



## FIRE PROTECTION OF THE WOODEN FLOORS.

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### IS IT:

*Product*

*Technology*

*Equipment*

### APPLICABLE FOR:

*Restoration*

*Rehabilitation*

*New Construction*

### APPLICABLE ON:

*1. Foundations and underground structures*

*2. Vertical structures*

*3. Horizontal structures and vertical connections*

*4. Roof and terraces*

*5. Façade and building envelope*

*6. Finishes and completion elements*

*7. Integrated services*

*8. General strategies for building recovery*

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***Related companies:*** No companies; university research; structural study.

## DESCRIPTION

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In wood joist floors that do not comply with the required fire resistance by themselves.

## WHY TO USE

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To allow for exposed wooden beams, or without the need for fire protection.

## HOW TO USE AND APPLY

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Rehabilitation of the floor slabs by adding a concrete compression layer connected to the existing (or possibly new) timber joists. The compression layer is also connected perimetrically to the existing load-bearing walls.

In an ordinary situation, the assembly acts as a mixed wood-concrete section, thanks to the connectors between the two materials, considerably increasing stiffness and resistance (improvement of deformations and resistance capacity).

In a fire situation, since the joists do not meet the required time, they should be considered to be completely charred according to the fire requirement. In this situation, the compression layer then functions as a two-way slab. It is calculated as a reinforced concrete slab of low thickness, with reduced actions (according to the applicable simultaneity coefficient) and with safety coefficients for actions and materials also reduced, for accidental situations. The sizing check is only at Ultimate Limit State (i.e. resistance), since in accidental situations the Serviceability Limit State (deformations) is ignored.

As a whole, this action makes it possible to keep the original structure of the floor slabs (wood joists) in view while maintaining fire resistance, which is often critical in cases of narrow wood joists and/or with a high fire requirement (depending on the use).

The concrete compression layer is executed as any compression layer in rehabilitation or new construction.

Simply put, this compression layer will be dimensioned not only for ordinary situations functioning as a compression layer in a mixed section (connected to the timber joists), but also dimensioned as a two-way slab in fire situation (excluding the joists).

## TECHNICAL CHARACTERISTICS

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The technical characteristics of the materials to be used will be those required for the project:

- Concrete: conventional or lightweight (to reduce the added load). Possible use of self-compacting concrete to increase performance and flatness of the finish.
- Reinforcing steel: According to current regulations.
- Joist connectors: There are several systems on the market to connect wood joists to the concrete compression layer. Alternatively, lag screws or nails can be used, always according to the calculation dimensioning.
- Wall connectors: They can be reinforcing bars according to current standards. Depending on the nature of the wall, they will be anchored with the appropriate type of resins (multiple products on the market).

## RECOMMENDATIONS AND OTHER INFORMATION

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The system is designed so that, in a fire situation, the compression layer acts as a two-way reinforced concrete slab, connected to the perimeter walls, obviating the existence of the joists.

However, in an ordinary situation, it is convenient that this concrete layer is connected to the wood joists, in order to optimize the capacity of the materials (mixed wood-concrete section). As in any compression layer on timber, it is advisable to place a breathable waterproof sheet under the concrete to prevent water absorption by the timber during pouring.

The concrete layer should have a minimum thickness of 8 cm (or minimum normative thickness for slabs).

It is recommended to place a single layer of reinforcement (bidirectional) on the lower face of the concrete layer, complying with the minimum cover (for durability or fire) below. The upper cover should not exceed 50 mm, to avoid cracking due to shrinkage. With these considerations, the maximum possible depth of the concrete layer is usually around 12 cm, depending on the reinforcement diameter.

The system is a technology that makes it possible to leave the wood joists exposed and/or unprotected, taking advantage of the capacities of the reinforced concrete in a fire situation. Therefore, all the applicable regulations for reinforced concrete are prescriptive.

## **EXAMPLES**

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Wood joist floor slabs with stone infill (ceramic vaults, stone vaults, etc.).

Wood joist floor slabs with wood deck (with or without intermediate battens).

[See images at the end of this sheet].

## **REFERENCES / SOURCES AND LITERATURE**

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Regulation: CTE DB-SE

Regulation: EHE-08

Book: Jiménez Montoya. Hormigón armado.

## **WEBSITE OF THE COMPANY**

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[www.bisstructures.com](http://www.bisstructures.com)

## IMAGES AND CAPTIONS



Fig.1-2: View of the wood joist floor slab, in this case with a ceramic infill with ceramic mortar, with the lag bolt connectors already screwed to the joists, with the bidirectional reinforcement of the concrete layer and the connectors to the perimeter of the walls. © *bisstructures*



Fig.3-4: View of the system before and after concreting. Note the lower breathable waterproofing sheet to prevent the absorption of water from the concrete by the joists. © *bisstructures*

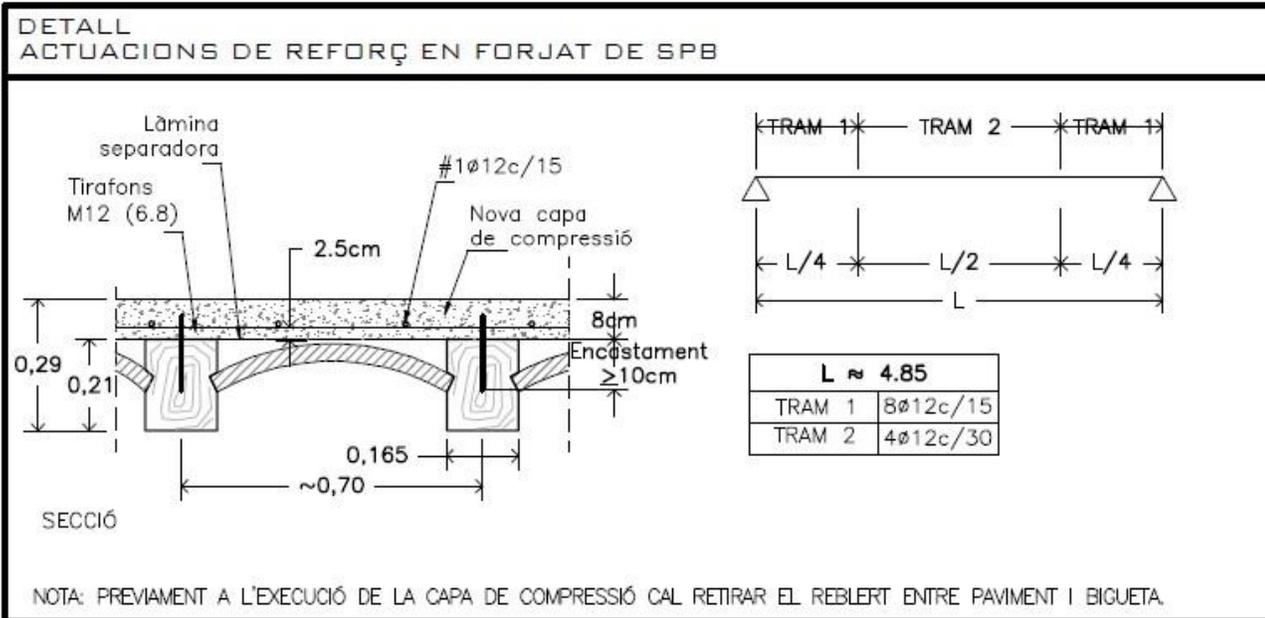


Fig.5: Detailed example of rehabilitation using a fire-resistant reinforced concrete compression layer of an existing 4.85 m span slab of wood joists and ceramic vaults. In this case, the new concrete layer is resolved with a thickness of 8cm and only a bottom reinforcement of #1Ø12c/15. This compression layer will work as a bidirectional slab in a fire situation and will be resistant on its own without the wood joists (which are considered to be carbonized). © *bisstructures*