PCN Proposed revision of

EN 1168 HOLLOW CORE SLABS
ANNEX J *Full scale test*

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IPHA Seminar Delft, 7th- 8th November 2005

DRAFT MINUTES
17TH MEETING OF CEN/TC 229/WG1
held in Milan on 28th October 2005

10. TG1 - EN 1168 Hollow core – Annex J: Full scale test (approval for UAP)

After a very long exchange of letters a final agreement has been reached (see doc. N. 427).

There are heavy doubts on EC2 equation 6.4 for uncracked sections, while equation 6.2a seems to work good.

WG1 decides to approve Annex J with some minor changes and to start a study in order to propose a modification of equation 6.4 of EC2.

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11. Amendments / revisions / complements to published standards
11.1 TG1 – EN 1168 Hollow core (ed. May 2005)

The following requests for revision arrived from Finland, Italy and Netherland:
- widen the scope of the standard to cover elements up to 500 mm depth;
- adjust numbering of clauses under 4.3.1.1;
- under the title 4.3.1.1.3 Tolerances for concrete cover add: " The maximum deviation for concrete cover shall be Δc = -10 mm. A more stringent tolerance can be declared by the manufacturer";
- editorial improvement of 4.3.1.2.2 (the version circulated for formal vote was correct);
- under 4.3.3.2 Verification by calculation the modifications of 6.4 of EC2 proposed BY A Task group will be added;
- the word "splitting" will be changed into "spalling" (in clause 4.3.3.2.1);
- improve the definition of Σhf on page 14 adding "where this scaled thickness is the actual thickness of the topping multiplied by the ratio between the tensile strength of the topping and the tensile strength of the slab";

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- in clause 4.3.6 Thermal properties (page 17) change “contact resistance” into “surface resistance”;
- in clause 5.2.1.1 Procedure (page 18) under d) and e) change the reference to 4.3.1.1.2 into 4.3.1.1.1;
- in Annex B (page 22) improve fig. B.1a and change “≥ 5” into “≥ 10”;
- in Annex C (page 29) improve fig. C.4 c and d (dashed lines);
- in Annex C (page 31) correct the scale of the vertical axis in fig. C.6;
- in Annex E (page 33) correct equation E.2 into “MEdf = 2/3 NEdta + ΔM”;
- in Annex F (page 36) clause F.2.2 change “τSd” into “τEd” ;
- the formula for τRd (Annex F – clause F.2.2 - page 36) will be revised by the Task Group;
- in Annex F (page 37) clause F.2.2 change “lpt2” into “lbpd” and “σcp” into “σcpm”;

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A **Task Group is created to finalize the proposal of a new equation for shear verification** of uncracked sections within December. This proposal will be circulated to WG1 members in January.

The members of the task group are:
Bernardi (F), Della Bella (I), Formichi (I), Lindstrom (S), Pajari (FIN), Van Paassen (NL)
with dr. Palermo (I) acting as secretary of the group.

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Annex J
(normative)

In red proposed amendment by BDB

Full scale test

J.1 General

The full scale test described in this Annex is an initial type testing intended to confirm the design model for failure. This initial type testing shall be performed when production factory starts up a new cross section.

The test elements shall be representative of the cross section and prestressing or reinforcement level shall be at least the 75% of the maximum level scheduled for the given cross section.

J.2 Apparatus

The testing machine shall be at least a class 3 machine according to 4.2 of EN 12390-4:2000.

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J.3 Test arrangement

Tests shall be carried out by the manufacturer, at a testing laboratory or in the factory.

The test shall be performed at a temperature of 0° C to 40° C. This temperature shall be recorded.

In order to get reference values of the strength of the concrete (direct structural strength – see EN 13369: 2004 point 4.2.2.2.3), cylindrical cores shall be drilled out of the element. To obtain these cores, a slab segment of 200 mm ± 5 mm length shall be sawn out from the casting bed, directly adjacent to the test specimens. This segment shall be conserved under the same condition of the test specimens. Short before testing, three cores shall be drilled out of the slab segment (see also Table A.3) and their strength shall be measured within ±3 days from the date of the test. The mean of the three measured values gives the actual compressive strength fc.

J.3 Test arrangement (cont.d)

Instead of drilled cores, in order to get reference values of the strength of the concrete, 3 specimens (cubes or cylinders) may be made during the fabrication of the test piece and submitted to the same heat treatment (indirect structural strength - see EN 13369:2004 point 4.2.2.2.4). The specimens shall be conserved under the same conditions as the test piece. The compressive strength of the specimens shall be measured within ±3 days from the date of the test. The mean of the three measured values gives the actual compressive strength fc.

In a similar way also the actual tensile concrete strength fct may be measured.

The test piece shall be a full-width slab element with a span of 4 m or 15 x h, whichever is bigger *(with a tolerance of ± 100 mm)*

J.3 Test arrangement (cont.d)

Initial type testing shall be done on three elements with the same prestressing reinforcement. The age of the test pieces shall be at least 28 days.

The support which is the nearest to the load application point shall be a roller bearing, so that no axial forces are generated by a rotation of the element at the support. Between the element and the support beam, a load distributing material such as 10 mm masonite or neoprene or a bed of mortar or gypsum shall be applied. This material has to compensate for the unevenness of the element surface and a possible curvature of the element in the transverse direction. The load shall be applied at the distance from the roller support of *2.5 h*, where *h* is the full depth of the cross-section, but not lesser than 600 mm. *(position with a tolerance of ±100 mm).* The support conditions shall be such that the load is equally distributed over the width of the member.

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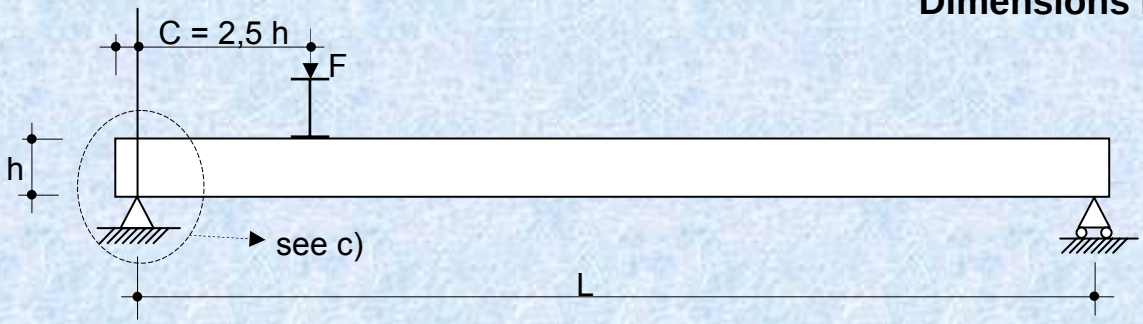
J.3 Test arrangement (cont.d)

The load shall be introduced by a stiff transverse steel beam. The stiffness of this beam shall be sufficient to prevent an unequal distribution of the load over the width of the beam.
The depth of the steel beam shall be at least 150 mm, but when using one jack, preferably 250 mm.

Dimensions in millimetres



a) One line loading

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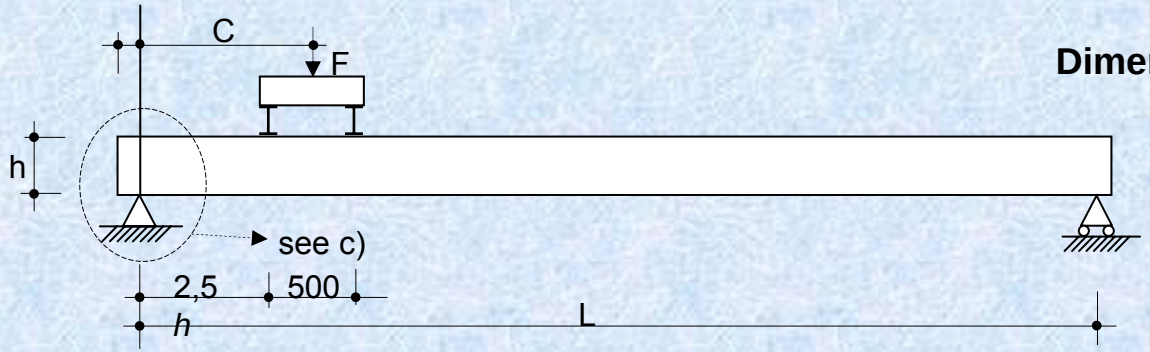
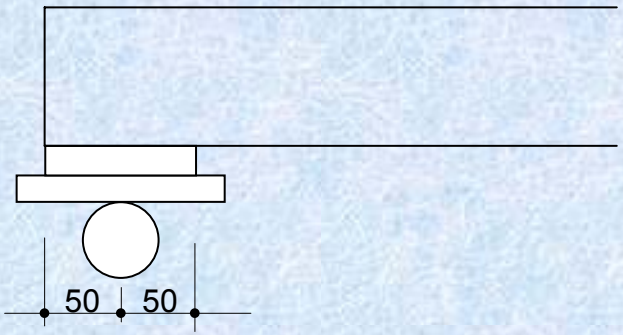
J.3 Test arrangement (cont.d)



Dimensions in millimetres

b) Two lines loading



c) Detail of support in a) and b)

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J.4 Loading procedure

The load shall be applied as repeated loading in 2 cycles. The amplitude of the loading of the first cycle shall be equal to 70%±2% of the required design ultimate load. In the last cycle the load shall be increased up to the actual ultimate load at failure.
The required design ultimate load shall be calculated using the design model for failure with the design values for material properties, nominal dimensions and with regard to the most unfavourable failure mode.
The speed of the loading of the element shall not exceed the following limits:
- for the first cycle:
two steps of equal amplitude in one minute each and subsequent withdrawal of the load;
- for the second cycle:
a first step up to 50% of the expected ultimate load in one minute;
a second step up to 75% of the expected ultimate load in one minute;
subsequent increase of the load with speed not exceeding 10% of the expected ultimate load per minute;

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J.4 Loading procedure (cont.d)

The expected ultimate load Fexp shall be calculated using the design model for failure, with the actual strength parameters of steel, with the actual strength parameters of concrete derived from its compressive strength such as measured in J.3, taking $\alpha cc = \alpha ct = 1.0$ and $\gamma C = \gamma S = 1.00$, with the actual dimensions and with regard to the most unfavourable failure mode. Instead of derived from compressive strength, tensile strength of concrete may be measured by tests (see J.3).

The actual ultimate load corresponding to the failure of the test piece shall be recorded together with the indication of the failure mode (shear tension, shear flexure, anchorage, cracking moment).

J.5 Interpretation of results

The results of the test shall be checked against the expected ultimate load Fexp.

NOTE: The design model for shear failure is represented by equations (6.2.a) or (6.4) of EN 1992-1-1:2004, where the actual compressive strength fc is used in place of fck and the *minimum value of* actual tensile strength fct,min is used in place of fctd. *Minimum value of* ~~Actual~~ tensile strength fct,min may be ~~measured or~~ derived *by the measured value fct (fct,min = 0.7 fct) or* by the correlations of Table 3.1 of EN 1992-1-1:2004, where fck = fc (fcm = fck + 8 MPa) and fct,min = fctk0.005 (fctk0.005 = 0,7 fctm). The stress σcp due to prestressing shall be calculated, with γP = 1, taking into account the prestressing losses developed at the test time and a linear increase over the transmission length lpt. The first uncracked section to be checked for failure is placed at d/2 from the support (d = effective depth). The cracking bending moment is computed with fct,min. *and the first section to be checked for cracking is at distance d from the support.*

For these calculations the rules of EN 1992-1-1:2004 are applied.

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J.5 Interpretation of results (cont.d)

The design model reliability is confirmed if the following requirements are fulfilled.

Ftest/ Fexp ≥ 0,95 for each test

Average (Ftest/ Fexp) ≥ 1,00 for the mean of the three tests

where:

Fexp is the expected ultimate load corresponding to the failure mode observed for each individual test piece;

Ftest is the actual ultimate load for each individual test piece;

Average (Ftest/ Fexp) is the mean value of the three ratio between each actual ultimate load and the corresponding expected ultimate load.

If the test results do not comply with the two requirements above, one of the following actions shall be undertaken:

- adjust the machinery and/or concrete mix and test again three new test pieces;

- apply a proper reduction factor to the design model for the design of the product.

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J.6 Test report

The test report shall include:

- **the identification of the test piece;**
- **the date of manufacture or any other code;**
- **the date and place of testing;**
- **the laboratory and the person in charge of testing;**
- **all the actual properties of materials used for the test piece;**
- **the test method;**
- **the measuring equipment used;**
- **the temperature at the location of testing;**
- **the failure load value;**
- **the failure mode;**
- **any observations regarding the test and any disorders noted (cracks, etc.);**
- **a declaration that the test has been carried out in compliance with this standard, plus details of any amendment made.**

Furthermore in Table A.3 of Annex A the subject 1-"Full scale test" shall be modified as follows:

1	Full scale test	As described in Annex J	Confirmation of design model for failure and/or proper functioning of casting equipment	3 element [b] after setting up a new product design or a new production facility or if there is a major change in design, type of material, or method of manufacture

Furthermore in Table ZA.3 of Annex ZA the task-"Initial type testing" shall be modified as follows:

	Initial type testing	Characteristics of ZA.1[a]	6.2 of EN 13369:2004 and Annex J

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THANK YOU FOR ATTENTION

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