

# Good vs poor intervention practices on historic concrete structures

## The case of Cyprus

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Reinforced Concrete is a relatively young composite building material; yet, it has been the catalyst factor in the process of modernization of societies, and has contributed the most in the transformation of the built environment worldwide. Its ability to take any form, the ease of on site production with minimum technical knowledge and its use in the construction of multi-storey buildings have all contributed to its widespread use. Yet, the original belief that concrete would last for ever, has proven to be an illusion. Carbonation, corrosion of the reinforcement, external loads (gravity, earthquake, wind), and environmental conditions (sea side, frost), have all contributed in highlighting the deficiencies of reinforced concrete structures and their degradation with time.

A number of reinforced concrete buildings constructed worldwide in the 20th century have very recently been acknowledged as holders of historical, architectural, social and engineering values, and therefore deserve to be preserved as parts of our architectural and cultural heritage. Nevertheless, this ongoing listing process has not been extended as much as required, thus leaving many historic concrete buildings unlisted and leading inevitably to their alteration, poor repair or even demolition. Even in the case of listed concrete buildings, when extensive retrofit is required against e.g. seismic loading, the lack of relevant technical knowledge and appreciation of their values, as well as the lack of specific regulations and guidelines for the preservation of historic concrete, usually lead to the adoption of poor practices, that eventually cause additional problems.

This presentation focuses on good and poor intervention practices adopted during the restoration of listed and non-listed historic concrete structures in Cyprus (Fig. 1), where the various repair and retrofit scenarios must include design for seismic events; this was not taken into consideration during the original design of historic concrete structures on the island, despite the fact that it is located in a seismic prone area. The interventions hereby presented (i.e., jacketing, complete replacement of reinforced concrete elements, confinement with metal parts, replacement of reinforcement cover with high performance grout material, addition of shear walls) have a construction age history span of ca. 20 years, thus allowing us to assess their performance in time and decide upon their efficiency and suitability for use in relevant restoration projects.



**Figure 1:** (a) Crack expansion in restored column due to expansion of corroded steel reinforcement, (b) Strengthening of column only on one side, (c) jacketing of column only up to a certain height, (d) externally bonded reinforcement of beam