

# **Introduction to durability, sustainability and life cycle assessment of concrete structures**

**Lecture notes of the  
DuRSAAM training course  
held September 2020**



**DuRSAAM**

The PhD Training Network on Durable, Reliable and Sustainable Structures with Alkali-Activated Materials

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## Foreword

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Concrete is one of the most popular building materials, making it also of concern when considering the environmental impact of the construction sector and the associated built environment. For example, the construction sector is responsible for over 35% of the EU's waste generation, buildings account for 40% of energy consumed, construction activities require a vast amount of resources and cement, being a major component of concrete, accounts for 5 to 8% of the carbon emissions. Although concrete performs quite well in terms of environmental impact compared to other construction materials, its wide use makes sustainability of concrete crucial in minimizing the environmental impact, as can be characterized from life cycle assessments.

The European Union is taking a lead in tackling climate change by the implementation of the 'Green Deal', an ambitious action plan to achieve the climate neutrality of the EU by 2050, among which the goal on zero greenhouse emissions by that time. This challenges construction companies, design engineers and all stakeholders involved, to act on durability and sustainability of buildings and infrastructure. To steer the construction sector further towards a more sustainable built environment, amongst others, growing emphasis is emerging on:

- The **sustainability** performance of construction products and solutions, including the possible introduction of secondary raw materials (recycled materials and by-products);
- The promotion of measures to improve the **durability** and adaptability of built assets in line with circular economy principles for building and infrastructure design and maintenance;
- A more quantified performance assessment of construction technologies over their life cycle, e.g. by integrating **life cycle assessment** in public procurement.

This vision represent a significant change with respect to just 10 years ago, when the reduction of carbon emission was mainly focussed on the optimization of energy performance of buildings in terms of design of thermal insulation and heating/cooling systems. Although energy performance remains very relevant, also growing emphasis is given on quantified durability and sustainability of building materials, looking into the entire life cycle, from manufacturing of constituents of building materials and solutions, over longevity of structures, up to end-of-life scenarios. Furthermore, this is increasingly considered in a framework of circular economy.

Eco-friendly or circular concrete solutions are investigated widely in view of lowering environmental impact, while keeping the high technical performance expected from contemporary building solutions. The durability, sustainability and life cycle assessment of such emerging solutions is of considerable importance in the framework of the Green Deal or similar visions, and highlights the need for engineers skilled in these subjects. This also formed the motivation in organizing an introductory training course on durability, sustainability and life cycle assessment of concrete structures, which is at the basis of this eBook.

This initiative has taken in the framework of the European Training Network on Durable, Reliable and Sustainable Structures with Alkali-Activated Materials (DuRSAAM), which organized the mentioned training course online on 14 till 17 September 2020. This open source book collects the lecture notes by the teachers of this training course and provides researchers, building professionals and stakeholders basic insights on the sustainability aspects of concrete structures, having eco-friendly concretes in mind as emerging building technology.

Stijn Matthys  
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Ghent, 2020

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