

## **Design recommendations for the structural safety of hollow-core slab floors in the event of fire in new buildings**

### **Introduction**

The structural safety of hollow core slabs in case of fire in recent years has been extensively investigated by renowned experts from home and abroad. The findings of these studies were presented to the Dutch "Expertise-centre Regulations Building". An ERB-consortium<sup>1</sup> has after examining the relevant documents stated that '... in the light of the Dutch regulation ... the total number of test results, real fires, modeling and track record show that given these recommendations with a sufficient degree of reliability the probability on disproportionate damage is sufficiently small ". This judgment relates to the use of hollow core slabs in new construction.

A closer look by renowned experts<sup>2</sup> on the available information led to the conclusion that with these recommended measures, the risk of casualties or disproportionate damage in the event of fire is acceptably small.

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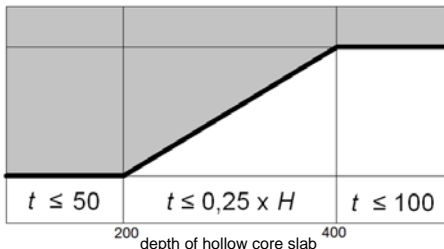
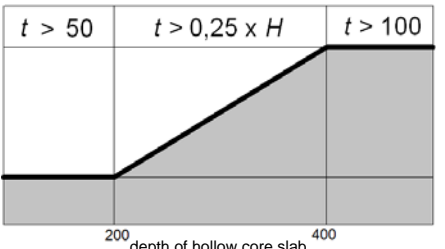
<sup>2</sup> Representatives of COBc, BFBN, VNConstructeurs, Efectis Nederland, TNO en Adviesbureau ir. J.G. Hageman.

## Recommended method for assessing the structural fire resistance of hollow-core slab floors

For hollow core slab floors for which a fire resistance requirement applies, the following assessment method for the fire resistance<sup>3</sup> is recommended:

- (1) In general the fire resistance in relation to bending and shear of rigid and non-rigid supported hollow-core slab floors is determined according to NEN-EN 1990 in combination with NEN-1991-1-2 and NEN-EN 1992-1-2 and NEN-EN 1168 Annex G.
- (2) For hollow-core slab floors with a topping, the measures set out in table 1 are recommended.

**Table 1 – Recommended measures in relation to the thickness of the topping<sup>a)</sup>, the depth of the hollow core slab and the consequence class**

Consequence Class	Thickness of topping $t^a)$ in relation to the depth of the hollow core slab $H$ in mm	
		
	$t \leq 50$	$t \leq 0,25 \times H$
	$t > 50$	$t > 0,25 \times H$
		$t > 100$
1	-	- <sup>b)</sup>
2a <sup>c)</sup>	-	- <sup>b)</sup>
2b	-	A
3	-	A
<p>A Measures based on a risk analysis in accordance with NEN-EN 1991-1-7 and NEN-EN 1990,  <b>or</b>                      Measures based on the realization of a second load path in the event of failure of the under flange; for example, based on membrane action by virtue of the reinforcement in the topping. In this case, calculations for the connecting structures must also be carried out,  <b>or</b>                      Installation of a sprinkler system class A, B or C under the floor at risk from fire<sup>d)</sup>,  <b>or</b>                      Measures to limit the temperature to less than 200 °C at the surface of the concrete during the legally required time for the fire safety.</p>		
<p>a The thickness of the topping is defined as the total of thickness of the structural topping and the thickness of the cement-bound finishing screed layer, unless interaction between the two layers is prevented. For adhesive finishing screed layers with strength class of a maximum D15, half the thickness of the finishing screed layer may be included for the determination of the topping. The thickness of the topping to be determined applies for the middle of the span. Possible camber of the slabs means that the thickness of the topping may be slightly greater near the supports.</p> <p>b In view of the small risk of personal injury, risk analysis shows that the risks are sufficiently low. This means that the requirements are met and the measures in A are, in fact, not necessary.</p> <p>c A building with two or more fire compartments, of which at least one is assigned to a group home for care or on call 24-hour care, should be classified for at least in consequence class 2b.</p> <p>d If the sprinkler system is not included as part of a proposed equivalent solution, the presence of a sprinkler system intended to protect the hollow-core slab floor can be regarded as a measure to limit the temperature as described in the measures in A. A careful assessment will have to be made, taking into account the type of sprinkler system, the reliability of the system, the residual risk (depending on the type of building and the purpose for which the building is used) and the interaction with other fire safety measures.</p>		

<sup>3</sup> Instead of the methods described above, testing according to NEN 6069 (Testing and classifying the fire resistance of building components and building products) is permitted, provided the boundary conditions are representative for the building in which the hollow-core slab floor is used.