# SLOVENSKI STANDARD
# SIST EN 15050:2007

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**Montažni betonski izdelki - Elementi za mostove**

Precast concrete products - Bridge elements

Betonfertigteile - Fertigteile für Brücken

Produits préfabriqués en béton - Eléments de ponts



**Ta slovenski standard je istoveten z:** **EN 15050:2007**

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# Precast concrete products - Bridge elements

Produits préfabriqués en béton - Eléments de ponts

Betonfertigteile - Fertigteile für Brücken

This European Standard was approved by CEN on 28 February 2007.

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The numbering of clauses is strictly related to EN 13369:2004 Common rules for precast concrete products, at least for the first three digits. When a clause of EN 13369 is not relevant or included in a more general reference of this standard, its number is omitted and this may result in a gap on numbering

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# Foreword

This document (EN 15050:2007) has been prepared by Technical Committee CEN/TC 229 “Precast concrete products”, the secretariat of which is held by AFNOR and was examined by and agreed with a joint working party appointed by the Liaison Group CEN/TC 229-CEN/TC250, particularly for its compatibility with structural Eurocodes.

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of an identical text or by endorsement, at the latest by November 2007, and conflicting national standards shall be withdrawn at the latest by February 2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This document is one of a series of product standards for precast concrete products.

For common aspects reference is made to EN 13369: *Common rules for precast products*, from which also the relevant requirements of the EN 206-1: *Concrete — Part 1: Specification, performances, production and conformity* are taken.

The references to EN 13369 by CEN/TC 229 product standards are intended to make them homogeneous and to avoid repetitions of similar requirements.

Eurocodes are taken as a common reference for design aspects.



The installation of some structural precast concrete products is dealt with by ENV 13670-1: *Execution of concrete structures – Part 1: Common rules*, which has at the moment the status of a European prestandard. In all countries it can be accompanied by alternatives for national application and it shall not be treated as a European Standard.



The programme of standards for structural precast concrete products comprises the following standards, in some cases consisting of several parts:

EN 1168, *Precast concrete products — Hollow core slabs*

EN 12794, *Precast concrete products — Foundation piles*

EN 12843, *Precast concrete products — Masts and poles*

EN 13224, *Precast concrete products — Ribbed floor elements*

EN 13225, *Precast concrete products — Linear structural elements*

EN 13693, *Precast concrete products — Special roof elements*

EN 13747, *Precast concrete products — Floor plates for floor systems*

EN 13978, *Precast concrete products — Precast concrete garages*

EN 14843, *Precast concrete products — Stairs*

EN 14844, *Precast concrete products — Box culverts*

EN 14991, *Precast concrete products — Foundation elements*

EN 14992, *Precast concrete products — Wall elements*

EN 15050, *Precast concrete products — Bridge elements*

prEN 15037, *Precast concrete products — Beam-and-block floor systems*

prEN 15258, *Precast concrete products — Retaining wall elements*

This standard defines in Annex ZA the application methods of CE marking to products designed using the relevant EN Eurocodes (EN 1992-1-1 and EN 1992-1-2). Where, in default of applicability conditions of EN Eurocodes to the works of destination, design Provisions other than EN Eurocodes are used for mechanical strength and/or fire resistance, the conditions to affix CE marking to the product are described in ZA.3.4.

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

## Introduction

The evaluation of conformity given in this European Standard refers to the completed precast concrete elements for bridges that are supplied to the market and covers all the production operations carried out in the factory.

For design rules and resistance to fire reference is made to EN 1992-1-1 and EN 1992-1-2. Additional complementary rules are provided where necessary.

In 4.3.3 and 4.3.4 this European Standard includes specific provisions resulting from the application of EN 1992-1-1, EN 1998-1, EN 1992-1-2 and EN 1992-2 rules made specific for the concerned product. The use of these provisions is consistent with a design of works made with EN 1992-1-1, EN 1992-1-2, and EN 1992-2.

## 1 Scope

This European Standard applies to precast concrete structural elements produced in a factory and used in bridge construction, for example deck elements, abutments, elements for piers and precast arches.

Normal weight concrete elements are considered, both reinforced and prestressed; their use can be on road bridges, railway bridges and footbridges.

Deck elements include both single elements from which the deck may be composed (beams, slabs, ribbed or cellular elements) and elements consisting of a segment of the entire deck.

The elements for abutments are precast elements able to support vertical and horizontal actions applied by the deck and the earth pressure due to the filling material.

The pier elements can consist of a segment of the pier or, for small heights, the entire pier.

Some examples of elements dealt with are shown in Annex A.

The durability aspects are also considered.

This European Standard makes reference to precast elements produced in a factory or near the construction site in a place protected from adverse weather conditions. It is assumed that if the elements are not manufactured in a factory, the production conditions assure the same level of quality control as in a factory. It is assumed that the production place is protected from rain, sunshine and wind.



Some of the elements are also treated in other European Standards (e.g. beams, slabs). This European Standard deals with the specific aspects related to the use of these elements in bridge construction.

Foundation piles, barriers, bumpers, guards and box culverts are out the scope of this European Standard.



## 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.

EN 206-1, *Concrete — Part 1: Specification, performance, production and conformity*

EN 1992-1-1:2004, *Eurocode 2: Design of concrete structures — Part 1-1: General rules and rules for buildings*

EN 1992-1-2, *Eurocode 2: Design of concrete structures — Part 1-2: General rules — Structural fire design*

EN 1992-2:2005, *Eurocode 2 — Design of concrete structures — Concrete bridges — Design and detailing rules*

EN 13369:2004, *Common rules for precast concrete products*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions given in EN 1992-1-1:2004 and EN 13369:2004 and the following apply.

**3.1**
**bridge**
civil engineering construction works mainly intended to carry loads related to communication over a natural obstacle or a communication line

NOTE This includes all types of bridges, especially road bridges, footbridges, railway bridges etc.

**3.2**
**abutment**
end support of a bridge

NOTE Rigid abutments and flexible abutments should be distinguished where relevant.

**3.3**
**pier**
intermediate support of a bridge, situated under the deck

**3.4**
**bearing device**
structural device located between the deck and an abutment or pier of the bridge and transferring loads from the deck to the abutment or pier



**3.5**
**prestress**
permanent effect due to controlled forces and/or controlled deformations imposed on a structure



NOTE Various types of prestress shall be distinguished from each other as relevant (for example pre-tensioning, post-tensioning by tendons, prestress by imposed deformation at supports).

**3.6**
**headroom**
free height available for traffic

**3.7**
**continuous bridge**
bridge with continuous deck surface through adjacent intermediate spans, with or without structural continuity

**3.8**
**floor plate**
reinforced or prestressed concrete plate used as permanent formwork for cast-in-situ concrete with which it generally contributes structurally when the cast-in-situ concrete has hardened to form a composite slab

**3.9**
**integral bridge**
bridge with no expansions joints neither between adjacent intermediate spans nor between end spans and abutments

**3.10**
**diaphragm**
transverse deck stiffener (precast or cast in-situ)

**3.11**
**crosshead**
transverse support beam at an intermediate or end deck support

**3.12**
**sagging moment**
bending moment inducing tension in the bottom fibres (positive moment)

**3.13**
**hogging moment**
bending moment inducing tension in the top fibres (negative moment)

**3.14**
**skew angle**
angle between the crosshead and a line perpendicular to the longitudinal axis of the bridge

# 4 Requirements

## 4.1 Material requirements

EN 13369:2004, 4.1 shall apply.

For indented bar and wire refer to EN 10080.



In case that the prestressing steel axis is deviated, deflectors shall not engrave the prestressing steel nor cause important voids in the concrete element. The strength of the deviated prestressing steel shall be not less than 95 % of the straight one.



## 4.2 Production requirements



### 4.2.1 General

The production of precast elements for bridges shall comply with the requirements in EN 13369:2004, 4.2 and with the following complementary subclause. For bridge elements other values than given in EN 13369:2004, 4.2.1.3 may be given following the requirements of their destination as indicated in the design documentation.

#### 4.2.3.2 Application of prestressing

##### 4.2.3.2.1General

If the transfer of prestress anchored by bond (pre-tensioning) is not gradual, the slippage, which is the shortening of the tendon after transfer of the prestressing force, shall be checked according to Annex J.

The measured values have to be in accordance with the limit values indicated in EN 13369:2004, 4.2.3.2.4.

The measured slippage shall not be used to determine the transmission length.

The check does not apply to debonded strands.

#### 4.2.3.3 End protection of debonded strands

When the ends of debonded strands are protected, a soft material should be used so that as the beam continues to creep, the unbonded strand length which does not shorten with the beam does not destroy the end protection. This soft cover (e.g. a bead of foam) should also be used even when the strand is to be cast into a diaphragm.

## 4.3 Finished product requirements

### 4.3.1 Geometrical properties

#### 4.3.1.1 Production tolerances

The permitted deviations of 4.3.1.1 of EN 13369:2004 shall be considered for geometrical dimensions.

For beams and box beams the complementary indications of Table 1 apply.

The permitted deviations indicated in the Table 1 are the limiting values of the difference between actual values (measured as described in Clause 5) and theoretical values shown on the design drawings; the permitted deviation of any dimension shall be not less than 5 mm.

**Table 1 — Permitted deviations (see Figure 1)**

| Dimension | Permitted deviation |
|---|---|
| Vertical skewness (v1, see Figure 1b) | ± 0,015 h |
| Horizontal skewness (v2, see Figure 1c) | ± 0,02 b or ± 0,02 a (which is relevant) |
| Verticality (g, see Figure 1d) | ± 0,015 h |
| Lateral deviation (with reference to theoretical axis) | ± L/500 |
| Camber or sag (with reference to the declared value evaluated taking into account the age and the load history of the element) | ± 50 % of the declared value or L/800<br><br>(which is greater) |

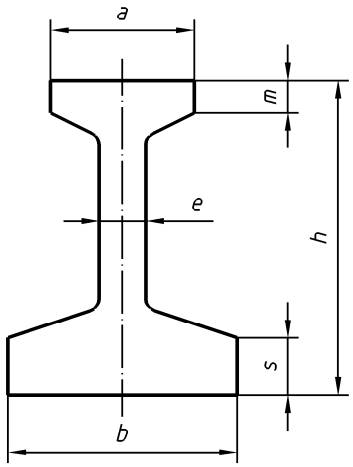


Figure 1a

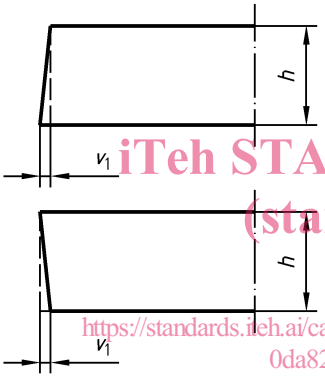


Figure 1b

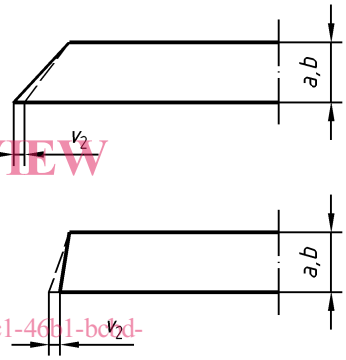


Figure 1c



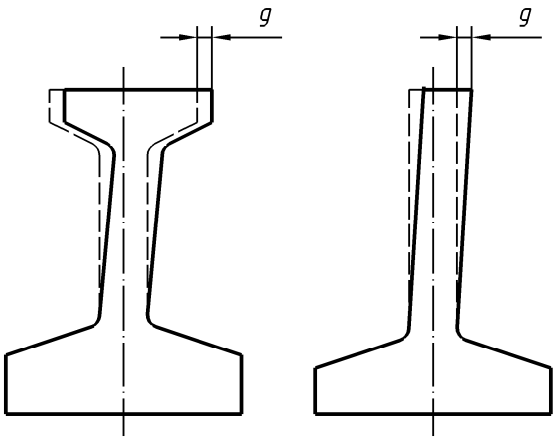


Figure 1d

**Figure 1 — Basic dimensions and deviations**

#### 4.3.1.2 Permitted deviations of inserts and holes

The permitted deviations in positions of inserts and holes (and of minor details not involving the structural behaviour) shall be specified in the manufacturer drawings.

Lacking different specifications, a permitted deviation of ± 30 mm shall be assumed for a single insert or hole. For the mutual position within a group, the permitted deviation shall be assumed ± 5 mm.

#### 4.3.1.3 Minimum dimensions

The minimum dimensions of structural members are defined by the structural calculations, by the provision of the values of cover required by EN 1992-1-1, EN 1992-2 and by this European Standard.

NOTE Greater dimensions can be indicated by the client or by the National Rules having regard to climate and environment.

### 4.3.2 Surface characteristics

The external aspect of each precast element shall be inspected at the time of demoulding in order to detect visible defects, such as voids, surface defects, cracking etc., with reference to J.4 of EN 13369:2004.

Defects of limited importance can be treated after transfer of prestress, preferably using non-shrinkage mortar or prestress, after a surface cleaning of the defective area.

Cracks perpendicular or almost perpendicular to the direction of prestress, detected before transfer and not exceeding 0,2 mm in width, shall not be taken into account.



Recesses deeper than 8 mm (5 mm for external surfaces of edge beams or upper surfaces of bottom flanges) should be filled using an appropriate mortar having strength not less than the concrete of the precast element. However, the presence of recesses deeper than 15 mm can be a symptom of poor compaction of concrete. In this case, and if permitted by client repair may be carried out only after a technical assessment of the problem and its severity is made.



The appearance of the elements is considered acceptable if no honeycombing, broken edges or too many surface voids are present; cracks should be evaluated case by case.

The methods of inspection of surface characteristics together with procedures for repair will be clearly defined within the quality system and will include any particular specification (or purchaser's) requirements.

For a thorough description of a factory production control system within a quality system, refer to Clause 6 of EN 13369:2004.

### 4.3.3 Mechanical resistance

#### 4.3.3.1 General

4.3.3 of EN 13369:2004 shall apply with the following complementary subclauses.

#### 4.3.3.2 Minimum shear reinforcement

Only elements complying with the minimum shear reinforcement for webs and flanges according to 9.2.2 of EN 1992-2:2005 shall be used in bridge decks, with the sole exception of solid slabs and infilled beams with or without in situ topping or under specific customer design allowed in particular application or reduced dynamic factor (pedestrian and light vehicles bridges).

#### 4.3.3.3 Structural joints transmitting longitudinal shear

In order to define the characteristics of the elements, structural joints transmitting longitudinal shear between precast and cast-in-situ concrete shall satisfy 6.2.5 of EN 1992-1-1:2004 and the following additional requirements.

Interfaces types “very smooth” according EN 1992-1-1:2004, 6.2.5 (2) shall not be considered for shear transmission.

For joints between concrete surfaces cast in two stages, the surface classification is applied to the surface into which the second stage concrete is cast.

The design shear resistance per unit design area is given by equation 6.25 of EN 1992-1-1:2004 shear stress is calculated in accordance with 6.2.5 of EN 1992-1-1:2004 and 6.2.5 of EN 1992-2:2005 in which:

— areas of contact surface where the contact width is less than 20 mm or less than the maximum aggregate diameter or where the minimum depth of the topping is less than 30 mm shall not be considered;

— under repeated loading, for fatigue verification 6.2.5 (105) of EN 1992-2:2005 applies.

In elements where differential shrinkage is important, the shear stresses induced by it should be taken into account. The free edges without reinforcement or with only low quantities of reinforcement deserve special attention.

When the in situ concrete will be fully encased in the precast element, for example as in Figure A.1 f and the stress in the interface will be less than $(0{,}5\ c \cdot f_{ctd})$ the minimum reinforcement across the interface is not required. Minimum reinforcement for vertical shear and flange shear in the precast elements shall be provided.



### 4.3.4 Resistance and reaction to fire



When the verification of the resistance to fire is required or is appropriate because of special situations, the procedures expressed in 4.3.4 of EN 13369:2004 shall apply.

### 4.3.5 Acoustic properties

Usually not relevant for precast bridge elements.

If relevant, 4.3.5 of EN 13369:2004 shall apply.

### 4.3.6 Thermal properties

Usually not relevant for precast bridge elements.

If relevant, 4.3.6 of EN 13369:2004 shall apply.

### 4.3.7 Durability

4.3.7 of EN 13369:2004 shall apply.

Guidance on ambient conditions is given in the Annex H.

The minimum concrete cover shall be increased by an allowance ($\Delta c$) for tolerances, which for precast elements can be assumed in the range $5 \leq \Delta c \leq 10$ mm depending on the standard of workmanship and quality control.