



## **GPR technique as a tool for decision-making regarding timber beam inner reinforcement: The Lonja de la Seda de Valencia, Spain**

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This paper describes the decision-making process for the timber beam inner reinforcement of the building The Lonja de la Seda de Valencia (15th c.), Spain. This research was based on the study of 13 timber beams for their diagnosis and the characterization before decision-making in structural reinforcement. For this purpose, we integrated the results of analysis of historical documentation, in situ visual inspection and ground penetrating radar (GPR).

The rehabilitation project considered the substitution of the upper-storey floor (The Consulate of the Sea Hall) for another one that complied with the original. This room was closed due to the instability of the timber beams. For the flooring renovation it was necessary to increase the rigidity of the timber floor framing.

Preliminary conclusions, which derived from the historical documentation and in situ visual inspection of the timber coffered ceiling were: (a) timber beams supported inside masonry walls could suffer moisture and xylophage attacks, (b) timber beams were significantly damaged (splits, ring shakes, failure of beam section that reduced its bearing capacity), (c) substantial timber beam warping.

So the main objectives of this GPR study were: to detect splits, to identify failure of section due to biological attacks, to pinpoint epoxy resin reconstructions and to assess the severity of the damages observed on surface.

A GPR survey was carried out in timber coffered-ceiling beams of The Consulate of the Sea Hall. Radar measurements were carried out using a SIR-10H system (GSSI) and a 1.6 GHz ground coupled antenna, due to the timber beam dimensions (0.45 x 0.45 x 8.75 m). A total of 37 longitudinal profiles were collected in the centre of all the beam accessible sides. After radargram processing steps, a number of anomalies were detected in the records, which were analysed. The outcomes derived from this GPR study were taken into account when it came to make decisions in the final restoration project of the timber coffered ceiling elements: timber beams, wooden latticework and floor.

The results obtained in this survey are a good example of GPR application in Civil Engineering for timber beam inner reinforcement of a building, establishing technical criteria.