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Thermal performance of buildings — Thermal design of foundations to avoid frost heave

Performance thermique des bâtiments — Conception thermique des fondations pour éviter les poussées dues au gel

Reference number
ISO 13793:2001(E)

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of member bodies casting a vote.

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International Standard ISO 13793 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 163, *Thermal insulation*, Subcommittee SC 2, *Calculation methods*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read "...this European Standard..." to mean "...this International Standard...".

Annexes A, B and C form a normative part of this International Standard. Annexes D and E are for information only.

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Foreword

The text of EN ISO 13793:2001 has been prepared by Technical Committee CEN/TC *89 "Thermal performance of buildings and building components*", the secretariat of which is held by SIS**,** in collaboration with Technical Committee ISO/TC 163 "*Thermal insulation*".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2001, and conflicting national standards shall be withdrawn at the latest by September 2001.

References to International Standards that have also been published as European Standards are given in normative annex ZA, which is an integral part of this European Standard.

Annexes A, B and C form an integral part of ISO 13793. Annexes D and E are for information only.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Frost heave is the deformation of a building due to ice lenses in the ground below it, which can occur when soil freezes under the foundations or other structural members in contact with the soil. This is relevant to the design of building foundations in climates where the depth of penetration of frost into the ground may exceed the minimum foundation depth necessary for structural reasons.

Not all types of soil are susceptible to frost heave (this is discussed in annex D).

The risk of frost heave can be avoided in various ways. One is to have foundations deep enough so as to be below the frost penetration depth. Thus, special design procedures for frost heave are not necessary for buildings with basements extending more than the frost penetration depth below ground level (except to ensure the use of suitable backfill material that will not adfreeze to the basement wall).

Another possibility is to remove the frost-susceptible soil down to a depth below the frost penetration depth, and replace it with material that is non-susceptible to frost before constructing the foundations.

A third option is to insulate the foundations so as to avoid frost penetrating below the foundations. In cold climates the latter option is frequently the most economic as it allows shallower foundations, and this standard gives methods for determining the width, depth, thermal resistance and placement of insulation in the foundation region in order to reduce the risk of frost heave to a negligible level.

In unheated buildings the heat available from the building itself is less than with heated buildings, and more perimeter insulation is needed to protect the foundations.

The procedures in this standard are essentially those that have been used in the Nordic countries over many years, and have been found to be satisfactory in practice in preventing frost heave. They are based on the results of dynamic computer calculations, which took account of the annual temperature cycle, the heat capacity of the ground, the latent heat of freezing of water, etc., and which have been validated by experimental data from actual constructions.

The standard is concerned with ensuring that the ground below the foundation (if frost-susceptible) does not become frozen. In permafrost areas (annual average temperature less than 0 °C), the appropriate design may, by contrast, be based on maintaining the ground fully frozen for the whole year. That involves quite different solutions that are not considered in this standard.