

Holcofire “Lessons learned”

- retrospective view -

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Content

- Introduction hollowcores and fire
- Background and motives Holcofire
- Holcofire project
 - Project organisation
 - Technical aspects
- Industry cooperation
- Recommendation

Hollowcore floors

- In Europe we erect yearly about 25 million m² of hollow cores
- The total amount of erected stock amounts 1 billion m² in buildings



This success is largely due to:

- highly efficient design
- efficient production method
- sustainability aspects
- structural efficiency
- flexibility in use

Fire and structures

Fires are essentially
rare and random events:
for BUILDINGS it is
 $P = 10^{-5} - 10^{-6} / \text{m}^2 / \text{yr}$



Hollowcores and fire by past performance

- 1 billion m² in buildings implies 1000 – 10.000 m² of hollow cores every year on fire throughout Europe
- We do *not* know of significant numbers of losses of lives due to - whole or partly – hollow core floor collapses in buildings under fire.



Past performance confirms that hollow cores have excellent fire resistance

Concrete is fire resistant

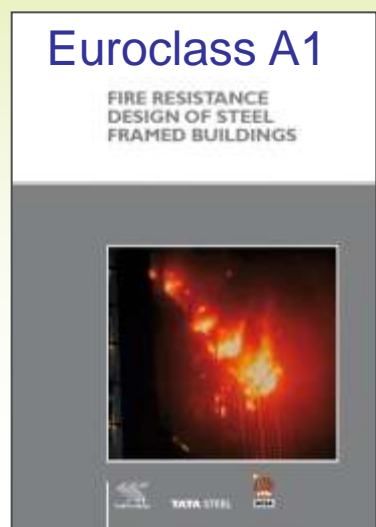
EN 13501-1 Euroclass A1 (non-combustible material)

- Concrete does not burn and does not increase the fire load;
- Concrete has a high fire resistance;
- Concrete leaves no dripping molten material that will spread the fire further;
- Concrete does not produce smoke or toxic gases;
- Concrete is a (heat) insulating material;

But, concrete industry has been underestimating the impacts of “fire resistance” in the recent years



Competitive material producers have developed advanced methods, such as Fire Safety Engineering, and communication campaigns to promote their – less fire resistant – products and solutions.





However, the concrete industry is sometimes struggling with discussions arising from fire cases in structures with concrete (precast) products.

More for a lack of satisfactory and coordinated communication than for real technical problems.

Questions around hollowcores and fire



1 October 2007: Rotterdam fire



Nov/Dec 1998: DIFT fire test

But clients asked questions in relation to fire on:

- Shear and anchorage
- Horizontal cracks in fire case Rotterdam
- How to deal with flexible supports



Rotterdam fire 1 October 2007



HOLCOFIRE project

Reacting to this situation and in order to be able to provide adequate answers, the European hollowcore industry acknowledged its responsibility to start a wide campaign of database analysis, tests and simulations.



The BIBM “Holcofire” project was initiated in 2010 in order to gain a complete understanding of the behaviour of prestressed concrete hollow-core slab floors under fire.

Participants in Holcofire

The following **BIBM** member organisations participate in “Holcofire”:

- Austria Verband Österreichischer Beton - und Fertigteilwerke, VÖB
- Belgium Fédération de l'industrie du béton, FEBE
- Denmark Betonelement-foreningen
- Finland Finnish concrete industry association
- France Fédération Française de l'industrie du béton, FIB
- Germany Bundesverband Spannbeton-Fertigdecken e.v., BVSF
- Italy Assobeton
- Netherlands Bond van fabrikanten van betonproducten in Nederland, BFBN
- Norway Betongelementforeningen
- Portugal Associação Nacional dos Industriais de Prefabricação em Betão, ANIPB
- Sweden Svensk betong

as well as

- **IPHA** International Prestressed Hollow core Association



**INTERNATIONAL PRESTRESSED
HOLLOWCORE ASSOCIATION**

BIBM Holcofire project

- For and by the industry
- Started in May 2010 and finalised in December 2013
- Steering group (7 persons) had 14 meetings
- Projectteam (8 persons) had 29 meetings
- Cerib as fire laboratory
- Experts from universities
- Big effort by industry: next to direct costs estimated 5 man years work

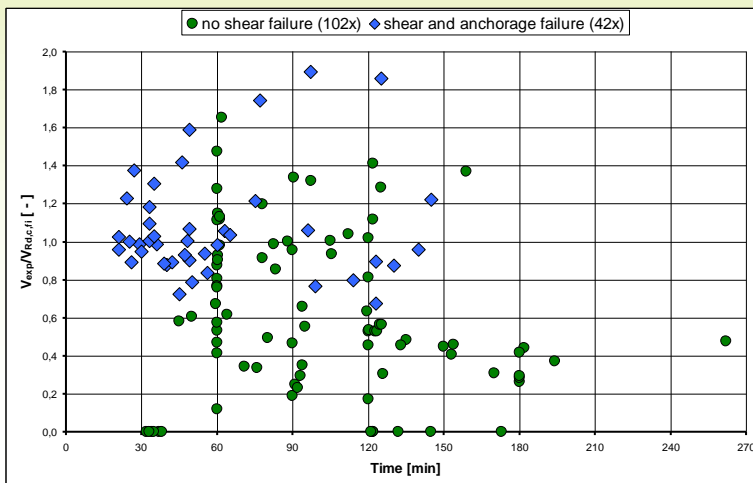


CERIB

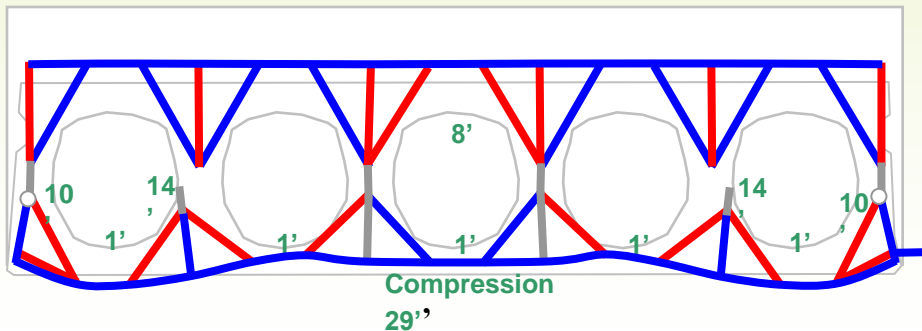
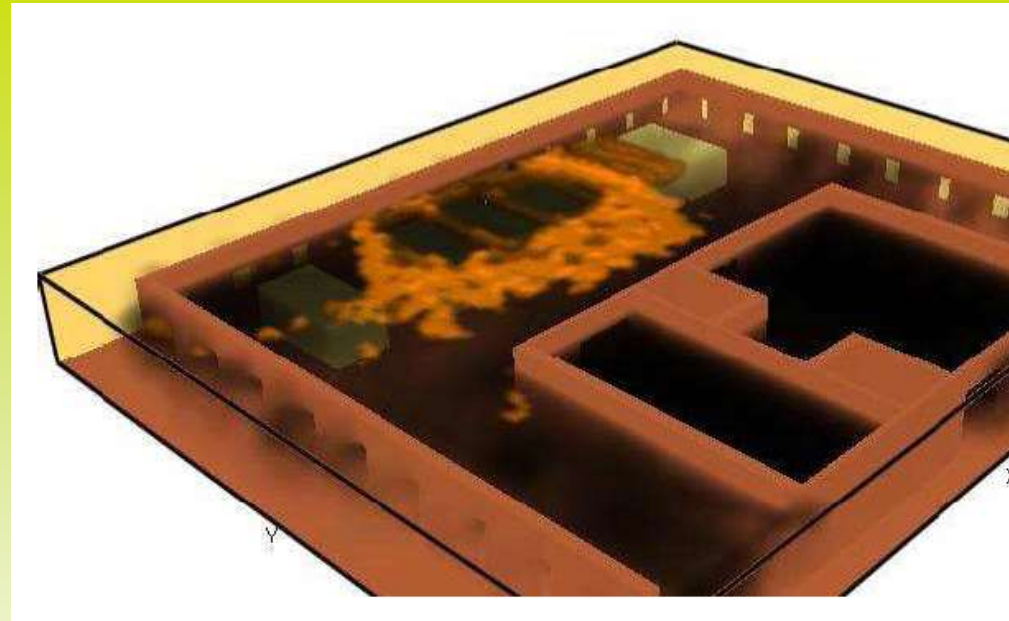
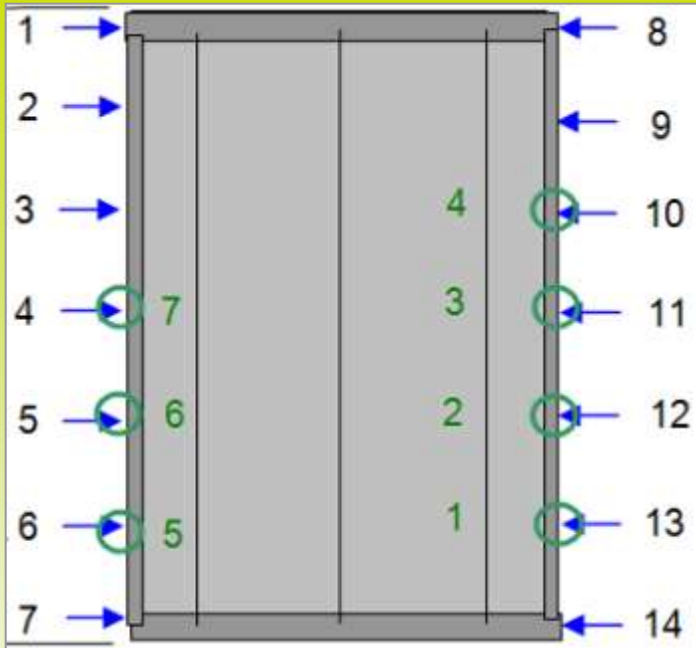
Holcofire project content



- Database → meta-analysis on 162 tests
- Shear and anchorage → fire test series G
- Flexible supports → desk research



Holcofire project content



- Rotterdam fire case → analysis and simulations
- Restraints on floor → fire test series R
- Local damage → numerical frame model

Lessons Learned

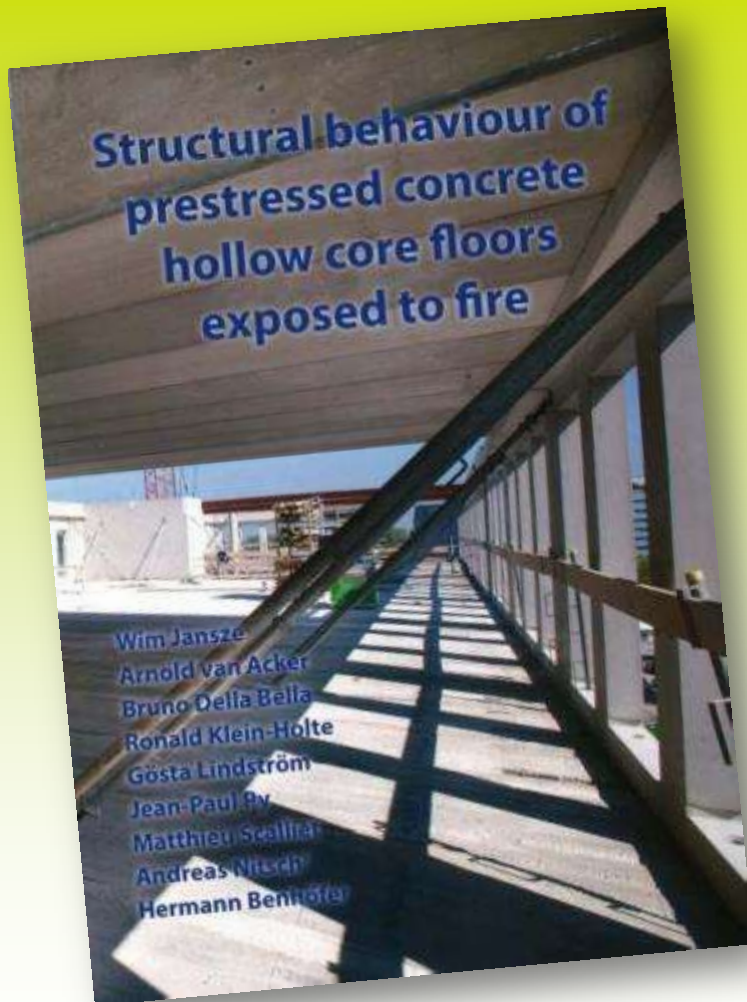
#1 The product meets regulations and requirements

#2 The product performs well when exposed to fire

#3 In specific cases fires in car parks are more severe than standard fires

No need for further fire testing and modelling

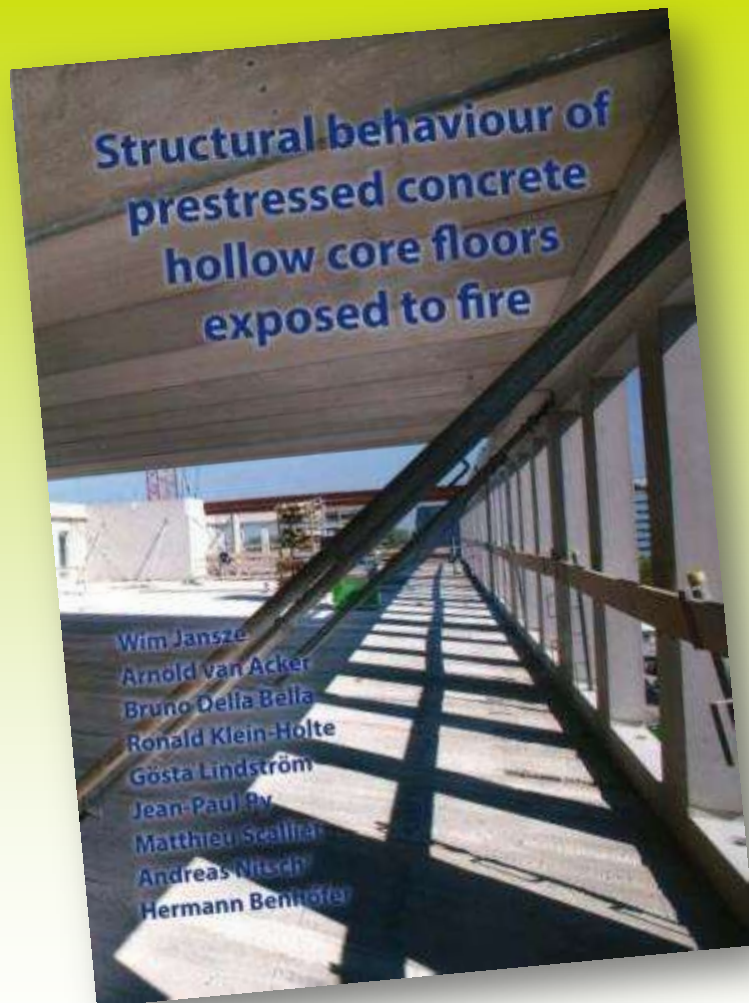
Publication



- **End report in a book**
all information together
- **No secrets**
book is available at BIBM /
IPHA [ISBN 978-90-8891-
812-4]

Currently working on
dissemination of results in
certain markets

Retrospective view



Broadgate (steel) vs Rotterdam (concrete)



Steel: Broadgate fire 23 June 1990



Threat or opportunity?

“... despite large deflections in the elements exposed to fire, the structure behaved well and there was no collapse of any of the columns, beams or floors”

The steel industry has global players, and the European steel industry is highly consolidated with a market share higher than 60% for the top five regional companies.

Broadgate → Cardington fire tests

- During 1996 six large-scale fire tests were performed in an eight story composite steel-framed test building constructed at the Cardington test site of UK BRE
- Initiated and sponsored by steel Industry: British Steel in that time (Corus [1999], Tata steel [2007]).



They turned in into an opportunity

“This test program surely represents the most comprehensive and realistic test series that has ever been performed, and is a **key reason** why the steel industry has been able to aggressively promote **performance-based structural fire design** in the subsequent decades, with **significant economic and sustainability benefits in steel-framed buildings**”.

Our opportunities?

The concrete industry as a whole should benefit more from collaborative projects – such as Holcofire - with advanced analysis to build up core competences and gain competitive advantage to promote the excellent fire resistance of their concrete (precast) products and solutions.

THANK YOU





Holcofire, Lessons learned by Wim Jansze - abstract

The concrete industry is sometimes struggling with discussions arising from fire cases in structures with concrete (precast) products, more for a lack of satisfactory and coordinated communication than for real technical problems. Based on the generally accepted principle that “concrete does not burn nor melt”, the concrete industry has been underestimating the impacts of “fire resistance” in the recent years. Competitive material producers have developed advanced methods, such as Fire Safety Engineering, and communication campaigns to promote their – less fire resistant – products and solutions. In 2010 the European precast flooring industry acknowledged its responsibility and launched under BIBM the “Holcofire” project to gain a complete understanding of the behaviour of concrete hollow core slab floors under fire conditions. The lessons learned are, firstly, that the product meets regulations and requirements with excellent safety margins; secondly, that the product performs well when exposed to fire, thus ensuring safety for occupants and stability for the structure; and thirdly, that in specific cases, fires in car parks are more severe than standard fires. Hollowcores have excellent fire resistance, even under severe fire conditions. The concrete industry as a whole should benefit more from collaborative projects with advanced analysis to build up core competences to proof and promote the excellent fire resistance of their concrete (precast) products and solutions.

