

Brittle finishes

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Brittle finishes

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Brittle finishes

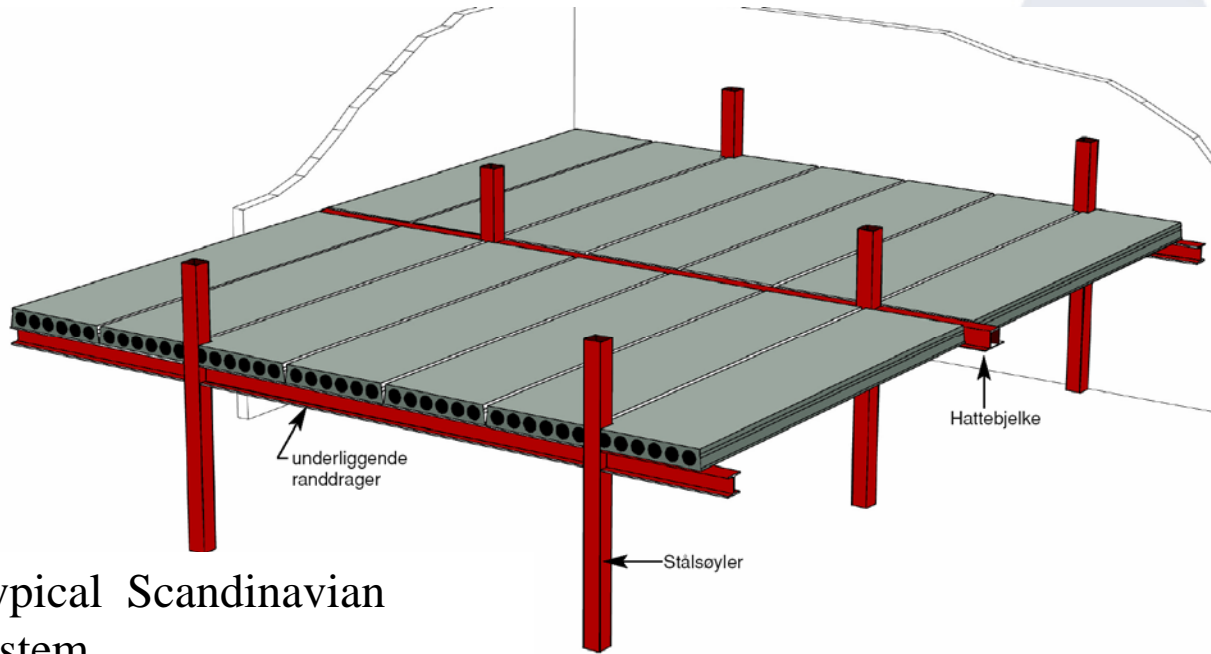
- Content
 - Structural solutions
 - Tiles fixed directly to HCS
 - Tiles on antifriction layers
 - Sliding joints
 - Ceramic tiles, gluing
 - Design guidelines
 - Specification texts

Brittle finishes

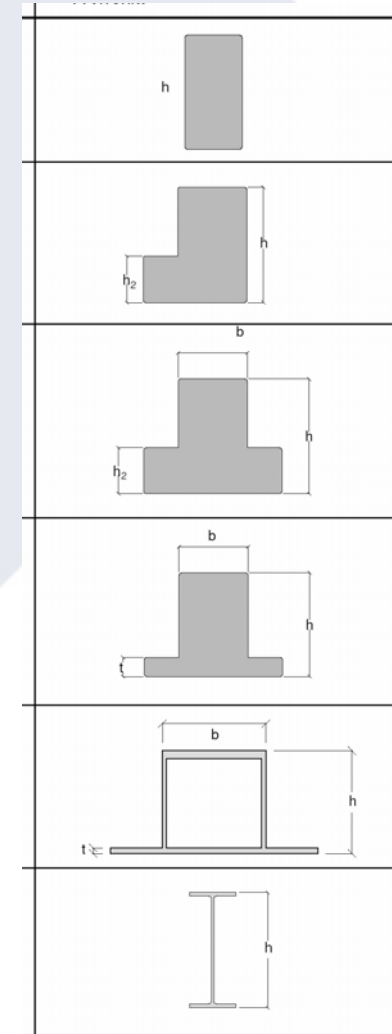
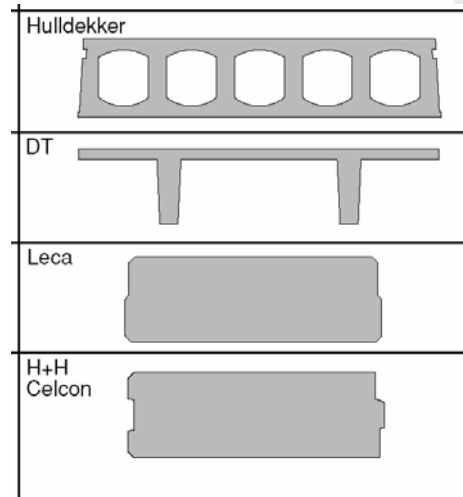


- Structural solutions
 - Floor slabs
 - Beams and joints
 - Deflections and end rotations
 - Principles to avoid cracking

Structural solutions

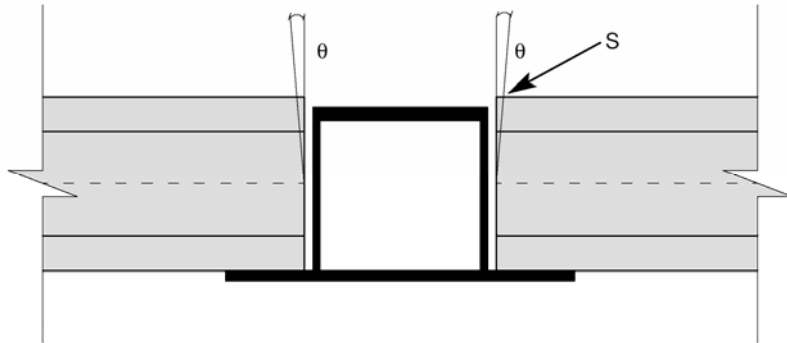


Typical Scandinavian system



Deflections and end rotations

Rotation at end
of HCS



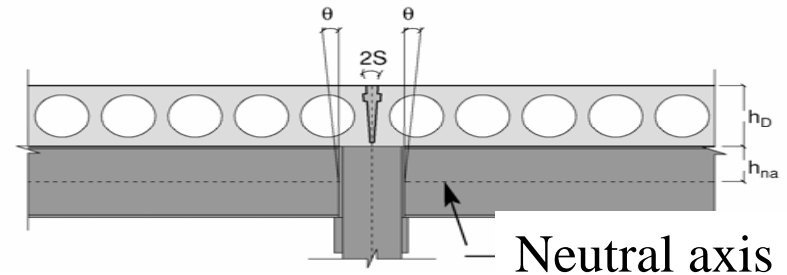
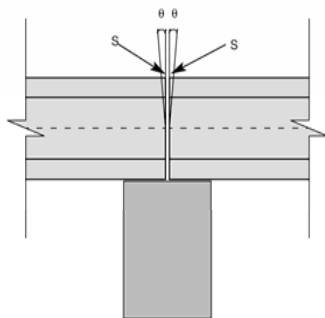
$$S = \theta (h_D + h_{na})$$

$$\theta = 16 d / 5L$$

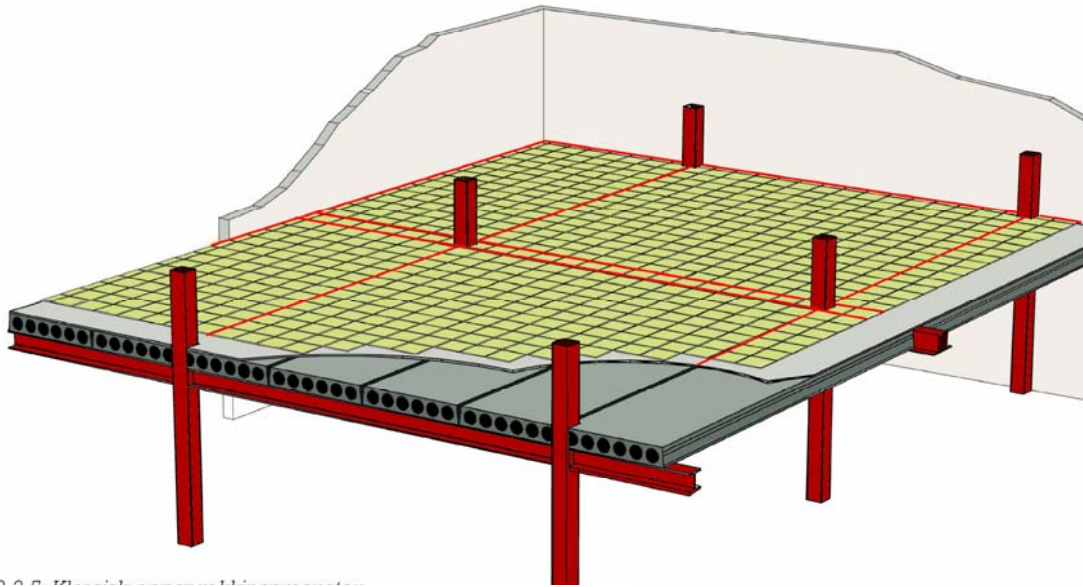
d = expected deflection

L = span width

Rotation at end of
beams



Possible consequences from end rotations



Typical fracture pattern

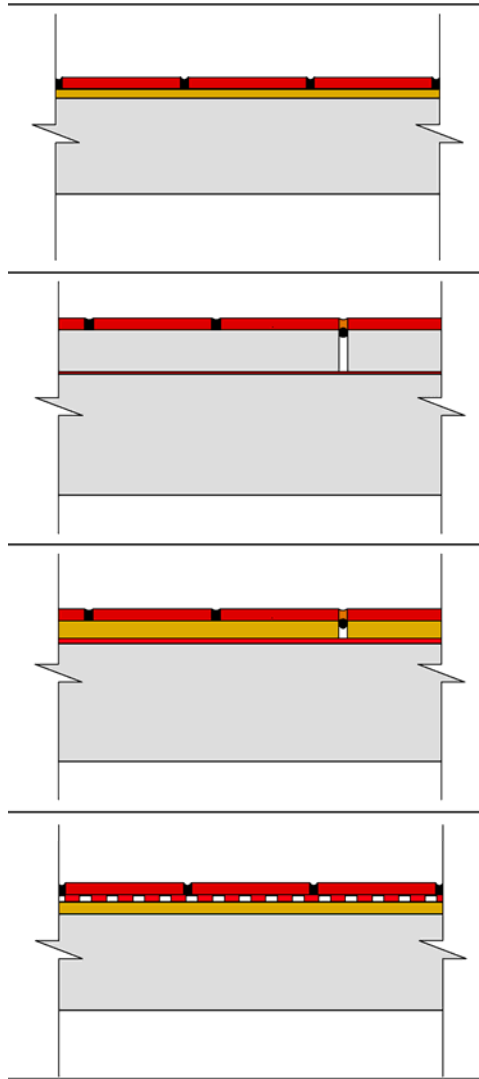


Typical cracking HSQ
(hat beam)

Some principles

- Brittle finishes are *brittle*
- The ability to take tensile deflections depends on
 - The material itself
 - Thickness of tiles
 - Interaction between tiles and glue
 - Floor structure above HCS

Four principles of top floors



Tiles fixed to self levelling screed

Tiles fixed to concrete topping separated from HCS by sliding layer

Tiles fixed to concrete topping separated from HCS by sliding layer, LFF (Low Floating Floor – fibres and elastic mortar)

Tiles fixed to elastic topping separated from HCS by “de-tensioning” elastic material

Limitation of tensions from rotations

- Use elastic joints
- Use floating floors
- Use a combination of both

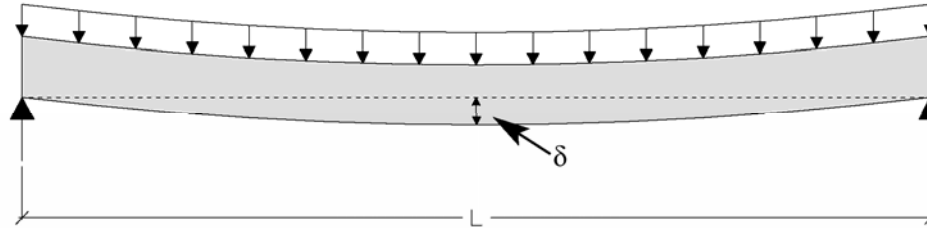
Limitation of tensions from rotations

- Deflection in the tile plane shall be less than 2 mm
- Long time deflection after applying 50 % of live load:

$$d/L < 1/1200$$

- 2 mm is the tensile capacity of glues normally used

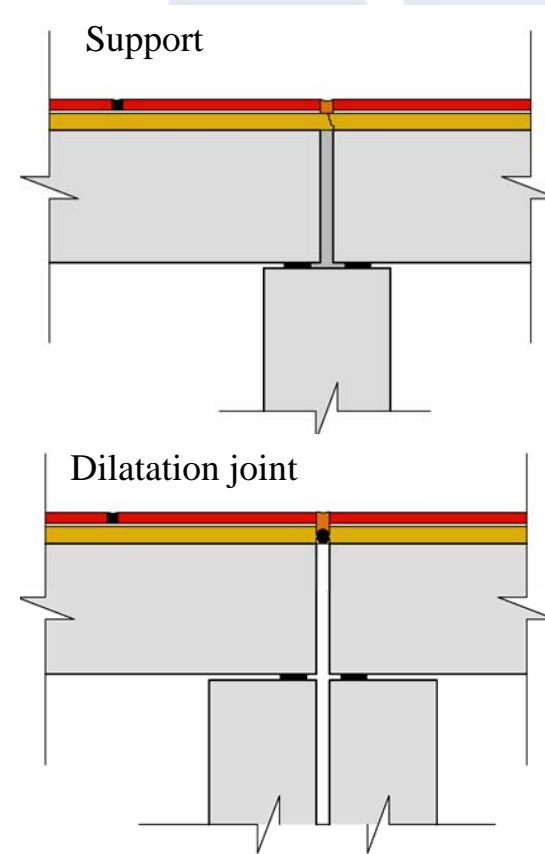
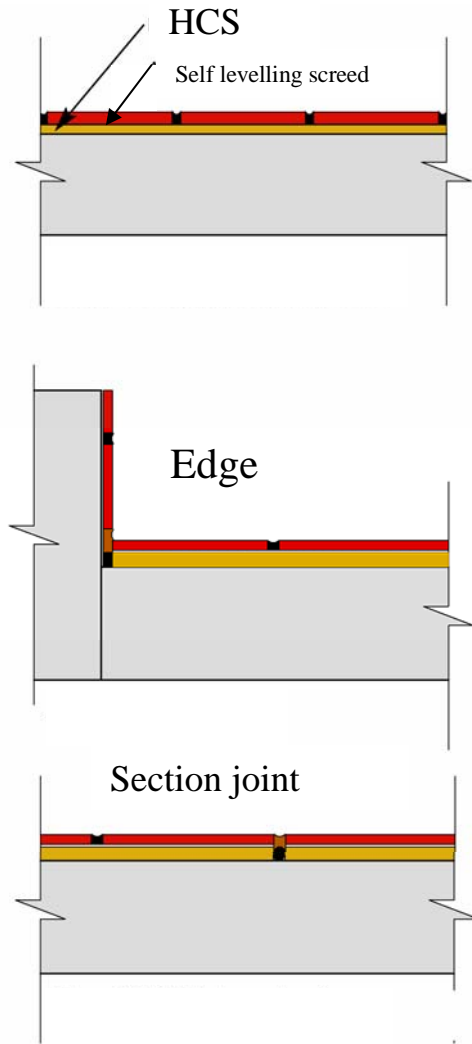
Limitation of tensions from



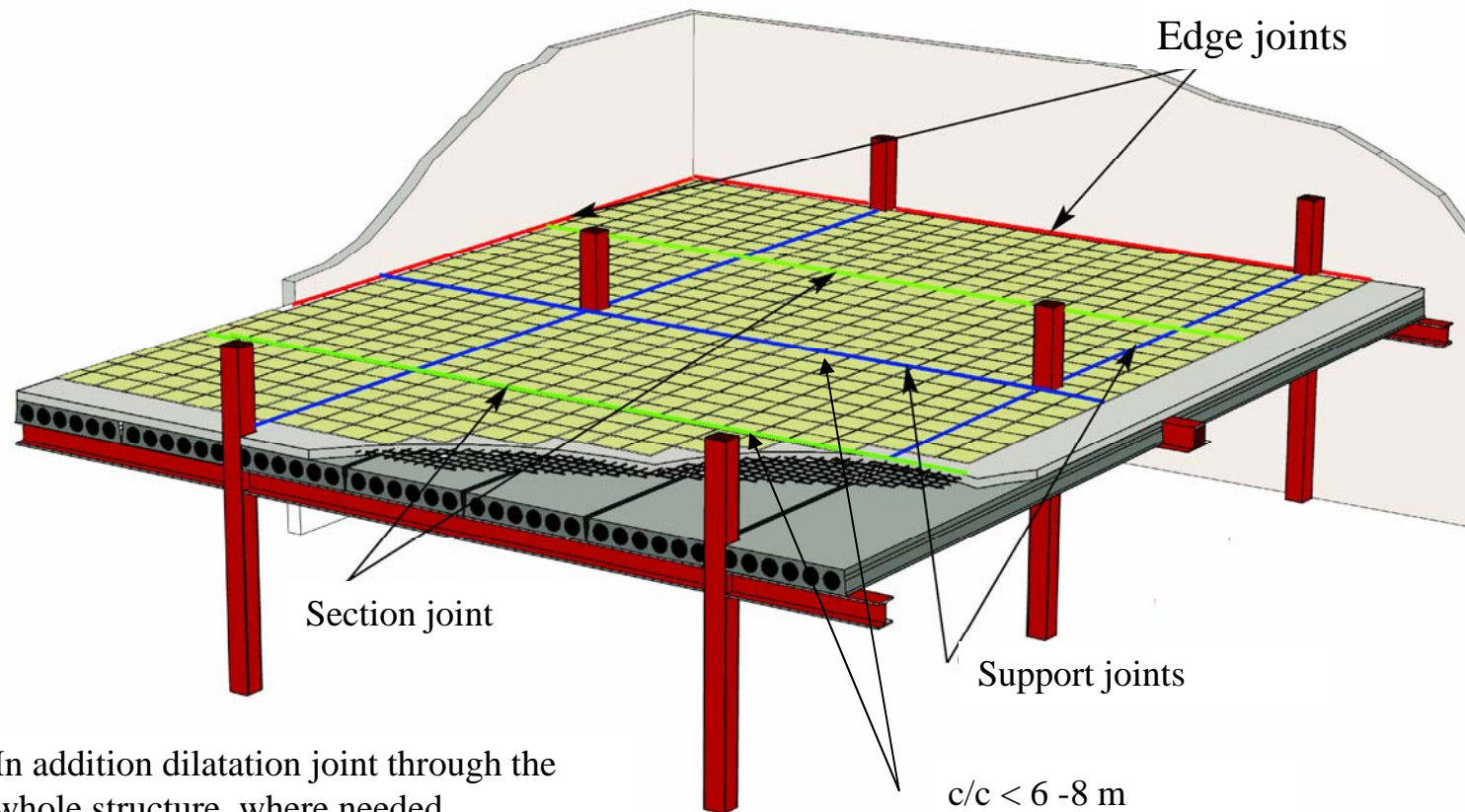
Deflections from 50% of live load plus long time deformation must cause crack widths less than 2 mm

Beam profile	L mm	h_{beam} mm	Width of cracks (mm) from $\delta / L = 1/1200$ mm
IPE	7000	500	2
HSQ	7000	270	1
RB	7000	600	2
LB/DLB	7000	600	1,5
HB	7000	365	1

Typical joints tiles fixed to HCS

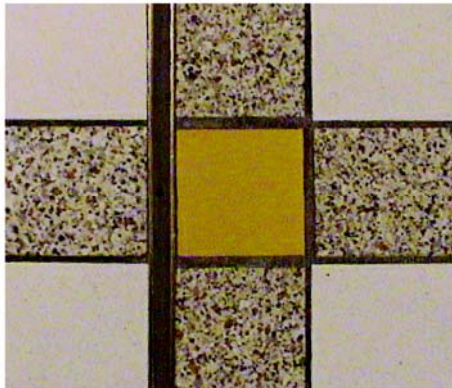
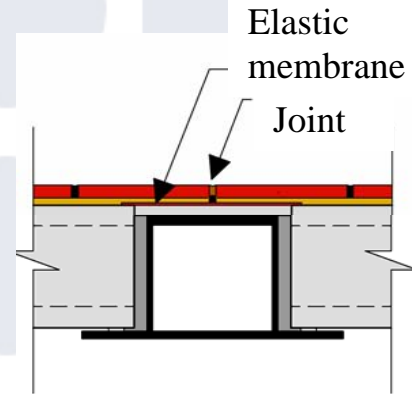
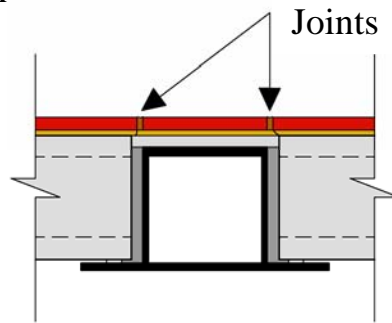
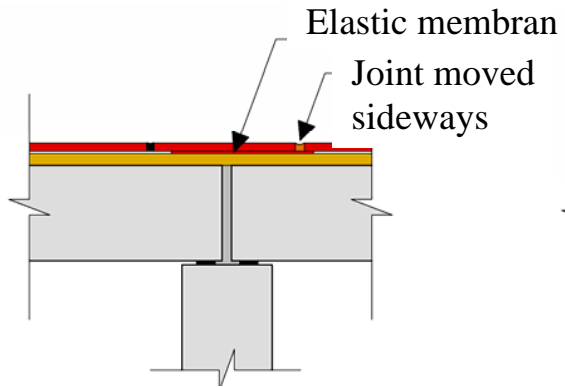


Typical joints tiles fixed to HCS



In addition dilatation joint through the whole structure, where needed

Practical details

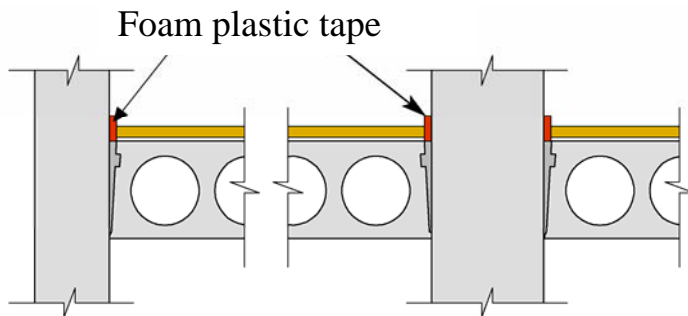
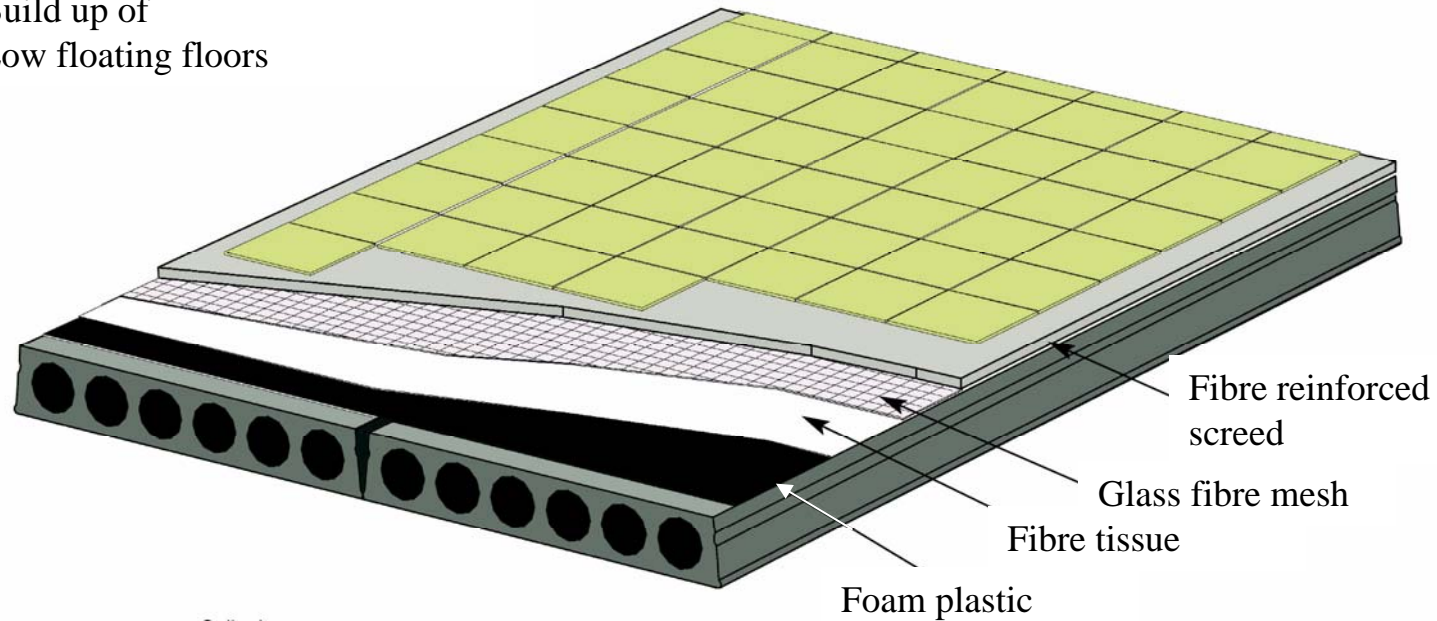


Narrow tiles close to joints



Low floating floors an alternative

Build up of
Low floating floors



Precautions at columns and
walls through several floors

Low floating floors an alternative

- If tensile prolongation is less than 1 mm due to end rotations the joints may make a grid of 20 x 20 meters
- The joints do not have to correspond to the joints of the frame
- Elastic joints as close as possible to the element support is recommended

Brittle finishes require a profound understanding of the frame structure

- It must be described in the specification text by the consultants maximum deflections of the frame, beams and slabs.
- Joints must be specified as cost bearing activities
- The HCS and frame designers and suppliers may get the responsibility of the cracks if they are not aware
- The ceramic tile industry have learnt the lesson, and do not want to pay for other contractor's lack of knowledge