

EN 1168 Update

CE marking

6th November 2007

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- **EN 1168:may 2005**
Precast concrete products – Hollow core slabs
- **Amendments for UAP: EN 1168:2005/prA1 and prA2**
- **Ad Hoc Groups:**
 - **Solid hollow cores**
 - **Tests**
 - **Fire**
- **Fire accident in the Netherlands**
- **CE marking**

EN 1168:may 2005

- **Start of CEN/TC229/WG1/TG1**
”Floors, Hollow core slabs”, in 1990
 - **No rules how to write a product code**
 - **No common rules**
 - **Euro code 2 was not ready and had no special rules for prefab products**
 - **Only prestressed hollow core slabs were part of the scope**
 - **After more than 20 drafts the “final” code EN1168 was published in 2005**

EN 1168:2005/prA1



- **prA1 is a draft amendment to the EN 1168:2005 and part of a Unique Acceptance Procedure (UAP)**
 - **Repairs editorial errors**
 - **Brings in last technical knowledge**
 - **Common use of national hollow core practice**

EN 1168:2005/prA1



- Maximum depth will be raised from 450 to 500 m
- The shear tension formula of the EC 2 will be overruled by the Yang's formula
- Annex J "Full scale test" will be changed .

EN 1168:2005/prA1



- **Maximum depth will be raised from 450 to 500 mm**
 - **Opposition from Pajari as the shear flexure formula in EC2 is too optimistic for 500 mm slabs**
 - **This item is possibly covered by a reduction factor of 0.9 in prA1 for slabs deeper than 450 mm**

- The shear tension formula of the EC 2 will be overruled by the Yang's formula

$$V_{Rd,c} = \frac{Ib_w}{S} \left(\sqrt{(f_{ctd})^2 + \alpha \sigma_{cp} f_{ctd}} \right)$$

EC 2 formula for shear tension capacity

$$V_{Rdc} = \frac{Ib_w(y)}{S_c(y)} \left(\sqrt{(f_{ctd})^2 + \sigma_{cp}(y) f_{ctd}} - \tau_{cp}(y) \right)$$

Yang's formula

EN 1168:2005/prA1

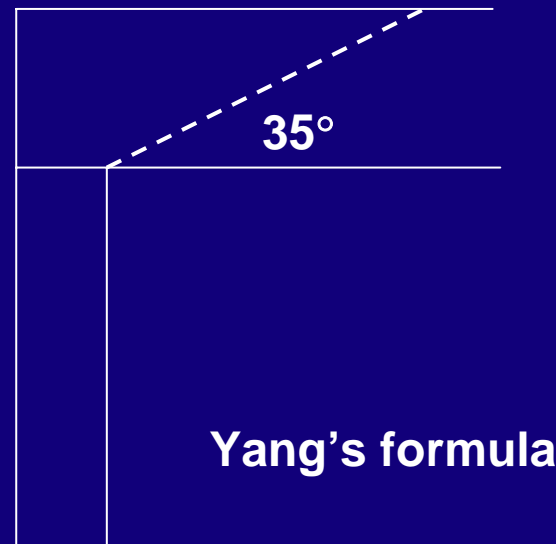
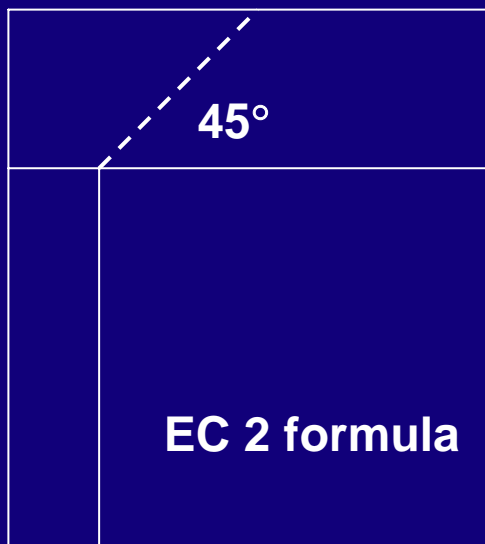
In which $\sigma_{cp(y)}$ and $\tau_{cp(y)}$ are:

$$\sigma_{cp}(y) = \sum_{t=1}^n \left\{ \left[\frac{1}{A} + \frac{(y_c - y) \cdot (y_c - y_{Pt})}{I} \right] \cdot P_t(l_x) \right\} + \frac{M_{Ed}}{I} \cdot (y_c - y)$$

$$\tau_{cp}(y) = \frac{1}{b_w(y)} \cdot \sum_{t=1}^n \left\{ \left[\frac{A_c(y)}{A} - \frac{S_c(y) \cdot (y_c - y_{Pt})}{I} + Cp_t(y) \right] \cdot \frac{dP_t(l_x)}{dx} \right\}$$

EN 1168:2005/prA1

The weakest point under an angle from the edge of the support has to be found, not per definition the centroidal axis



EN 1168:2005/prA1

As an alternative the EC2 formula may be used with reduction factors

$$V_{Rd,c} = \varphi \frac{I b_w}{S} \left(\sqrt{(f_{ctd})^2 + \beta \alpha_l \sigma_{cp} f_{ctd}} \right)$$

In which following factors are used

$$\varphi = 0,8$$

$$\beta = 0,9$$

- **Annex J “Full scale test” will be changed , in which next changes are the most essential:**
 - Tests on productfamilies
 - More precise description how to perform the test
 - 2 instead of 10 loadcycles
 - More precise description how to interpret the results

EN 1168:2005/prA2



- **prA2 is a draft amendment to the EN 1168:2005 and EN 1168:2005 prA1 and also part of a Unique Acceptance Procedure (UAP)**

It gives modifications for full scale ITT in which next points are the most essential:

- **Gives a more precise description of a product family**
- **No ITT required for ongoing production, only for new products or new production facilities**
- **Further type testing for mayor changes in the design of the cross sections, in concrete strength, type or operation principal of production machines or any other significant change which affects the shear resistance.**

Adhoc groups

- **Solid hollow core slabs**

In many countries hollow core producers produce with the same equipment also massive slabs. For that case it will be efficient if this is covered by the same product code.

A proposal is made and will be voted in next CEN/TC229/WG1 meeting in Berlin.

The proposal gives next to a description additional formulas for torsion and floors supported on three edges

Adhoc groups

- **Testing**

The references to testing has to be improved

An ad hoc group under mr. Barthou will report in the next CEN/TC229/WG1 meeting in Berlin.

Adhoc groups



- **Fire**

A joint working group between TG1 and FIB C.6 makes a proposal for fire regulations in EN 1168

The convenor of this group is mr. Chefdebien and will also report in the next CEN/TC229/WG1 meeting in Berlin.

Fire accident



Fire in new apartment building at Rotterdam in the early morning of the 1st October 2007

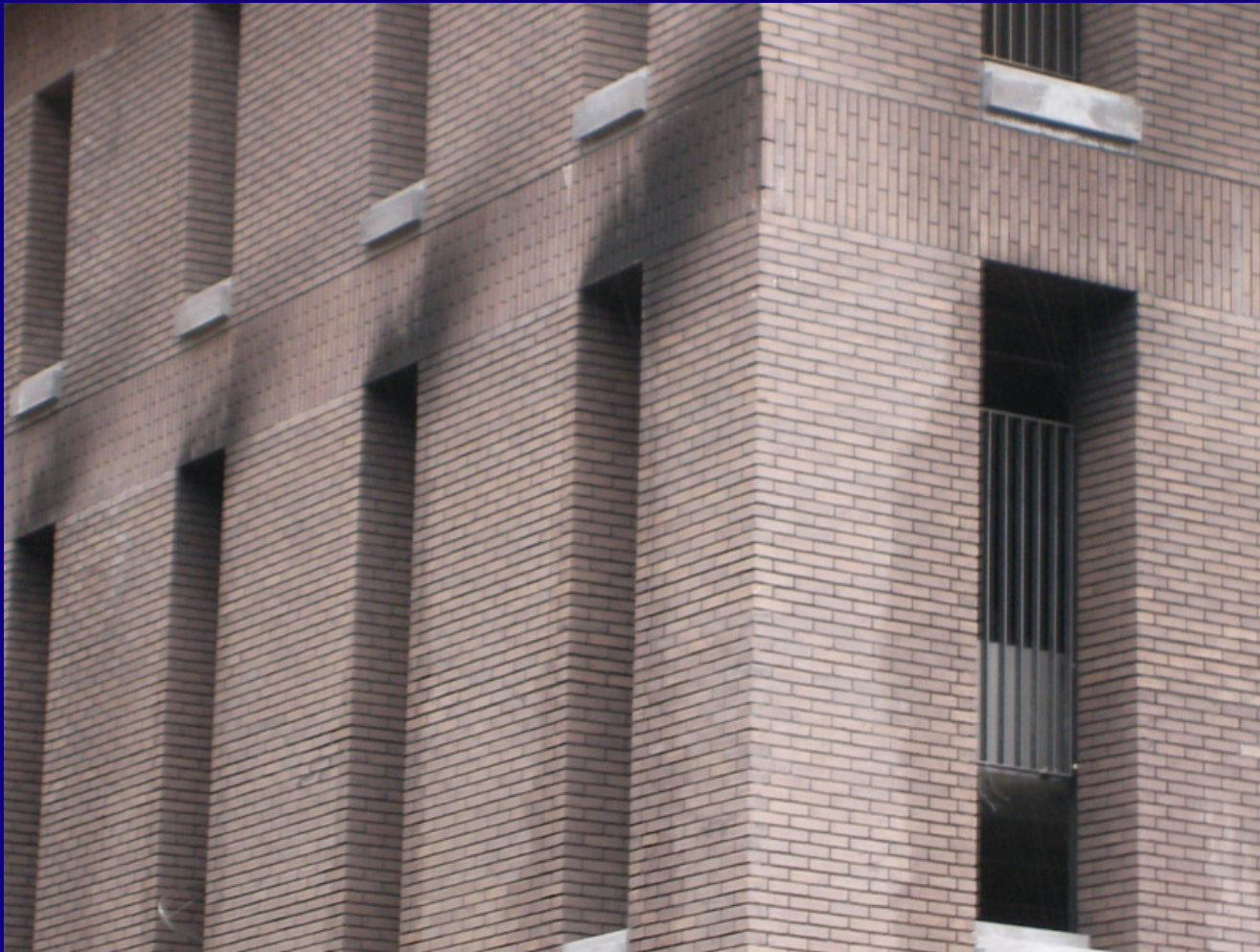
Fire accident



Fire accident



Fire accident



Fire accident



Fire accident



Fire accident



Fire accident



INTERNATIONAL PRESTRESSED



HOLLOWCORE ASSOCIATION



Fire accident



Fire accident

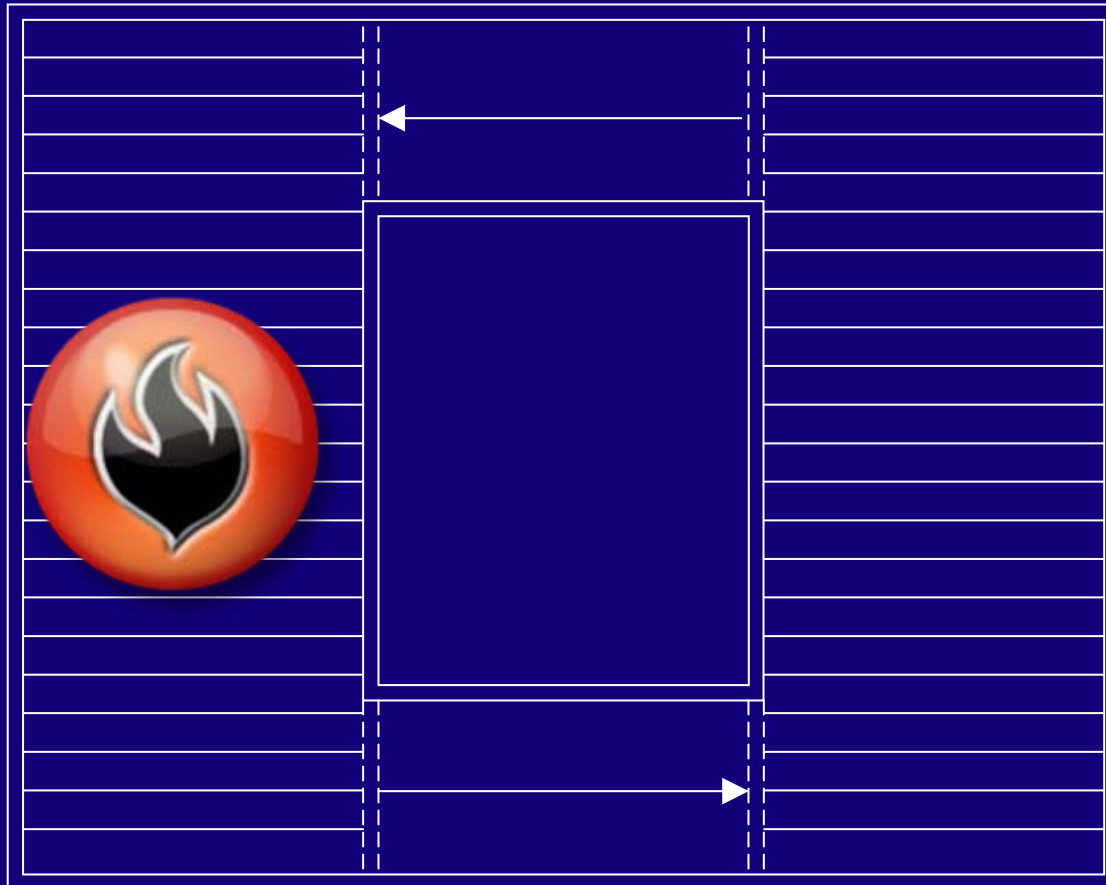


Fire accident

How can a floor collapse in half a hour which was designed for a fire resistance of 2 hours?

Fire accident

Groundplan of the parking area



Fire accident

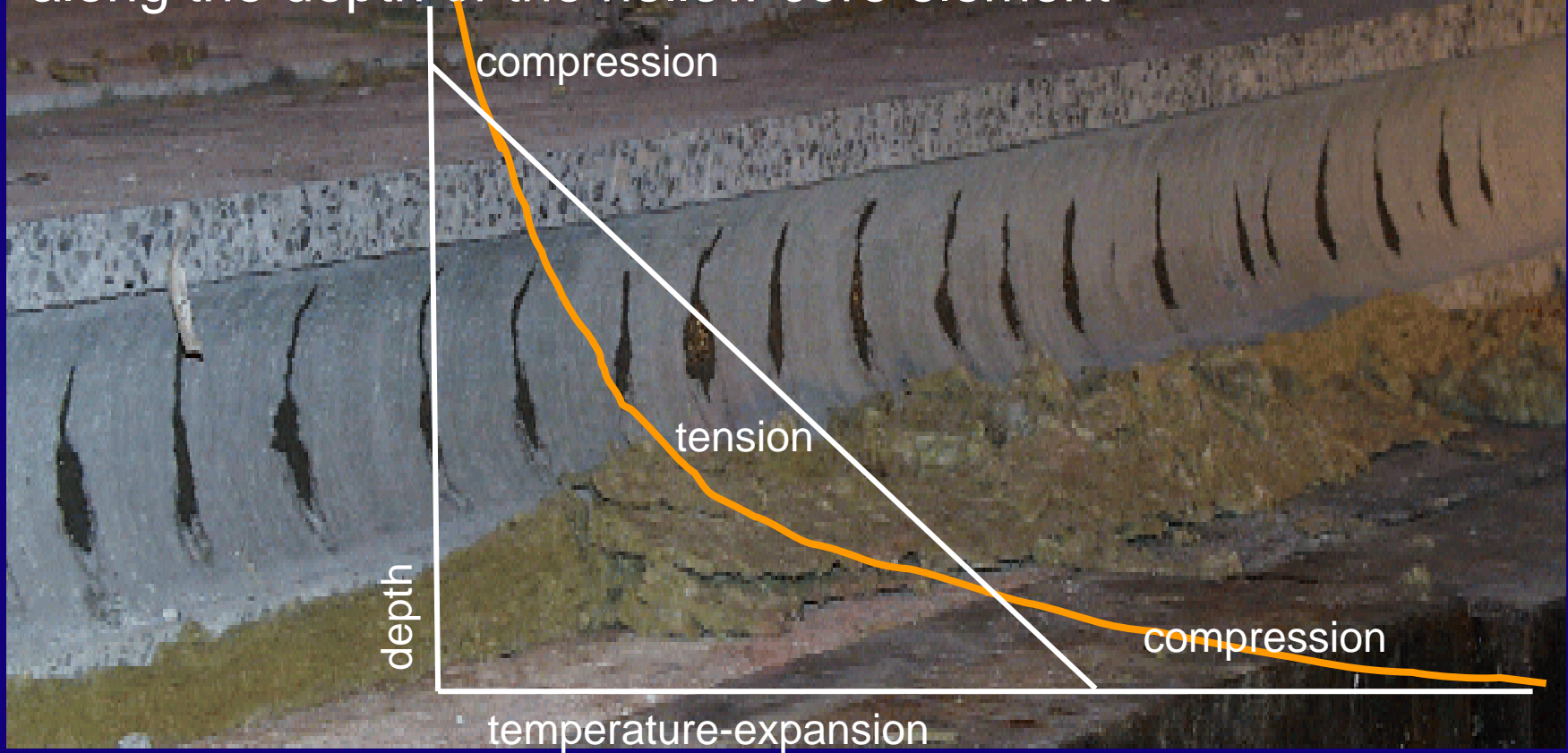
Asphalt 40 – 140 mm
Structural concrete topping 75 mm
Hollow core floor 260 mm



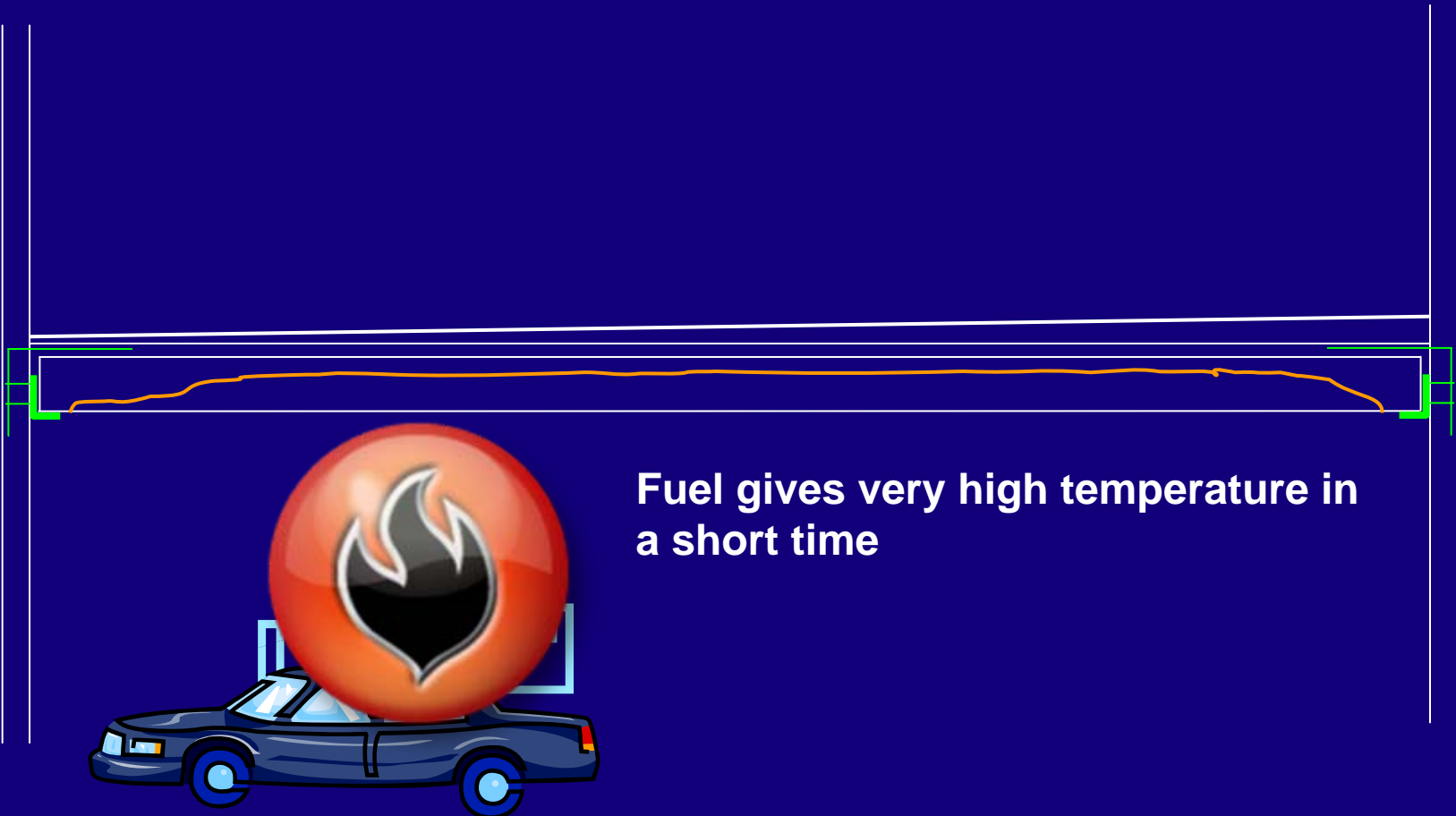
Cross section of the
parking area

Fire accident

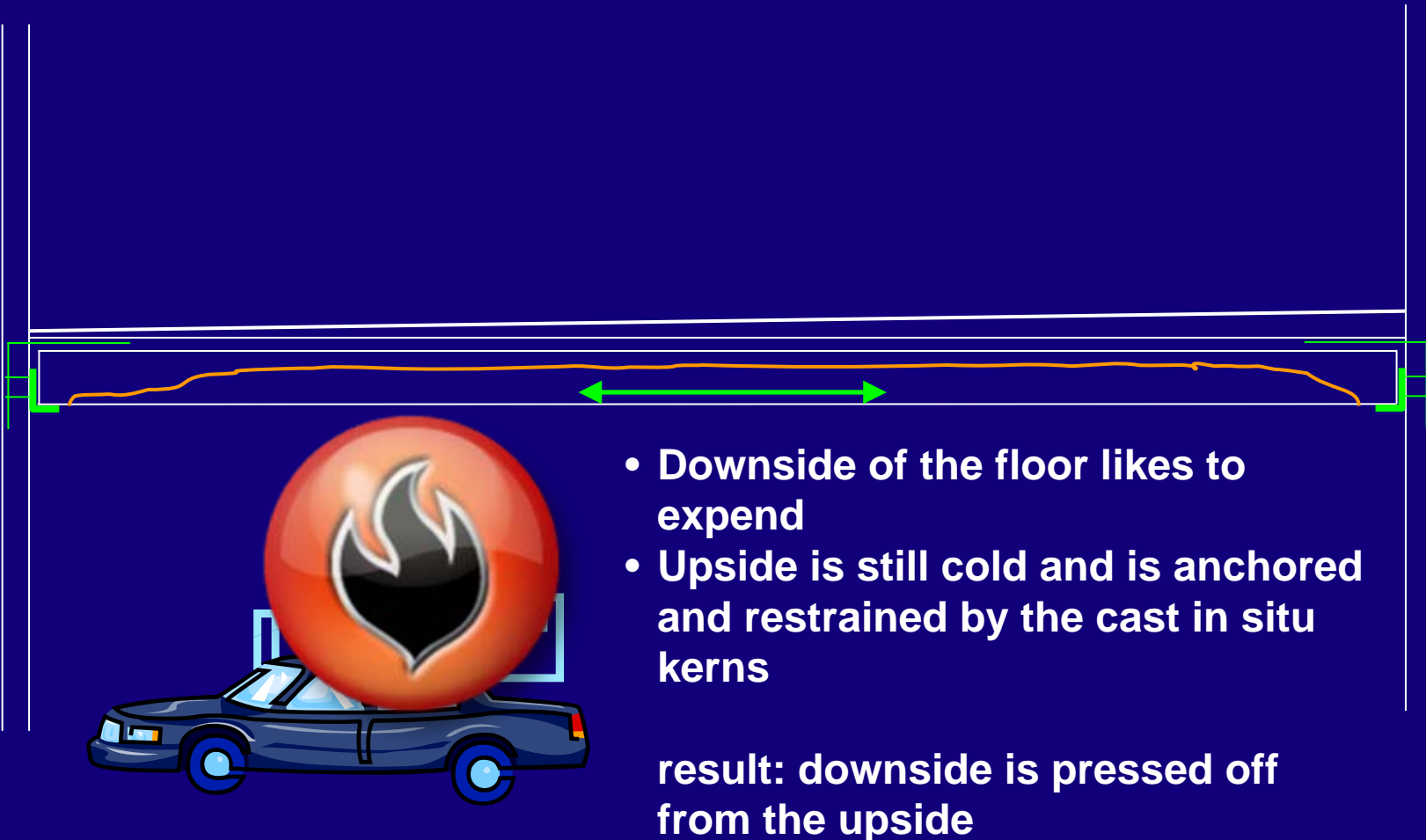
Cracks due to a non linear temperature distribution along the depth of the hollow core element



Fire accident



Fire accident



CE Marking



- EN 1168 gives in annex Y and ZA the rules for CE marking
- Annex Y gives methods of CE Marking
- Annex ZA gives the essential requirements or other provisions for CE Marking

CE Marking



- The CE Mark is set up to have a free trade between countries.
- The problem however is, that for the execution of the slabs every country has his own box values for the EC2 and the EN206

CE Marking



The Norwegian, Polish, Dutch example

Dycore has CE marked Hollow Core Products and an Attestation of Conformity (CoA)

However this is not enough.

Norway has a national foreword to the EN13369 that not only covers the design, but also workmanship and materials, in particular a reference to the national annex NS-En 206-1 is important.

CE Marking



The Norwegian, Polish, Dutch example

More details were needed, such as:

- W/C ratio
- Cement type
- Kind and amount of additions
- Documentation over potential alkali-aggregate reactivity
- Certificate after EN 12620 about used aggregates
- Cover
- Type and certificates of the prestressing strands
- Acceptation responsible designer that steel complies his specs.
- AoC after NS-EN 1168 by the producer, confirmed by NB
- NB confirms the producer has procedures to implement NP etc

CE Marking



The End

