Special Issue: “Assessment and Rehabilitation of Existing Reinforced Concrete Structures and Infrastructures: Methods, Techniques and New Frontiers” †

Editorial

Special Issue: "Assessment and Rehabilitation of Existing Reinforced Concrete Structures and Infrastructures: Methods, Techniques and New Frontiers"

Diego Gino[1] and Gabriele Bertagnoli[1]

[1]Department of Structural, Geotechnical and Building Engineering (DISEG), Politecnico di Torino, Turin, Italy. E-mail: diego.gino@polito.it; gabriele.bertagnoli@polito.it.

A special issue of Applied Sciences (ISSN 2076-3417). This special issue belongs to the section "Civil Engineering".

1. INTRODUCTION

In the last several decades, assessment and rehabilitation of the existing built environment constitute one of the major challenges for engineers, practitioners, and code-makers all over the world.
The aging, the deterioration processes, the lack of or improper maintenance, and increasing occurrence of extreme events due to climate change have led to the need of more efficient methods for the safety assessment and retrofitting/rehabilitation of existing reinforced concrete (RC) structures. The research focused to develop new approaches suitable for assessment of existing structure is ongoing also with reference to the drafting of next generation of design codes [1]-[4]. In one hand, these approaches deriving from research should be able to provide solutions devoted to reducing and/or avoiding the necessity of interventions, asses the safety conditions for human life and performances for serviceability on aged infrastructures always respectful of economic constrains. On the other hand, in case interventions are needed, the research should provide both the tools to determine the priority of the intervention and the techniques able to reduce costs and environmental impact.

2. ADVANCES FOR ASSESSMENT OF EXISTING RC STRUCTURES

In light of the above, the present special issue was introduced to collect the latest research on relevant topics, and more importantly, to address present ongoing research related to the assessment and rehabilitation of existing reinforced concrete structures and infrastructures. With reference to the special issue, 9 original papers from Authors coming from several Countries have been submitted and accepted for publication after peer-review process. Several topics have been addressed, mainly on concrete technology, life cycle assessment, structural monitoring, degradation and fiber-reinforced concrete.
The first paper [5], which is authored by Vereecken E., Botte W., Lombaert G. and Caspeele R., proposes an application the Value of Information (VoI) method to the estimation of the benefit that can be gained from a monitoring system before it is actually implemented on existing bridge or infrastructure. This investigation is of relevance due to the progressive adoption of monitoring systems by Authorities for bridges and infrastructure management all over the World and proposes a straightforward approach and suggestions for selection of the most efficient monitoring strategy. The second paper [6] is authored by Kraľovanec J., Bahleda F., Prokop J., Moravčík M. and Neslušan M. and illustrate the results of the application of an indirect method to determine the value of prestressing force in prestressed concrete sleepers on the base of a set experimental tests. In particular, the evaluation of the actual prestressing in prestressed concrete structures is crucial for estimation of

serviceability behavior as well as the remaining service life. The third paper [7] relates to an experimental study on the effect of sustained loading and different service temperatures (steady and cyclic) of Near-Surface Mounted (NSM) Carbon Fibre-Reinforced Polymer (CFRP)-concrete bonded joints and their post-sustained loading load-slip behavior. The paper is authored by Gómez J., Barris C., Baena M., Perera R. and Torres L. and reports results useful for strengthening interventions on concrete structures.

The fourth paper [8] is proposed by the authors Syll A., Shimokobe, H. and Kanakubo, T. and relates to the bond strength degradation due to reinforcement corrosion. The analysis is carried out performing pull-out tests on concrete specimens having induced crack width and variable stirrups ratio as principal parameters for investigation. In fact, the reinforcement corrosion is recognized as one of first issues for decade of bond between steel and concrete in RC members with related issues for durability and structural resistance.

The fifth and the sixth papers [9]-[10] are authored by Cleven S., Raupach M. and Matschei, T. . The authors propose a new method to characterize the steel-fiber content in existing structures realized with steel-fiber reinforced concrete. In particular, the first paper deals with the definition and validation of the method while the second one is focused on tests set up and related numerical modelling.

The seventh paper reported in the special issue is authored by Mathern A. and Magnusson J. [11] and relates to the analyses and critically review of data collected during the production, inspection, diagnosis and repair activities conducted in relation to the construction of foundations for a wind farm project in Sweden. The eighth paper [12], authored by Pleșcan C., Barta M., Maxineasa S. and Pleșcan E., discuss evaluates the life cycle assessment (LCA) for the rehabilitation of a national road sector in Romania with reference to crucial ecological issues.

Finally, the paper [13] authored by Rutkowska G., Ogrodnik P., Żółtowski M., Powęzka A., Kucharski M. and Krejsa M. discuss the possibility of using fly ash from the thermal treatment of sewage sludge as an alternative additive to concretes resistant to environmental influences occurring in communication tunnels.

In conclusion and as a final remark, the challenge of the next decades for the engineers and practitioners will be the assessment, monitoring and rehabilitation of the existing built environment. Concerning the existing RC structures and infrastructures, many of those was built more than 60 years ago, requires accurate evaluations in order to decide if interventions are required or it is preferable to demolish and rebuild. These decisions will have a significant impact on society also with the goal to limit the climate change.

ACKNOWLEDGEMENTS

This special issue is constituted by the collection of valuable contributions of various talented authors, hardworking and professional reviewers, and dedicated editorial team of Applied Sciences (MDPI). Congratulations to all authors — no matter what the final decisions of the submitted manuscripts were, the feedback, comments, and suggestions from the reviewers and editors helped the authors to improve their papers. We would like to take this opportunity to record our sincere gratefulness to all reviewers and their patient work. Finally, we express our gratitude to the editorial team of Applied Sciences, and special thanks to Ms. Tracy Yu, Section Managing Editor of Applied Sciences (MDPI).

REFERENCES

[1] CEN. EN 1990: Eurocode – Basis of structural design. CEN 2013. Brussels.
[2] CEN. EN 1992-1-1: Eurocode 2 – Design of concrete structures. Part 1-1: general rules and rules for buildings. CEN 2014. Brussels.
[3] *fib* Model Code for Concrete Structures 2010. *fib* 2013. Lausanne.

[4] Gino, D.; Castaldo, P.; Bertagnoli, G.; Giordano, L.; Mancini, G. Partial factor methods for existing structures according to fib Bulletin 80: Assessment of an existing prestressed concrete bridge. Structural Concrete 2020, 21, 15-31; https://doi.org/10.1002/suco.201900231

[5] Vereecken, E.; Botte, W.; Lombaert, G.; Caspeele, R. VoI-Based Optimization of Structural Assessment for Spatially Degrading RC Structures. Appl. Sci. 2021, 11(11), 4994; https://doi.org/10.3390/app11114994.

[6] Kraľovanec, J.; Bahleda, F.; Prokop, J.; Moravčík, M.; Neslušan, M. Verification of Actual Prestressing in Existing Pre-Tensioned Members. Appl. Sci. 2021, 11(13), 5971; https://doi.org/10.3390/app11135971.

[7] Gómez, J.; Barris, C.; Baena, M.; Perera, R.; Torres, L. Sustained Loading Bond Response and Post-Sustained Loading Behaviour of NSM CFRP-Concrete Elements under Different Service Temperatures. Appl. Sci. 2021, 11(18), 8542; https://doi.org/10.3390/app11188542.

[8] Syll, A.; Shimokobe, H.; Kanakubo, T. Effect of Stirrup on Bond Strength Degradation in Concrete Cracked by Expansion Agent Filled Pipes. Appl. Sci. 2021, 11(19), 8874; https://doi.org/10.3390/app11198874.

[9] Cleven, S.; Raupach, M.; Matschei, T. A New Method to Determine the Steel Fibre Content of Existing Structures—Evaluation and Validation. Appl. Sci. 2022, 12(1), 454; https://doi.org/10.3390/app12010454.

[10] Cleven, S.; Raupach, M.; Matschei, T. A New Method to Determine the Steel Fibre Content of Existing Structures—Test Setup and Numerical Simulation. Appl. Sci. 2022, 12(2), 561; https://doi.org/10.3390/app12020561.

[11] Mathern, A.; Magnusson, J. Lessons Learned from the Construction, Inspection, and Defect Assessment of Reinforced Concrete Foundations for Wind Turbines. Appl. Sci. 2022, 12(3), 1443; https://doi.org/10.3390/app12031443.

[12] Pleșcan, C.; Barta, M.; Maxineasa, S.; Pleșcan, E. Life Cycle Assessment of Concrete Pavement Rehabilitation: A Romanian Case Study. Appl. Sci. 2022, 12(4), 1769; https://doi.org/10.3390/app12041769.

[13] Rutkowska, G.; Ogrodnik, P.; Żółtowski, M.; Powęzka, A.; Kucharski, M.; Krejsa, M. Fly Ash from the Thermal Transformation of Sewage Sludge as an Additive to Concrete Resistant to Environmental Influences in Communication Tunnels. Appl. Sci. 2022, 12(4), 1802; https://doi.org/10.3390/app12041802.