



Underneath view of a floor requiring reinforcement. The well-preserved beams made static adaptation possible using this technique.



View of a floor after removing the substrate and flooring existing before it was strengthened.

Right: view of Campo Manin .



This typical late-gothic building, located in the centre of Venice, is of great architectural interest (loggetta finely decorated with columns and double-lancet windows in Istria stone). After various alterations in later periods that slightly changed the interior layout, the building was due to house public offices. This change of use obviously required the floors to be upgraded to current standards though the wood they were made out of had to remain. The solution of composite timber-concrete floors was chosen in order to increase their load capacity.

REINFORCING WOODEN FLOORS

Campo Manin complex Venice

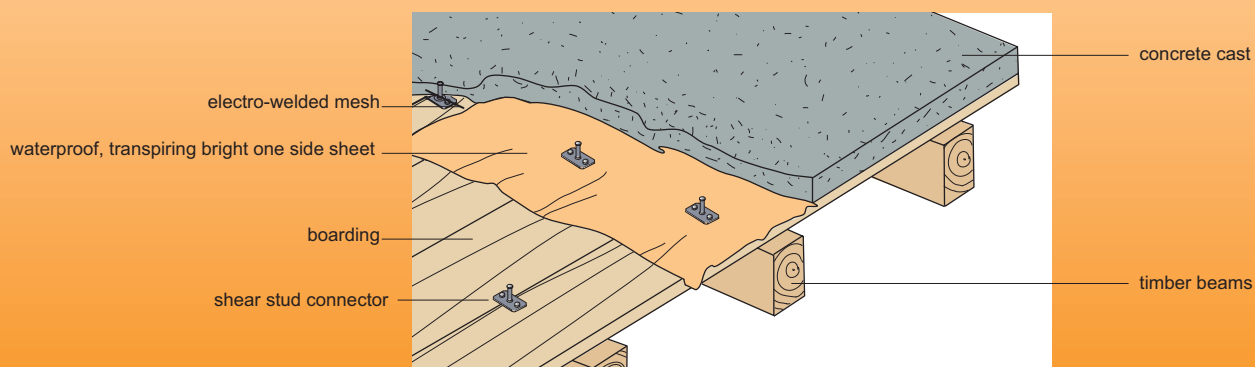
Description of work

The building was due for restoration and static upgrading. The old wooden floors were consolidated as, being built to withstand modest loads, they were structurally unsound, also considering the change in the use of the building which entailed a further increase in load. Their scarce rigidity made them particularly susceptible to irritating impact vibrations. Moreover, they had been subjected to considerable creeping over the years with consequent sinking of the boarding and irregular flooring.

The floors were built with a frame of beams in fir and larch wood to which 2 cm thick boarding was nailed. The cross-section of the beams varied from about 4 to 5.5 metres depending on the clearance. The beams lay on solid brick walls. The hypothesis of total demolition and replacement of the floors was impracticable due to the excessive cost and the obvious difficulties of working in the centre of Venice.

From the technical and economic point of view, the ideal solution for renovating the floors was to achieve the required rigidity by means of a thin slab of concrete (about 5 cm thick) which was made to collaborate with the wooden elements by means of special connectors developed and produced by Tecnaria S.p.A.

The combination of wood with concrete by means of special connectors achieved a composite structure in which the combined mechanical characteristics of the materials are exploited to offer considerable advantages as regards flexural rigidity, load capacity, thermal and acoustic insulation and fire resistance.



TECNARIA

TECNARIA S.p.A. Viale Pecori Giraldi 55 - Bassano del Grappa (VI) - Italy - Tel. +39. 0424 502029 r.a.

Fax +39.0424.502386 - E-mail: info@tecnaria.com - <http://www.tecnaria.com>

laying procedure



The old flooring and substrates were removed to expose the boarding and the surface was roughly cleaned. In order to prevent the wood from absorbing the water from the cast concrete, a bright one side sheet was placed over the boarding.



Holes drilled in boarding and beam with a double drill. This tool is available for hire.

Two holes with a diameter of 8 mm and a depth of 12 mm were drilled to hold the two screws supplied together with the connector.

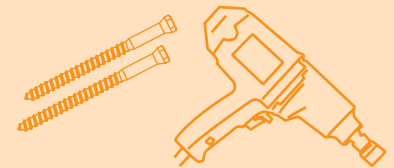
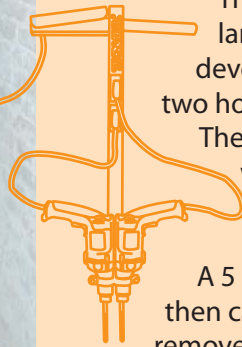
The two screws were then tightened with an impact wrench. As a large number of connectors were used, a special tool was developed by Tecnaria to rapidly drill two holes at the same time.

The floor was reinforced with electro-welded mesh.

The floors were shored before casting the concrete.

A 5 cm thick layer of concrete was then cast (Rck 250). The shoring was not removed until the concrete had totally cured.

No specialised operators were required.



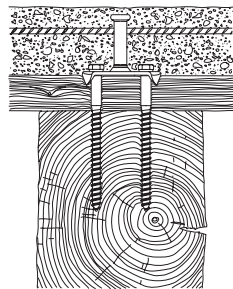
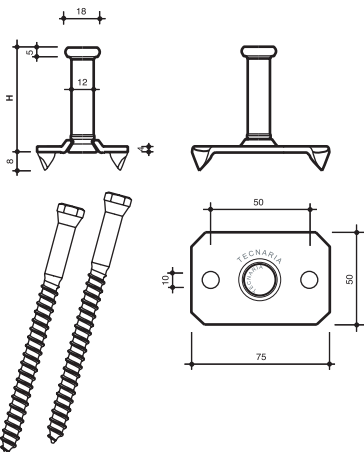
Fixing the connectors with an electrical impact wrench and a 13 mm hexagonal insert.



A bright one side sheet was placed between the boarding and the concrete in order to prevent direct contact between the wood and the concrete which would cause the humidity from the concrete to escape, a dangerous thing during curing. The photo shows a detail of a brickwork anchor obtained by inserting bars.



A suitable sized electro-welded mesh was inserted in the concrete. The photo shows the concrete being poured. The floors were shored beforehand.



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