Toppings and Interface Shear in Hollowcore Composite Floors

July 2018

A composite hollowcore floor combines precast hollowcore units with a structural concrete topping resulting in enhanced structural performance and lateral load distribution. However, the design of the topping and the shear at the interface between the precast and in-situ concrete must be properly addressed.

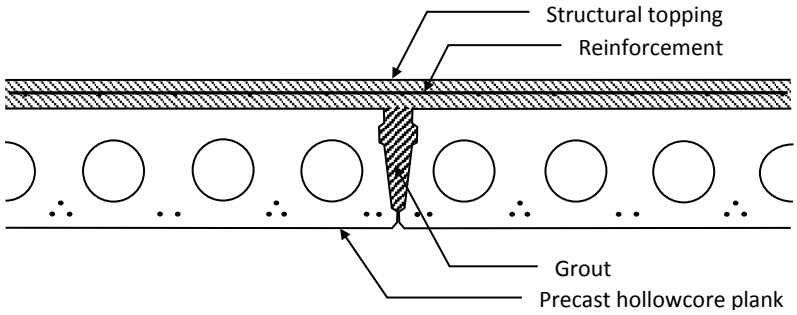
STRUCTURAL DESIGN OF HOLLOWCORE COMPOSITE FLOORING

- Hollowcore planks are designed in accordance with Eurocode 2: Design of concrete structures, in particular Part 1-1 (General rules and rules for buildings) and Part 1-2 (General rules - structural fire design). Additionally, hollowcore planks are manufactured to conform to BS EN 1168.

- Hollowcore composite floors are designed to have effective shear key joints between adjacent slabs such that when grouted with a minimum C20/25 concrete the individual slabs become a system that behaves similarly to a monolithic slab.

- The use of a structural topping on precast prestressed planks enhances the structural capacity of the floor due to composite action between the topping and the planks. Steel Construction Institute (SCI) Report P401 indicates that if a structural topping is used, then typically it is possible to increase the resistance of hollowcore planks by between 20% and 60%.

- Typically, a structural topping comprises a 50 mm to 75 mm thick layer of C25/30 normal weight concrete reinforced with A142 fabric reinforcement. The structural topping should not be confused with some types of screed that do not contribute any structural enhancement to the precast concrete planks.



- Prestressed hollowcore slabs will exhibit a degree of camber, the extent of which will depend upon the span and the amount of prestress within the design. Due allowance must therefore be made for this in determining finishes and the overall floor thickness. The specified thickness of structural topping must be provided at the point of maximum camber.

mpa British Precast Flooring Federation

The Old Rectory, Main Street, Leicester, LE3 8DG
Tel: 0116 232 5170, email:
info@precastfloors.info
www.precastfloors.onfo

- The design of the topping must take into account the following:

  (a) compressive stress in the topping
  (b) horizontal (complementary) shear at the interface between the topping and the floor planks
  (c) durability requirements of the concrete
  (d) cracking of the topping due to shrinkage and thermal movement during and after construction

- With respect to item (b), although there is usually no mechanical fixing between the structural topping and precast planks, the two parts can be designed to act compositely provided that the shear stress at the interface meets the requirements of clause 6.2.5 of BS EN 1992-1-1:2004.

  In simple terms the design value of the shear stress at the interface should not exceed the design shear resistance at the interface. The magnitude of the design shear resistance takes into account the roughness of the interface using two factors c and μ. Surfaces may be classified as very smooth, smooth, rough or indented as follows:

Classification	Example	c	μ
Very smooth	A surface cast against steel, plastic or specially prepared wooden moulds	0.025 – 0.10	0.5
Smooth[1]	A slipformed or extruded surface, or a free surface left without further treatment after vibration	0.20	0.6
Rough[2]	A surface with at least 3 mm roughness at about 40 mm spacing, achieved by raking, exposing of aggregate or other methods giving an equivalent behaviour	0.40	0.7
Indented	A surface with indentations complying with Figure 6.9 of BS EN 1992-1-1	0.50	0.9

[1] This is the standard top surface finish
[2] This is an optional surface finish that can be formed at the time of casting

  The upper surfaces of precast planks can therefore be finished as to ensure that the topping acts compositely with the planks to form a unified structural element.

- Hollowcore composite floors can be designed to provide diaphragm action to transmit horizontal force to the primary supporting structure. Any requirement for floor diaphragm action will need to be considered when designing precast prestressed concrete floors. The reinforcement in the structural topping will need to be designed for both bending and diaphragm actions. Clause 10.9.3 of BS EN 1992-1-1 explains the principles of how a precast floor can be designed to act as a diaphragm.

- On site hollowcore planks must be grouted immediately after installation. Prior to laying a structural topping the top surfaces of the precast planks should be thoroughly cleaned and free from any debris and then they should be wetted approximately 30 minutes before laying the topping. The precast surfaces should be saturated but free of surface water.