International Standard 7845

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Horizontal joints between load-bearing walls and concrete floors — Laboratory mechanical tests — Effect of vertical loading and of moments transmitted by the floors

Assemblages horizontaux entre murs porteurs et planchers en béton — Méthodes d'essai mécanique en laboratoire — Sollicitations résultant de l'application de charges verticales et de moments transmis par les planchers

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7845 was prepared by Technical Committee ISO/TC 59, *Building construction*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Horizontal joints between load-bearing walls and concrete floors — Laboratory mechanical tests — Effect of vertical loading and of moments transmitted by the floors

0 Introduction

The analysis of structures with load-bearing walls and floors has shown the importance of the role that can be played by joints between the walls and floors.

Modern methods of calculation allow the influence of these joints to be taken into account when sufficient knowledge of their behaviour is available, and the purpose of this International Standard is, therefore, to provide a method for the experimental determination of the principal elements of the behaviour of some of these joints.

This International Standard does not deal with the interpretation or use of the test results. In particular, as these are tests which are often difficult to perform in large numbers, this International Standard does not specify a minimum repetition factor. Attention is drawn, however, to the dispersion which often affects the results of such tests and to the desirability of repeating several times those tests which are most representative of the real conditions.

Modern methods of calculation rely on knowledge of the mechanical properties of horizontal joints between load-bearing walls and floors. These properties relate to the limit states for cracking, rupture and excessive deformation. In addition, the verification of the limit states of the walls themselves takes into account the influence of the deformability of the joints on the interaction between walls and floors. This International Standard provides test methods which can be used to determine the corresponding mechanical properties.

1 Scope

This International Standard specifies methods of test for the determination of the mechanical properties of horizontal joints between load-bearing walls and concrete floors subjected to vertical loading and moments transmitted by the floors.

2 Field of application

This International Standard is applicable to horizontal joints between load-bearing walls and concrete floors which are intended to transmit the moments of the floors to the walls. The walls may be interior or exterior walls, supporting a floor on one or on both sides.

The walls may be of masonry made up of units of small or medium dimensions (stone, solid, perforated or hollow bricks, solid or hollow blocks of heavy- or lightweight concrete. They may also be made of prefabricated units of big dimensions (large panels).

This International Standard is applicable in the case of effects on the joints resulting from the transmission by the upper wall of vertical loads N displaced from the centre of the wall by a distance e and from the transmission by the floor of vertical loads T and moments M (see figure 1).

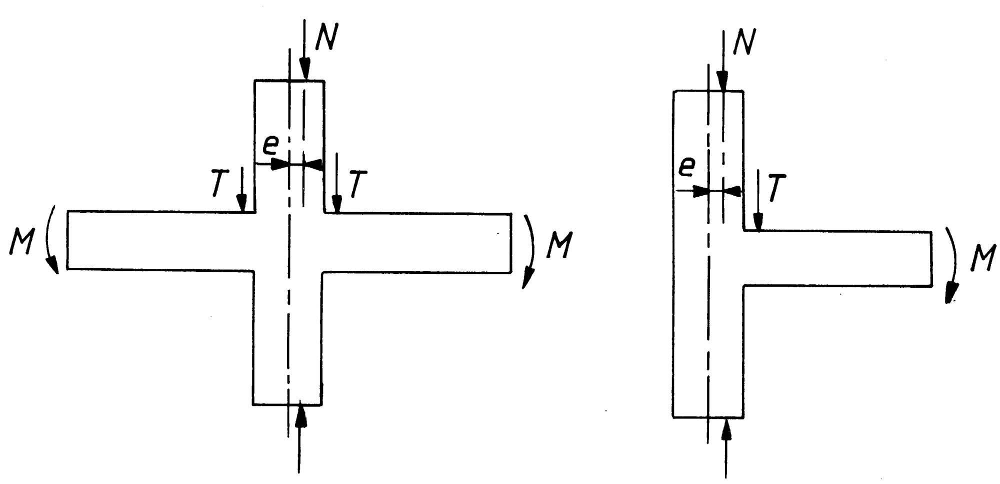

Figure 1

3 Principle

Submission of test pieces, made of wall and floor segments connected by a joint, to combinations of forces representing the vertical loads transmitted by the wall of the storey above and the vertical loads and moments transmitted by the floor(s). Noting the deformation of the test pieces and deterioration (cracking and failure) for the different combinations of forces.

4 Test apparatus

The test apparatus shall allow application of the forces and reactions necessary for the simulation of the conditions defined after structural analysis of the joint and for the limit states to be considered.

In general, in order to satisfy this requirement, the test apparatus shall be able

— to ensure good distribution of loads over the length and thickness of the ends of the test piece,

— to allow rotation of the ends,

— to allow the application of loads and moments to floors.

In general, this requires that traditional presses, where the upper plate is equipped with a spherical swivel, should incorporate the following additional devices :

a) two longitudinal articulated devices placed between the platens of the press and the horizontal ends of the test piece, designed to meet the first two conditions above;

b) a single or dual device which, when fixed on the floors of the test piece, allows the selected loads and moments to be applied to the floor.

Figure 2 shows diagrammatically, as an example, three principles for assembly in the case of walls bearing two floors. Only that shown in c) allows the load and the moment transmitted by the floors to be varied independently.

Furthermore, it should be noted that some modifications of the test apparatus are necessary if the actual conditions in which the joints are used prevent horizontal displacements of the floor edges. As an example, figure 3 shows diagrammatically such modifications for joints with a floor on only one side.

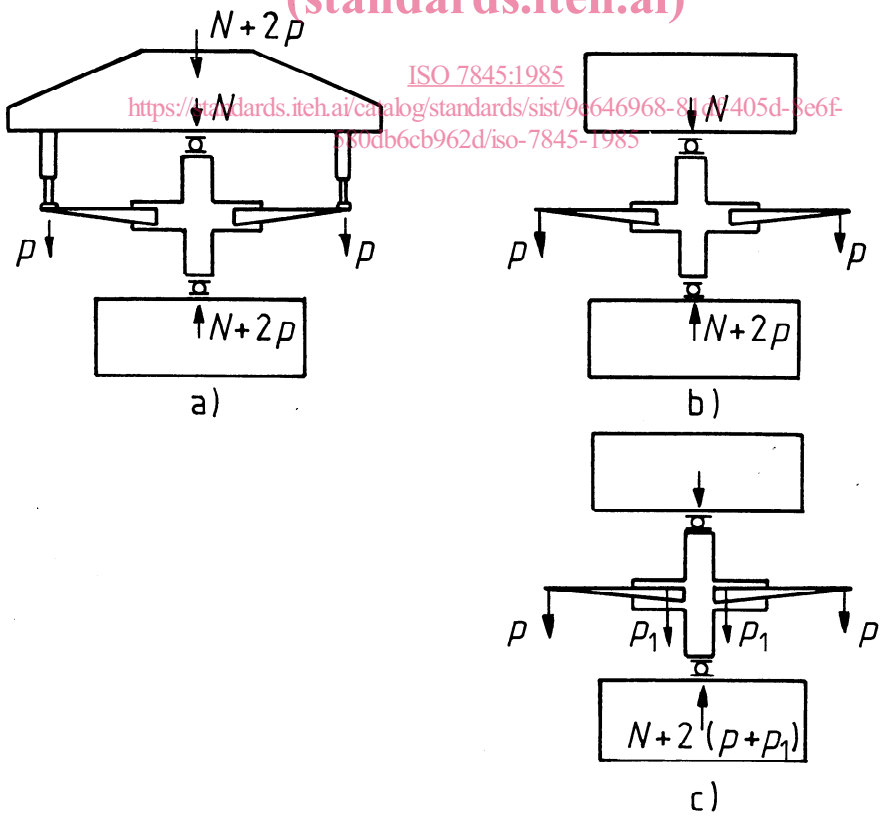

Figure 2

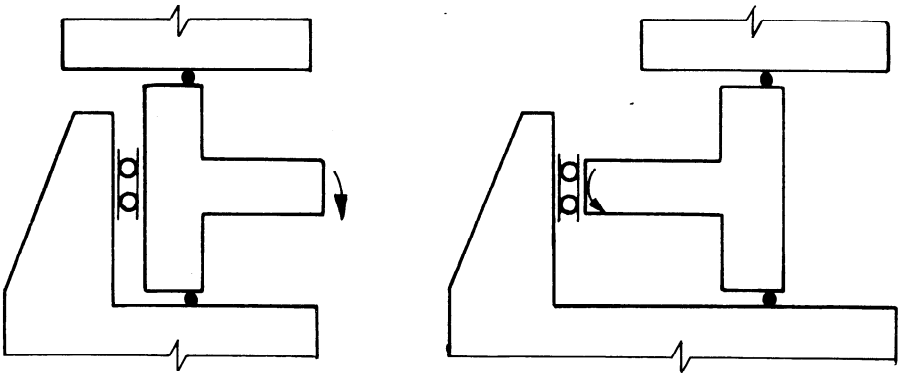

Figure 3

5 Test pieces

5.1 Composition and dimensions

5.1.1 Composition

The composition of the test pieces shall be in accordance with that of the actual joints and the dimensions shall be determined in such a way that any local particularities of the joints will be properly represented.

5.1.2 Length

The mean basic length of the test pieces shall be about 800 mm. For joints of constant composition along the whole length, the length of the test pieces may be reduced, the minimum length being that deemed necessary for the material or masonry constituting the walls.

If the actual joint does not have a constant composition and form along the whole length, the test piece shall be sufficiently long to include, in the same proportions as in the actual joint, the different composition and forms found in the joint.

5.1.3 Height

The height of the test pieces shall be chosen so that

— there is no influence from the slenderness ratio, and

— the contact of the platens of the press with the ends of the test piece does not have an influence.

NOTE — A height of 500 to 600 mm for each of the upper and lower segments of wall is usually sufficient to ensure compliance with these requirements.

5.1.4 Width of floor segments

If reinforcement in the joint is anchored in the floor, the width of the floor segments shall allow for the necessary anchorage.

In all other cases, the choice of the width of the floor segment is left to the test operator.

NOTE — Figure 4 shows, for information only, possible test pieces for determinations on joints with a floor on one side only of the wall, for two particular cases of masonry walls and one use of prefabricated units.

5.2 Preparation

The method of preparing the test pieces shall be chosen so as to represent as closely as possible the conditions of assembly corresponding to current practice, in particular concerning

— the bonding of masonry units;

— their humidity;

— the composition, thickness and compactness of the mortar of the joints;

— the temperature during the preparation of the masonry;

— the composition, compactness and thermal curing of concrete in prefabricated units;

— the time lapse to be observed between the different stages in the preparation of the test pieces;

— the composition, compactness and hardening conditions for the infill concrete, etc.

When the test pieces are made of several units whose interconnection cannot resist without deterioration the stresses of handling and transport to the test apparatus, the units should be equipped with devices to connect them sufficiently rigidly so that the joint itself is not stressed. The location of these devices in the units should be chosen so that the behaviour of the joint is not affected.

Dimensions in millimetres

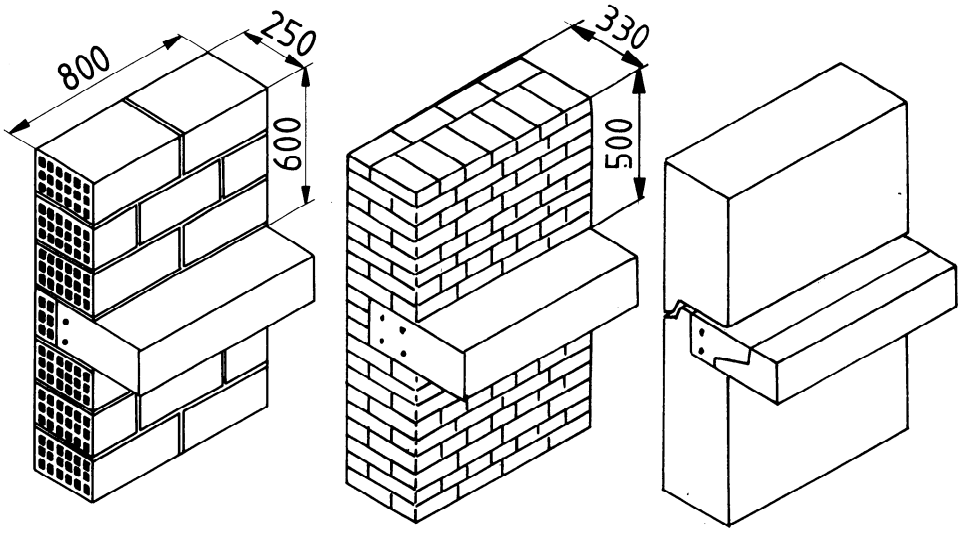

Figure 4

5.3 Rectification of bearing surfaces

Rectification of bearing surfaces has generally to be carried out in order to avoid the influence of local stresses due to non-uniform contact between the bearing surfaces of the test piece and the platens of the press or the platens of the auxiliary longitudinal hinges.

This may be done by one of the following methods :

a) Construct the test piece directly on a very rigid sill, the underside of which is flat and horizontal.

Add to the top of the test piece a very rigid sill the upper face of which is flat and horizontal. The sill may be a reinforced concrete beam or a part set up in mortar or resin.

b) Place between the test piece and the platens of the test apparatus or the platens of the auxiliary longitudinal hinges a sheet of cardboard, fibreboard or plywood.

This method can only be used if defects in the flatness of the upper and lower faces of the test piece do not exceed about 1 mm.

c) Polymerize a layer of synthetic resin between the test piece and the synthetic platens of the test apparatus or the platens of the auxiliary longitudinal hinges. The modulus of elasticity of the polymerized resin shall be of the same order of magnitude as the modulus of the materials constituting the wall segments of the test piece.

6 Procedure

6.1 Structural parameters under test

The structural parameters which are tested are of two types, i.e.

a) a value which remains constant throughout the test : eccentricity e of the loads applied to the wall. Except for special cases, it is considered equal at the two ends of the test piece;

b) Values which can vary during the test :

— the load applied to the wall which does not have the same value at the two ends of the test piece (see figure 2) because of the loads exerted by the floor;

— the forces applied to the floor and which determine, either independently or not, depending on the test arrangement, both the shearing force in the fixed end of the floor sections and the moment M in these sections;

— rotation θ of the floor at the fixed end which is linked to the preceding value can be considered to be the principal parameter, the forces applied to the floor being regulated to obtain the rotations required by the test programme;

— forces applied to the joint to prevent horizontal movement of the floors.

6.2 Preliminary cycles of loading-unloading

Two cycles of loading-unloading shall be carried out before beginning the procedure. For this purpose the test piece shall be loaded to about 30 % of the load corresponding to the expected limit state and θ shall then be increased to reach about 30 % of the value θ_1 in procedure b) (see 6.3.1). Unloading is carried out by progressively cancelling the moment applied to the floor, then by bringing the normal load N to a value N_0 equal to about 1/5 of the load reached during the cycle (see figure 5).

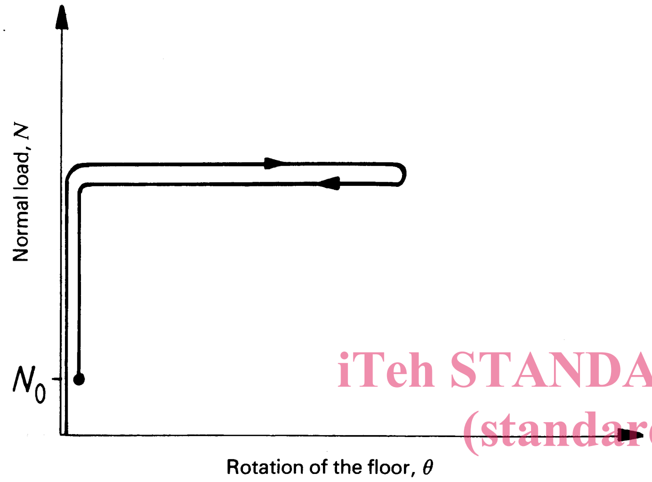

Figure 5

6.3 Choice of procedure

Various loading procedures or sequences may be used. They are shown diagrammatically by figure 6.

6.3.1 Principal procedures

a) Apply a given load N and keep it constant. Then gradually increase the moment M until the limit state for cracking, rotation θ or failure occurs [see figure 6 a)].

b) Apply a small vertical load N_1 and then set the moment M so that the rotation reaches the value θ_1 chosen in advance. Then, whilst regulating M so as to keep the rotation constant and equal to θ_1, increase the value of N until the limit state is attained [see figure 6 b)].

6.3.2 Other procedures

Other procedures are possible [see figure 6 c), d) and e)].

6.4 Conduct of the test

After two loading-unloading cycles have been completed, carry out the test until the limit state is attained using the procedure chosen. The increase in loads and deformations shall be carried out step by step, of increments chosen in such a way that, taking into account the known or estimated limit state, this is reached after about 10 steps.

The rate of increase of load shall be as constant as possible, regulated so that each step lasts 1 or 2 min.

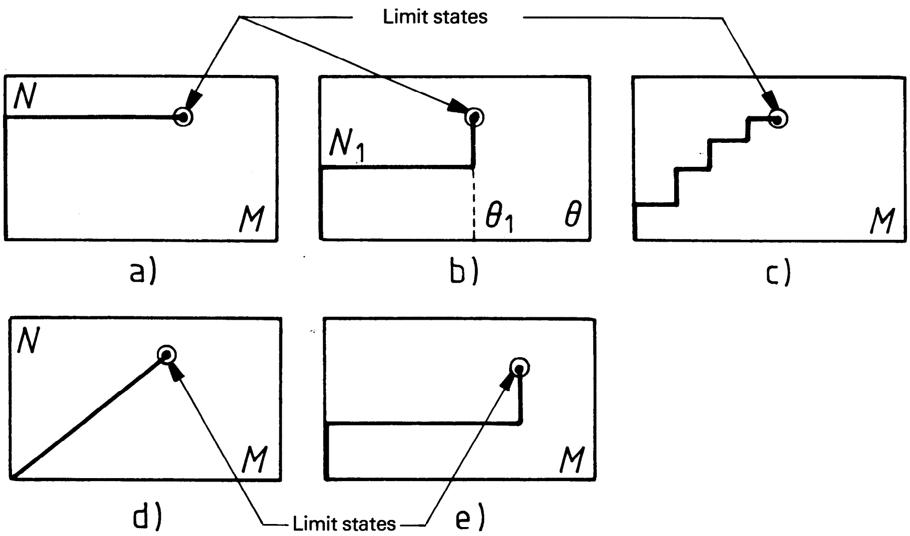

Figure 6

6.5 Measurements

After each stepwise increase, note the value of the loads, in newtons, applied to the wall and floor and the resulting deformations.

6.5.1 Deformations

There are two types of deformations :

a) shortening or elongation of the wall surfaces and of certain layers constituting the joint (layer of mortar, part of floor included in the joint, etc.) [see figure 7 a) on which the bases for measurement are illustrated]; these are expressed as percentages;

b) rotations of segments of the wall or floor relative to each other [see figure 7 b) which illustrates the location of the device for measuring rotation]; these are expressed in radians.

6.5.2 Origin of measurements

The origin of measurements shall be the value obtained for all parameters measured at the end of the preliminary cycles of loading-unloading when the load is equal to N_0 (see 6.3).

7 Test report

The test report shall include the following information :

a) dimensions of the test pieces;

b) position of measuring apparatus and points of application of loads;

c) method of rectification;

d) diagram of the test installation;

e) value of the loads and rotation of the floors which were obtained during the preliminary cycles of loading-unloading;

f) the test programme characterized by the procedure identified by reference to figure 6, by reference values such as N_1 and θ_1 by the values of the loads attained during the successive increase in loading;

g) for each increment of increasing load, the values of the loads applied and the values of the measured deformations;

h) the formation of any cracks and their development characterized by the position of the ends of crack for each level of load;

j) the location, appearance and loads at rupture.

If necessary, the test report may be combined advantageously with the test report concerning the simple compression test of a wall segment.[1)]

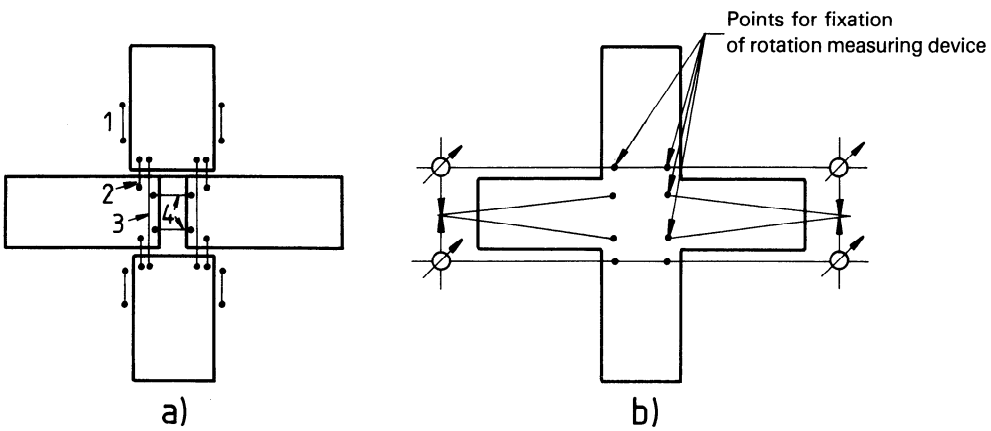

Figure 7

1) This test gives the resistance to simple compression of a standard section of the wall without any influence of the joint of slenderness or eccentricity. It is often necessary to know this resistance for the interpretation of the results of tests on joints.