

# CITE 2019

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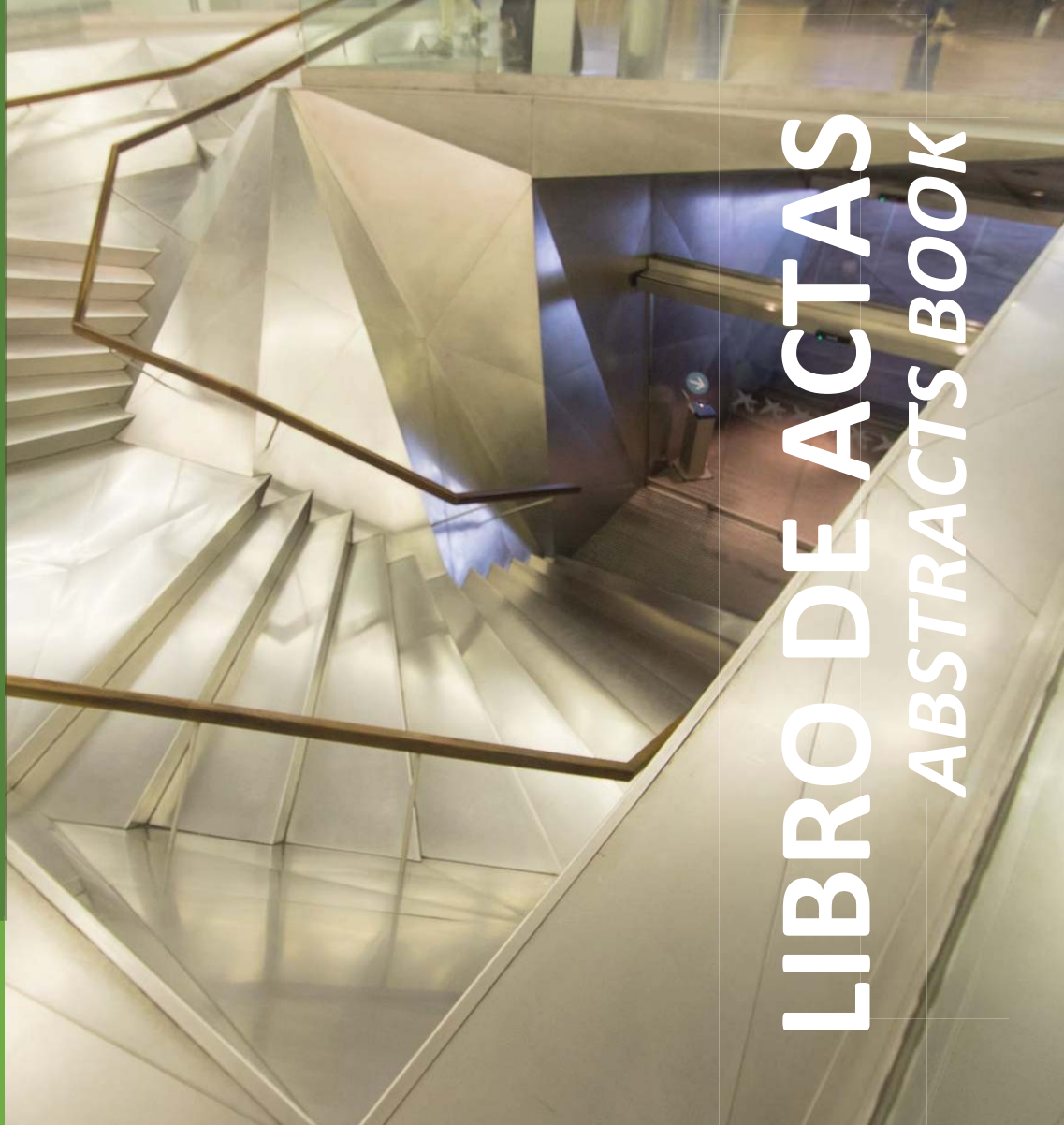
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ESCUELA TÉCNICA SUPERIOR DE EDIFICACIÓN  
UNIVERSIDAD POLITÉCNICA DE MADRID  
Avda. Juan de Herrera, 6-28040-MADRID



**International  
Conference on  
Technological  
Innovation in  
Building**

**Congreso  
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Innovación  
Tecnológica en  
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**LIBRO DE ACTAS  
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**IV INTERNATIONAL CONFERENCE ON  
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ESCUELA TÉCNICA SUPERIOR  
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CONSEJO GENERAL  
DE LA ARQUITECTURA TÉCNICA  
DE ESPAÑA



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# EFFICIENCY AND EFFECT OF CONSOLIDATION AND WATER REPELENT TREATMENTS ON STONE MATERIALS. CASE STUDY: BUILDING RESTORATION AT ALMUDENA CEMETERY.

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Since a long time ago, some products have been used in order to preserve and protect natural stone monuments as well as bricks and mortars and thus achieve greater resistance to deterioration processes. At first, natural resins of animal and vegetable origin were used but, in the last decades, synthetic polymers have been commercialized to cover the capillary pores of the material, lowering its water suction capacity, coating the material and isolating it from the aggressive environment [1-4].

Regarding to its effect, two main types of products are distinguished: consolidants and water repellents. First ones are substances that --penetrating inside the stone or ceramic material porous network-- improve their internal cohesion and therefore their mechanical behavior. They work attempting to achieve the adhesion between the surface --generally more weathered-- and the unaltered inner base. A water repellent is a product with a behavior that prevents the penetration of water in its liquid state but allows moisture vapor transmission. It can be applied on the surface of the already altered material or under weathering process. These products act in a double way, both narrowing pore radius and thus avoiding liquid water penetration into the pore network on one side, and repelling water due to a chemical hydrophobic behavior on the other side [5].

In recent years, numerous commercial products have emerged in the market for restoration and conservation of architectural and monumental heritage stone materials. It has generated a great confusion among professionals of the sector because of a lack of knowledge of its long-term performance. Therefore, the evaluation of these products is necessary before their use on the materials surfaces [6-10].

Due to different stone and ceramic materials properties, the behavior of these products has not always been optimal and their use has caused irreversible damage to monuments. Therefore, recently, its use has been limited to strictly

necessary cases and the need to perform laboratory tests to confirm its suitability is prescribed.

At the present work, an experimental study of the efficacy and effects of different consolidating products based on ethyl silicate and siloxane has been carried out. They have been applied on a limestone and ceramic bricks belonging to a façade of a building from Almudena Cemetery in Madrid where restoration works are being carried out. The aim is to determine the suitable product to use for each material. Conservation treatment selection has been made based on results discussion of the laboratory tests, attending to their effectiveness, suitability and compatibility with existing materials. Penetration depth, interfaces formation, possible aesthetic alteration and water penetrability, have been also studied.

As conclusion, the need to carry out pre-tests prior to the application of any product is emphasized and not applying any product before checking long-term behavior is recommended.

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