Methodology for the restoration of heritage built in exposed concrete

Summary

The conservation of concrete heritage is a current concern and must be addressed from the restoration point of view. The planning and the execution of interventions, as well as the knowledge of the constructions technics and a correct diagnosis are essential for the evaluation of the intervention. Exposed concrete constructions can present several pathologies. One of the most applied repair techniques is the 'Patch Repair Method', which does not guarantee the chromatic and texture correspondence between the two materials. To achieve the compatibility between materials, the usual repair methods must be applied with restoration concerns. The main objective of this thesis is the development of a methodology for the restoration of exposed concrete constructions, considering different colours and finishing and with different mechanical and durability requirements.

The thesis was structured in a set of six papers, where several methods were presented, calibrated in the laboratory and validated in two case studies. The first paper presents the concept of 'Patch Restoration Method', based on image processing techniques. In the second paper, a mix design method of restoration mortars was presented, that enables to adapt the formulation of mortars to different specifications and exposure conditions. In the third and fourth papers, two methods for restoring exposed concrete surfaces were developed; the CCR-method (Colour Concrete Restoration Method), for coloured and smooth surfaces of exposed concrete, and the GCR-method (Gray Concrete Restoration Method), for white or grey smooth exposed concrete surfaces. The methods were applied in an innovative restoration methodology for exposed concrete surfaces, validated in two case studies, which originated the last two papers that complete the thesis. The first case is an exposed white concrete building, 'Pavilhão do Conhecimento' in Lisbon, and the second one is a grey exposed concrete construction, with different finishing textures and heavily exposed to chloride ions, 'Piscina das Marés' in Leça da Palmeira. The methodology was based on the scale-up of previously developed methods and allowed to define and to apply customized restoration mortars on exposed concrete surfaces, and to replicate their finishes. The results demonstrate the ability of the methodology developed for the restoration for exposed concrete constructions, with different colour, texture and finishing, and exposure conditions, with the desired aesthetic (colour and texture) match between the restored and the original surface, and to ensure the mechanical and durability requirements.

Keywords

Concrete Heritage, restoration mortar, performance, texture, colour, pigment, chromatic reintegration.

Pavilhão do Conhecimento, Lisboa.

Piscina das Marés, Leça da Palmeira.

PhD student
Judite Lucinda Miranda Botas

PhD program
Civil Engineering (IST, University of Lisbon)

Supervisor
Jónatas Valença (CERIS, IST, University of Lisbon)

Co-supervisors
Hugo Costa (ISEC, Polytechnic University of Coimbra; CERIS, IST, University of Lisbon) and Eduardo Júlio (CERIS, IST, University of Lisbon)

Period
2016-2022

Funding
FCT scholarship (SFRH/BD/118428/2016)