BS EN 13877-1:2013

BSI Standards Publication

Concrete pavements

Part 1: Materials

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/510/3, Materials for concrete roads.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

This document (EN 13877-1:2013) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by September 2013 and conflicting national standards shall be withdrawn at the latest by September 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13877-1:2004.

The following modifications have been made:

— The normative references have been reviewed.

— The units have been updated from N/mm^2 to MPa.

— The steel meshes have been included in the definition of reinforcement.

— Table 1 has been modified to include more strength classes, and the notes included in the table have been updated.

— Notes in Table 2 have been updated.

— Notes to Table 3 have been added.

— References EN 197-1 and EN 934-2 have been added to the Bibliography.

This European Standard is one of a series of standards as listed below:

— EN 13877-1, *Concrete pavements — Part 1: Materials*

— EN 13877-2, *Concrete pavements — Part 2: Functional requirements for concrete pavements*

— EN 13877-3, *Concrete pavements — Part 3: Specifications for dowels to be used in concrete pavements*

This European Standard refers to EN 206-1. In accordance with the scope of EN 206-1 some additional or different requirements are necessary for pavements, particularly to comply with safety of users, durability, environment and health.

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

1 Scope

This European Standard specifies requirements for:

— the constituents (concrete and other materials) of concrete pavements;

— the properties of fresh and hardened concrete.

This European Standard is applicable to concrete pavements cast in situ. Concrete compacted by rollers is not covered by this European Standard.

This European Standard covers concrete pavements for roads, motorways and airports, pedestrian footpaths, cycle tracks, storage areas, and in general all traffic-bearing structures.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 1008, *Mixing water for concrete — Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*

EN 10080, *Steel for the reinforcement of concrete — Weldable reinforcing steel — General*

EN 12350-7, *Testing fresh concrete — Part 7: Air content — Pressure methods*

EN 12390-3, *Testing hardened concrete — Part 3: Compressive strength of test specimens*

EN 12390-5, *Testing hardened concrete — Part 5: Flexural strength of test specimens*

EN 12390-6, *Testing hardened concrete — Part 6: Tensile splitting strength of test specimens*

CEN/TS 12390-9, *Testing hardened concrete — Part 9: Freeze-thaw resistance — Scaling*

EN 12620, *Aggregates for concrete*

EN 13877-2:2013, *Concrete pavements — Part 2: Functional requirements for concrete pavements*

EN 13877-3, *Concrete pavements — Part 3: Specifications for dowels to be used in concrete pavements*

EN 14188-1, *Joint fillers and sealants — Part 1: Specifications for hot applied sealants*

EN 14188-2, *Joint fillers and sealants — Part 2: Specifications for cold applied sealants*

EN 14188-3, *Joint fillers and sealants — Part 3: Specification for preformed joint seals*

CEN/TS 14754-1, *Curing compounds — Test methods — Part 1: Determination of water retention efficiency of common curing compounds*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
concrete pavement
concrete layer capable of withstanding direct passage of traffic and environmental effects

Note 1 to entry: Several types exist: jointed unreinforced, jointed reinforced, continuously reinforced.

3.2
lean concrete
concrete having a lower cement content than pavement quality concrete

3.3
exposed aggregate concrete surface
surface finish for concrete pavements achieved by removing the surface mortar, in order to expose the coarse aggregate

3.4
curing compound
product that can be applied on the surface of newly placed concrete to minimize the loss of moisture and in the case of pigmented compounds to reflect heat minimizing heating up of the concrete

3.5
dowel
coated smooth steel bar which extends into adjoining slabs at a joint in a concrete pavement, to improve load transfer and to avoid faulting

3.6
tie bar
steel bar used to keep joints closed, normally longitudinal joints, in a concrete pavement

3.7
reinforcement
steel bars or steel meshes embedded in concrete to control cracking and/or to provide tensile capacity

3.8
calculated density of fresh concrete
density calculated from mass of all materials batched and the total absolute volume of the constituent materials

4 Requirements for constituent materials of concrete

4.1 General

Only constituent materials permitted in EN 206-1 shall be used.

The constituent materials for concrete shall be selected to satisfy the specified requirements of this document for fresh and hardened concrete including consistence, density, strength, durability, and protection of embedded steel against corrosion.

Where there is no European Standard for a particular constituent material which refers specifically to the use of this constituent material in concrete conforming to EN 206-1, the establishment of suitability may result from:

— a European Technical Approval which refers specifically to the use of the constituent material in concrete conforming to EN 206-1; or

— the relevant national standards or provisions valid in the place of use of the concrete which refers specifically to the use of the components material in concrete conforming to EN 206-1.

Characteristics of constituent materials and properties of concrete shall be measured in accordance with EN 206-1 except where otherwise given in the following clauses.

4.2 Type of cement

The type of cement shall be selected in accordance with EN 206-1 for the specified class. Additional requirements may be specified by relevant national standard or provisions in the place of use.

4.3 Aggregates

4.3.1 General

Aggregates shall comply with EN 12620. The permitted types and classes of aggregates shall be specified by relevant national standard or specifications in place of use.

4.3.2 Maximum size of aggregates

The maximum nominal size of aggregate shall not exceed one third (1/3) of the layer thickness.

For jointed reinforced concrete and continuously reinforced concrete pavements, the maximum aggregate size shall not exceed one third (1/3) of the spacing between the longitudinal reinforcing bars.

4.4 Mixing water

Mixing water for concrete shall conform to EN 1008.

4.5 Other constituent materials

Admixtures, additions and other constituent materials, when used, shall conform to the requirements of EN 206-1.

5 Basic requirements for concrete

5.1 General

The specified properties of the concrete shall be measured as prescribed in EN 206-1 and in this document. In specifying the concrete, account shall be taken of the environmental, traffic and site conditions, and the effect these may have on the concrete.

5.2 Fresh concrete

5.2.1 Consistence

The consistence of concrete shall be in accordance with the requirements of EN 206-1.

The consistence of concrete may be specified by consistence class or by target value in accordance with EN 206-1, which should be suitable for the construction plant used to construct the pavement.

5.2.2 Density of fresh concrete

When the density of fresh concrete is specified as a target value, a tolerance of 1,5 % shall apply. The target value shall be the calculated density of a cubic metre of approved concrete, as defined in 3.8, but including an allowance for the volume of any entrained air. Conformity shall be assessed in accordance with EN 206-1.

5.2.3 Air content

When the air content of concrete is to be determined, it shall be measured in situ in accordance with EN 12350-7.

Air content may be specified by relevant national standards or provisions in the place of use.

5.2.4 Cement content

The cement content of concrete may be specified by relevant national standards or provisions in the place of use.

5.2.5 Content or particles smaller than 0,25 mm for pavement quality concrete and lean concrete

The content of particles smaller than 0,25 mm shall conform to national standards or provisions in the place of use.

5.2.6 Chloride content

When concrete contains embedded steel not protected against corrosion (tie bars, reinforcement bars, steel meshes and dowel bars) the total chloride ions content shall not exceed 0,40 % of the mass of cement in accordance with EN 206-1.

5.3 Hardened concrete

5.3.1 Resistance to the effects of freeze-thaw and de-icing agents

Where concrete is exposed to significant attack by freeze-thaw cycles, the exposures shall be classified in accordance with EN 206-1. The freeze-thaw resistance shall be selected and specified in accordance with CEN/TS 12390-9.

Other test methods may be specified by relevant national standards or provisions in the place of use.

5.3.2 Mechanical strength

Specimens shall be evaluated for mechanical strength by one (or more) of the following methods:

— compressive strength in accordance with EN 12390-3;

— tensile splitting strength in accordance with EN 12390-6;

— flexural strength in accordance with EN 12390-5.

Where required

— a class of compressive strength shall be selected and specified in accordance with EN 206-1;

— a class of tensile splitting strength shall be selected and specified in accordance with Table 1;

— a class of flexural strength shall be selected and specified in accordance with Table 2.

Table 1 — Tensile splitting strength, f_{sk} classes

Strength class[a]	f_{sk}[b] MPa
S1,3	1,3
S1,7	1,7
S2,0	2,0
S2,4	2,4
S2,7	2,7
S3,0	3,0
S3,3	3,3
S3,7	3,7
S4,0	4,0
S4,3	4,3
S4,6	4,6
S4,8	4,8
S5,0	5,0
S5,5	5,5
S6,0	6,0

[a] In special cases intermediate strength levels between those given may be used if this is permitted by the relevant design standard.

[b] f_{sk} is the characteristic strength at 28 days. The diameter of a cylinder shall be at least three and a half times the nominal size of the aggregate in the concrete. The height of the cylinder shall be twice the diameter, but with a minimum dimension 100 mm for both cylinders and cubes.

Table 2 — Flexural strength, f_{fk} classes

Strength class[a]	f_{fk}[b] MPa
F2	2,0
F3	3,0
F3,5	3,5
F4	4,0
F4,5	4,5
F5,5	5,5
F6,5	6,5
F8,5	8,5
F9	9,0
F10	10,0

[a] In special cases intermediate strength levels between those given may be used if this is permitted by the relevant design standard.

[b] $f$fk is the characteristic strength at 28 days. The cross section dimension of the prism shall be at least three and a half times the nominal size of the aggregate in the concrete, but with a minimum dimension 100 mm ×100 mm. The length of the prism shall not be less than three and a half times the cross section dimension.

All concrete will be assessed for conformity by the producer using the requirements in EN 206-1.

Where flexural strength is specified, conformity assessment shall be made in the same way as for tensile splitting strength.

When mechanical strength is to be evaluated on cores, the procedure given in EN 13877-2:2013, 4.2, shall be followed.

6 Basic requirements for other materials for concrete pavements

6.1 General

Where there is no European Standard for a particular material in concrete pavements which refers specifically to the use of this material, suitability shall be established from:

— a European Technical Approval which refers specifically to the use of this material;

— the relevant standards or provisions valid in the place of use of the concrete which refers specifically to the use of this material.

6.2 Curing materials

Curing compounds shall comply with CEN/TS 14754-1. Other materials used for curing concrete shall conform to national standards or provisions in the place of use.

6.3 Surface retarders

For exposed aggregate concrete surface finishes, only surface retarders with established suitability shall be used.

The surface retarder shall be protected against evaporation after application.

6.4 Joint sealants

Joint materials shall comply with EN 14188-1, EN 14188-2 and EN 14188-3.

6.5 Tie bars

Smooth tie bars or deformed tie bars shall be at least grade B250 and B500, respectively, and shall comply with the properties specified in EN 10080.

Tie bar dimensions shall be selected from Table 3.

Protective measures against corrosion shall be specified in accordance with national standards or provisions in the place of use.

Table 3 — Dimensions for tie bars

	Diameter mm				**Length** mm
Tie bars	10	12	16	20	800
NOTE 1 For maintenance works, shorter tie bars can be used. NOTE 2 Longer tie bars can be used in thick pavements (e.g. in airport or harbour facilities) or at special locations (e.g. in transitions from rigid pavements to flexible constructions).					

6.6 Dowels

Dowels shall comply with EN 13877-3.

6.7 Reinforcing bars

Reinforcing bars shall be at least of grade B500 and shall comply with the properties specified in EN 10080.

In continuously reinforced concrete pavement, continuity of reinforcement may be achieved by lapping, by means of connectors or by welding, and shall comply with national standards or the provisions in the place of use.

Bibliography

[1] EN 197-1, *Cement — Part 1: Composition, specifications and conformity criteria for common cements*

[2] EN 934-2, *Admixtures for concrete, mortar and grout — Part 2: Concrete admixtures — Definitions, requirements, conformity, marking and labelling*

[3] EN 12350-1, *Testing fresh concrete — Part 1: Sampling*

[4] EN 12350-2, *Testing fresh concrete — Part 2: Slump-test*

[5] EN 12350-3, *Testing fresh concrete — Part 3: Vebe test*

[6] EN 12350-4, *Testing fresh concrete — Part 4: Degree of compactability*

[7] EN 12350-5, *Testing fresh concrete — Part 5: Flow table test*

[8] EN 12350-6, *Testing fresh concrete — Part 6: Density*

[9] EN 12390-1, *Testing hardened concrete — Part 1: Shape, dimensions and other requirements for specimens and moulds*

[10] EN 12390-2, *Testing hardened concrete — Part 2: Making and curing specimens for strength tests*

[11] EN 12390-7, *Testing hardened concrete — Part 7: Density of hardened concrete*

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