# Revision of EN 1168/A3


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in cooperation with StruSoft

# Taskgroup 1 Hollow Core Slabs

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# Product Standard EN 1168

- **EU Product Standard for Hollow Core Slabs**
- **Not: a standard or code for design of Hollow Core Floors!**
- **Informative Annexes for design of HC Floors**
- **Harmonized standard with an Annex ZA for CE-marking**

# Revision EN1168

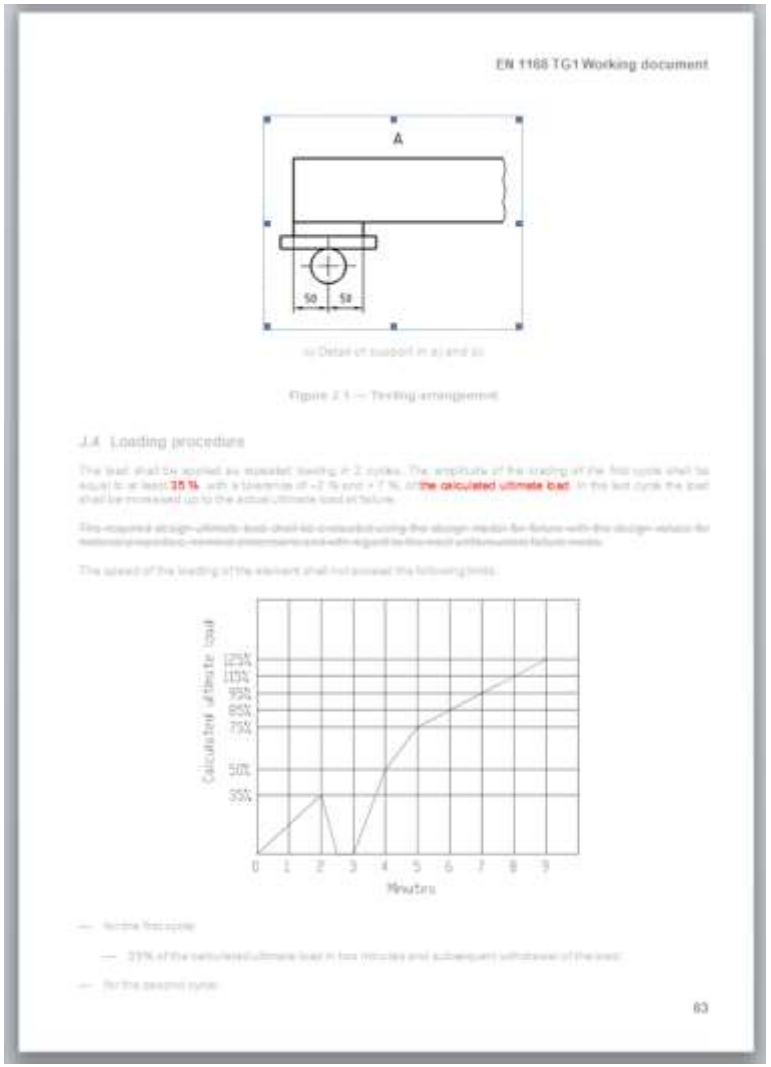
- **Status**
  - Feasibilty study
  - No TC229 Work Item (WI) yet

# EN 1168 Revision topics

- **Punching shear (Finnish proposal)**
- **Minor changes in body tekst: skew slab ends, min. amount of strands, drainage hole aspects, sag of top flange.**
- **Max. concentrated loads with regard to load distribution from body text to informative Annex C**
- **Move chapter “Three supported edges” to Annex C**
- **Annex E “unintended fixing moments” in line with EC2: NDP with recommended value 15%**
- **Holcofire update to Annex G: flexible support, drainage holes and limitation thickness topping.**

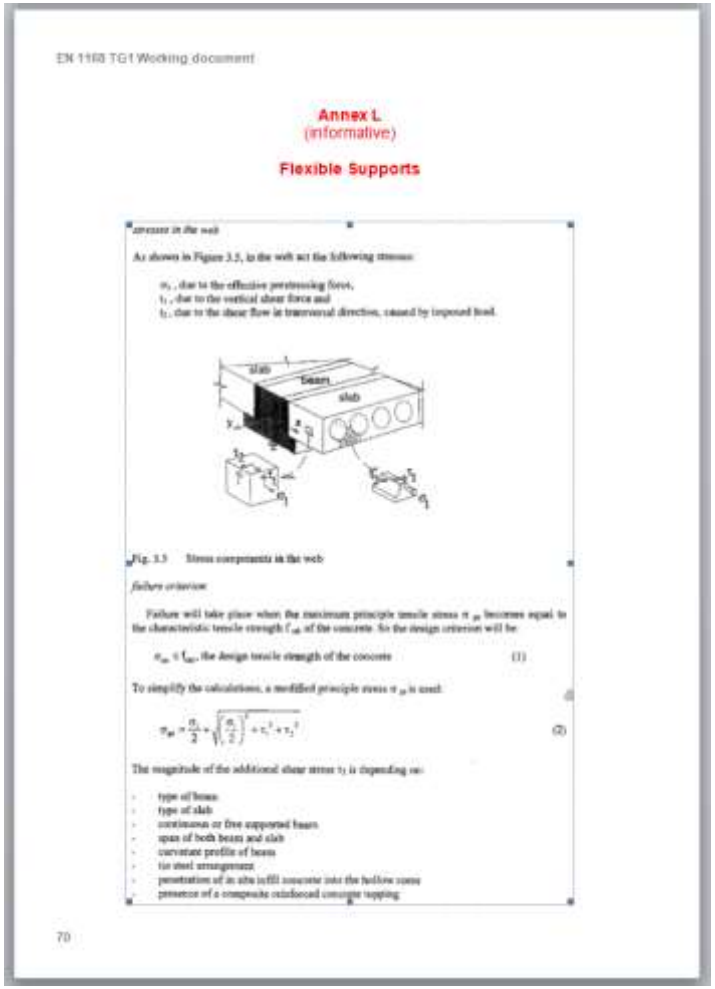
# EN 1168 Revision topics

- **Annex J Full Scale Test**



# EN 1168 Revision topics

- **Informative Annex Flexible Supported HC**



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Annex L
(informative)

Flexible Supports

stresses in the web

As shown in Figure 3.5, in the web act the following stresses:

$\sigma_x$ , due to the effective prestressing force,
$\tau_1$ , due to the vertical shear force and
$\tau_2$ , due to the shear flow in transversal direction, caused by imposed load.



Fig. 3.5 Stress components in the web

*failure criterion*

Failure will take place when the maximum principle tensile stress $\sigma_{pt}$ becomes equal to the characteristic tensile strength $f_{ctk}$ of the concrete. So the design criterion will be:

$\sigma_{pt} \leq f_{ctd}$, the design tensile strength of the concrete (1)

To simplify the calculations, a modified principle stress $\sigma_{pt}$ is used:

$$\sigma_{pt} = \frac{\sigma_x}{2} + \sqrt{\left(\frac{\sigma_x}{2}\right)^2 + \tau_1^2 + \tau_2^2} \qquad (2)$$

The magnitude of the additional shear stress $\tau_2$ is depending on:

- type of beam
- type of slab
- continuous or free supported beam
- span of both beam and slab
- curvature profile of beam
- tie steel arrangement
- penetration of in situ infill concrete into the hollow cores
- presence of a composite reinforced concrete topping

70

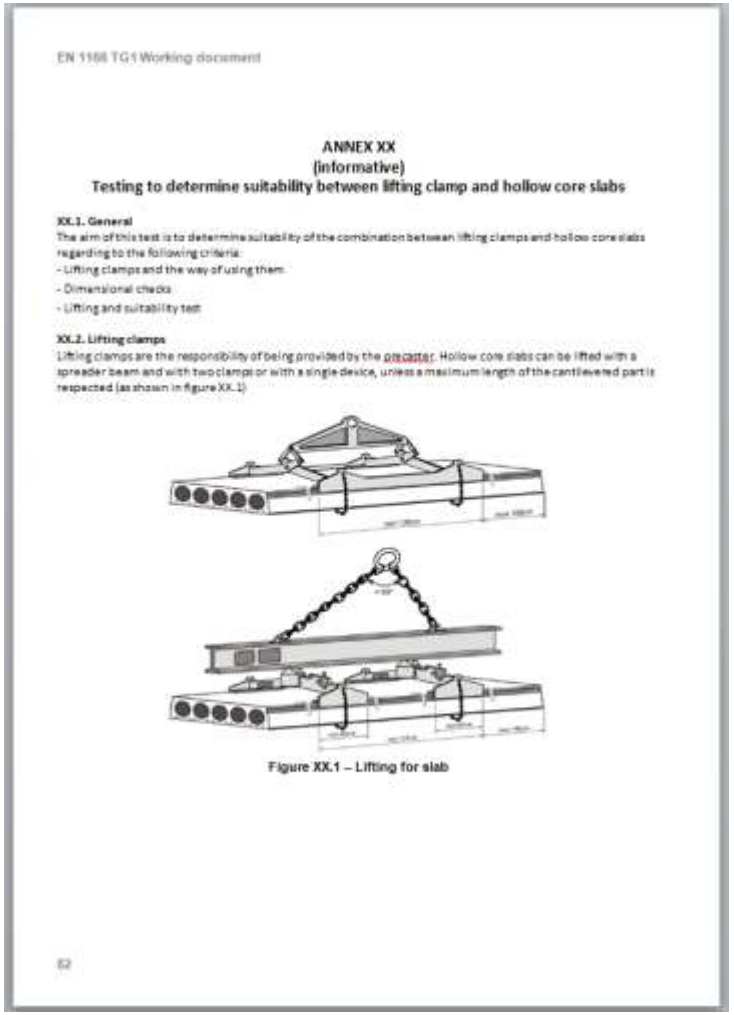
Based on *fib* Bulletin 6

Agreement on HC without topping

Cooperation with fibCOM6 TG 6.1

# EN 1168 Revision topics

- **Informative Annex Lifting Clamps**



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ANNEX XX
(informative)
Testing to determine suitability between lifting clamp and hollow core slabs

XX.1. General
The aim of this test is to determine suitability of the combination between lifting clamps and hollow core slabs regarding to the following criteria:
- Lifting clamps and the way of using them
- Dimensional checks
- Lifting and suitability test

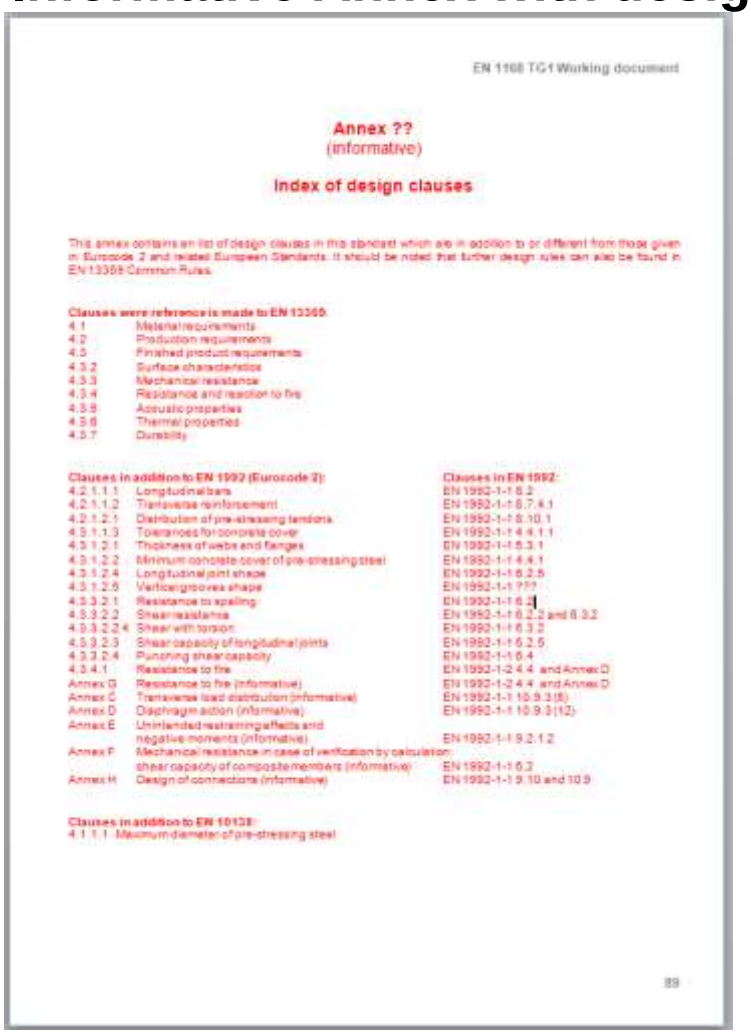
XX.2. Lifting clamps
Lifting clamps are the responsibility of being provided by the precaster. Hollow core slabs can be lifted with a spreader beam and with two clamps or with a single device, unless a maximum length of the cantilevered part is respected (as shown in figure XX.1)

Figure XX.1 – Lifting for slab

62

# EN 1168 Revision topics

- **Informative Annex with design clauses**



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**Annex ??**
(informative)

**Index of design clauses**

This annex contains an list of design clauses in this standard which are in addition to or different from those given in Eurocode 2 and related European Standards. It should be noted that further design rules can also be found in EN 13369 Common Rules.

**Clauses were reference is made to EN 13369:**

| | |
|---|---|
| 4.1 | Material requirements |
| 4.2 | Production requirements |
| 4.5 | Finished product requirements |
| 4.5.2 | Surface characteristics |
| 4.5.3 | Mechanical resistance |
| 4.5.4 | Resistance and reaction to fire |
| 4.5.5 | Acoustic properties |
| 4.5.6 | Thermal properties |
| 4.5.7 | Durability |

| **Clauses in addition to EN 1992 (Eurocode 2):** | | **Clauses in EN 1992:** |
|---|---|---|
| 4.2.1.1.1 | Longitudinal bars | EN 1992-1-1 6.2 |
| 4.2.1.1.2 | Transverse reinforcement | EN 1992-1-1 6.7 4.1 |
| 4.2.1.2.1 | Distribution of pre-stressing tendons | EN 1992-1-1 6.10.1 |
| 4.5.1.1.3 | Tolerances for concrete cover | EN 1992-1-1 4.4.1.1 |
| 4.5.1.2.1 | Thickness of webs and flanges | EN 1992-1-1 5.3.1 |
| 4.5.1.2.2 | Minimum concrete cover of pre-stressing steel | EN 1992-1-1 4.4.1 |
| 4.5.1.2.4 | Longitudinal joint shape | EN 1992-1-1 6.2.5 |
| 4.5.1.2.5 | Vertical grooves shape | EN 1992-1-1 ??? |
| 4.5.3.2.1 | Resistance to spalling | EN 1992-1-1 6.8 |
| 4.5.3.2.2 | Shear resistance | EN 1992-1-1 6.2.2 and 6.3.2 |
| 4.5.3.2.2.4 | Shear with torsion | EN 1992-1-1 6.3.2 |
| 4.5.3.2.3 | Shear capacity of longitudinal joints | EN 1992-1-1 6.2.5 |
| 4.5.3.2.4 | Punching shear capacity | EN 1992-1-1 6.4 |
| 4.5.4.1 | Resistance to fire | EN 1992-1-2 4.4 and Annex D |
| Annex G | Resistance to fire (informative) | EN 1992-1-2 4.4 and Annex D |
| Annex C | Transverse load distribution (informative) | EN 1992-1-1 10.9.3 (5) |
| Annex D | Diaphragm action (informative) | EN 1992-1-1 10.9.3 (12) |
| Annex E | Unintended restraining effects and negative moments (informative) | EN 1992-1-1 9.2.1.2 |
| Annex F | Mechanical resistance in case of verification by calculation: shear capacity of composite members (informative) | EN 1992-1-1 6.2 |
| Annex H | Design of connections (informative) | EN 1992-1-1 9.10 and 10.9 |

**Clauses in addition to EN 10138:**
4.1.1.1 Maximum diameter of pre-stressing steel

89

# EN 1168 Revision topics

- **Shear capacity**

Wish for only one formula for the shear tension capacity, and not loose for advantages of the simplified formula.

$$V_R(y,V) := \frac{b(y)\cdot I_{i2}}{S_{c2p}(y)}\cdot\left[\sqrt{f_{ct}^{\,2} - f_{ct}\cdot\sigma_c(y,V) - \left(\beta_f\,\tau_2(y,V)\right)^2} - \tau_1(y) - \tau_{pt}(y)\right]$$

Extended: compute the governing position y with the functions of the normal and shear stresses described in the functions.

Simplified: with assumptions or tabulated values:

Y = lowest point of the web with smallest thickness

Tabulated values…e:

| Span of the beam | Transverse Shearstress |
|---|---|
| 0 | 0 MPa |
| 1 | 0 |
| 2 | 0.5 |
| 4 | 1 |
| 8 | 3 |

Note: the span is the distance between the “momentzero” points.

Transmission shearstresses: = 1,0 MPa

Suggested values to be calibrated/validated.
This approach is in line with the basis formula of Eurocode 2 and is only more detailed referring to the remark of the Eurocode 2 formula.

# EN 1168 Revision topics

- **Shear capacity**

  Increasing the background information on shear force…

  Collecting shear tests.

  Test reports are welcome….