

Sustainable Concrete: Materials and Structures

Ruben Paul Borg¹, Petr Hajek², David Fernandez-Ordonez³

¹ Faculty for the Built Environment, University of Malta, Malta
Member, *fib* The International Federation for Structural Concrete, Commission 7 Sustainable Concrete

² Czech Technical University in Prague, Czech Republic,
Chairman, *fib* The International Federation for Structural Concrete, Commission 7 Sustainable Concrete

³ Secretary General, *fib* The International Federation for Structural Concrete

E-mail: ruben.p.borg@um.edu.mt

Sustainability of Concrete Materials and Structures refers to materials and structures which not only have sufficient strength and durability but which meet these requirements throughout their intended life time in intended applications. The term sustainability, indeed *durable* in French, reflects the need to address environmental, societal and economic priorities. Cement and Concrete have a significant large impact on the environment with 1 ton of CO₂ resulting for every ton of cement produced and with the cement production industry contributing to a significant quantity of the global carbon emissions.

Economic development puts significant larger demands on the exploitation of natural resources. Indeed the construction industry relies particularly on concrete for new buildings and infrastructure to address these growing demands, with large quantities of natural resources required to address these needs. Sustainable construction promotes effective use of resource and waste, therefore exploiting the potential for waste material and industrial by-products not only to reduce demands on natural resources but also exploiting the recycling of materials therefore reducing the volume of waste disposal. The exploitation of waste and industrial by-products present an opportunity in the concrete industry. Industrial by-products have the potential for cement replacement, to improve the properties of the materials even contributing to durability. These measures directly promote sustainable use of the materials through environmental friendly practices, which become even more effective when considering the large quantities of concrete produced.

The innovative use of materials together with the development of new materials and innovation in cement based materials and composites, for more challenging applications in Civil and Structural Engineering, also lead to more durable concrete and reinforced concrete structures with better performance throughout their intended life-time. Advanced materials help achieve more economic structures when considering the whole life cycle; with increased safety of structures during their service life with lower demands for repair and maintenance leading to significant economic advantages.



Quality concrete is key for the sustainable use of materials. Concrete is a very complex composite which can be engineered to address specific performance requirements and which relies on a variety of constituent materials including locally available materials in a specific region. Quality assurance systems are necessary to ensure the adequate use of constituents, mix proportions and production processes and application.

Sustainable use of concrete is not only achieved through innovation in materials and structural systems but also through an appreciation of the optimum use of materials for an intended application. This can be achieved equally through innovation in research and developments in industry, therefore working through effective research and development frameworks as indeed promoted by *fib*, The International Federation for Structural Concretes. Academic and industry collaboration is key towards effective solutions to the demands for greater efficiency and economy, safety of structures and environmental protection.

In this direction, the conference Sustainable Concrete: Materials and Structures, which was the first *fib* conference in Malta, was organised by *fib* The International Federation for Structural Concrete and the University of Malta as the higher academic institution in Malta, with the support of Industrial partners BASF and Philip A. Tabone Ltd, in association with the leading Construction Industry organisations and entities in the Maltese Islands; the Planning and the Property Market Secretariat, Ministry for Transport, Infrastructure and Capital Projects, the Building Industry Consultative Council of the Government of Malta, the Kamra tal-Periti (Malta Chamber of Architects and Civil Engineers), The Malta Developers Association, The Malta Group of Professional Engineering Institutions (Institution of Civil Engineers, UK), Sustainable Built Environment Malta, the International Initiative for a Sustainable Built Environment (iiSBE). The Conference was also organised in association with Concrete Plant International CPI-Worldwide.

The papers presented in the first Malta *fib* Conference, held on the 10th April 2018 at the Valletta Campus of the University of Malta, cover a range of advances in cement and concrete. Yet there is a unifying element and a focus which is evident; the promotion of the sustainable use of concrete materials with regards to environmental protection and resource efficiency, addressing societal needs and economic demands, while achieving safe reinforced concrete structures which perform effectively throughout their lifetime.