS EN 1295-1:1997 and PD CEN/TR 1295-2:2005.

BS EN 1295-1:1997 specifies general requirements for the structural design of buried pipelines under various conditions of loading. Guidance is also given on the application of the nationally established methods of design declared by, and used in, CEN member countries at the time it was prepared. The established United Kingdom method is summarised in **B.2.12**, and National Annex A describes the calculation procedure in more detail.

PD CEN/TR 1295-2:2005 summarizes the nationally established methods of design made available to CEN and the United Kingdom method is described in **A.9**, which is consistent with BS EN 1295-1:1997, National Annex A, as corrected by Corrigendum No. 1 on 31 May 2006.

This British Standard gives further information to facilitate in full the structural design of buried pipelines under various conditions of loading using the established United Kingdom method; it does not alter any of the provisions of BS EN 1295-1:1997.

Whilst recognizing that the UK National Annex to EN 1295-1 might be reviewed in the future in respect of possible changes to current practice for the design of thermoplastics pipelines, it was agreed that this first edition of BS 9295 is specifically required to be a guide to the existing BS EN 1295-1.

Use of this document

As a guide, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it was a specification or a code of practice and claims of compliance cannot be made to it.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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The established United Kingdom method for the structural design of buried pipelines under various conditions of loading ("the UK method") is based on the "Marston" or "Computed load" method developed at the Iowa Engineering Experiment Station in the USA by Professor Anson Marston and his colleagues Professors Merlin G. Spangler and W.J. Shlick in the first half of the twentieth century. In 1951, at the request of the then Ministry of Housing and Local Government, a 10-year programme of experimental work was carried out at Garston by the Building Research Station (later the Building Research Establishment). The work was led by N.W.B. Clarke, supported by Oliver C. Young and J.H. Smith and in 1962 resulted in the publication of *Simplified tables of external loads on buried pipelines* [1], followed in 1966 by *Loading charts for the design of buried rigid pipes* [2] and in 1967 by *High-strength beddings for unreinforced concrete and clayware pipes* [3]. In 1970 an updated and revised *Simplified tables of external loads on buried pipelines* [4] was published.

Throughout the 1960s the Marston work was complemented by a programme of research on rigid pipe beddings at the British Ceramic Research Association at Stoke-on-Trent, sponsored by the Clay Pipe Development Association and led by John H. Walton. This phase of the Stoke-on-Trent investigations culminated in 1970 with the publication of *The structural design of the cross-section of buried vitrified clay pipelines* [5], but by then the work had moved on into minimum beddings for small diameter pipes. That research was led by Colin E.G. Bland, whose work in chairing the B/505 project group that developed this British Standard is acknowledged by both B/504 and B/505. In 1975 the use of minimum beddings for rigid pipes not exceeding DN225 was endorsed by the Department of the Environment's Working Party on Sewers and Water Mains in its First Report [6].

By 1983 the United Kingdom central role in this field had passed from the Building Research Station to the Transport and Road Research Laboratory (now the Transport Research Laboratory) and, based on work by Oliver C. Young and Myles P. O'Reilly, it published *A guide to design loadings for buried rigid pipes* [7]; there was no longer any limit on the size of rigid pipes that could be used with minimal bedding. In 1986 a further edition of *Simplified tables of external loads on buried pipelines* [8] was published, based on work by the same authors and Guy Brennan. BSI gratefully acknowledges the permission kindly granted by Her Majesty's Stationery Office to draw heavily on the texts of these two publications in the preparation of this British Standard.

In 1989 a joint working group of CEN/TC 164 *Water supply* and CEN/TC 165 *Wastewater engineering*, led by the latter, was created to develop a common method for the structural design of buried pipelines. The varying practices throughout Europe and the huge task of agreeing a common method led the group to adopt what became a three-stage approach. The first stage was to produce an EN specifying general requirements and giving guidance on the application of nationally established methods; this was achieved in 1997 and implemented by BSI as BS EN 1295-1:1997. The second stage was to collate and summarize the various nationally established methods of design that had been reported in Europe and this was published by BSI as PD CEN/TR 1295-2:2005.

was decided to stop work on an EN, since the human and financial resources necessary were no longer available. By then the draft had been distilled into two separate methods, broadly speaking those used in France and the Germanic countries, and so it was decided to publish these as what became CEN/TR 1295-3:2007. The United Kingdom recorded opposition to the proposed Technical Report at CEN formal vote stage because the two methods not only give widely varying results for the same input data for both rigid and flexible pipes, but neither produces equivalent results to the UK method described in BS EN 1295-1:1997, which has been proven both by research and practice correlating theory and practice for both rigid and flexible pipes.

More recent research work indicates a possible need for revision of the design method for buried thermoplastics pipes to be included in a future revision of BS EN 1295-1.

BSI is not obliged to publish CEN Technical Reports and so, on the advice of B/505, supported by B/504, did not do so in the case of CEN/TR 1295-3:2007.

The method for semi-rigid pipes in BS EN 1295-1:1997 was taken from published and unpublished work by C. Barrie Greatorex at Stanton plc.

The aim of this British Standard, therefore, is to consolidate and update the various documents that together describe the UK method. The opportunity has also been taken to expand on the published information and in this connection both B/504 and B/505 acknowledge the kind permission of MWH (Montgomery Watson Harza) UK Ltd. to incorporate work developed by the late Jonathan L. Olliff, for many years a member of both committees and principal UK expert in the CEN joint working group.

1 Scope

This British Standard gives information and guidance for the use of BS EN 1295-1:1997, National Annex A, the UK established method for the structural design of buried pipelines under various conditions of loading. The procedures are explained and, for situations where general assumptions can be made, loading tables are given.

NOTE The scope of BS EN 1295-1:1997 is restricted to the structural design of water supply pipelines, drains and sewers, and other water industry pipelines, whether operating at atmospheric, greater or lesser pressure.

The design for longitudinal effects is not covered (see BS EN 1295-1:1997, **5.4**).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 545, *Ductile iron pipes, fittings, accessories and their joints for water pipelines – Requirements and test methods*