

## RE-USE OF CONCRETE

The future of construction will see design and building practice become more and more closely aligned with circular economy principles. There is much current focus on the recycling of demolition waste; however, taking broader circular economy principles into account, value is lost in a number of areas<sup>1</sup>. These include underutilised space, buildings demolished prematurely, vacant land, depreciated building materials and under-performing components. Moving to a circular economy means changing business models to retain value in all of these areas. Smart use of concrete as a material and the assets built from it have the perfect potential to recapture this value.

Concrete is a material everyone is familiar with, while perhaps not being fully aware of its contribution to society. Concrete is robust, durable, safe, and requires very little maintenance. It provides shelter against the most extreme weather conditions and renders thermal comfort in dwellings and office buildings, which translates into savings on energy bills.

The concrete frame and many concrete elements can be designed to last over 100 years, which is often much longer than the life cycle of the overall building. The pathway to carbon neutrality in the built environment by 2050 will require the design of new construction works to consider a longer-term view, beyond the original life cycle of the building, whereby building elements and/or the concrete frame can be reused in a future life cycle. This change will require innovation in both design and building techniques and building codes.

By applying durability, disassembly, adaptability and circularity principles to the design of buildings and infrastructure, the properties of concrete elements can be enhanced to enable their re-use in future life cycles of a building or in other future structures. Careful consideration of column spacing and structural properties could, for example, enhance flexibility in the end use of buildings while providing capacity to construct additional floors in the future. Such an approach would help future proof buildings, and significantly reduce demolition and subsequent raw material extraction requirements while avoiding future CO<sub>2</sub> emissions.

The solid structure and foundation of a concrete building can be reused to give way to a completely new, renovated or repurposed building. During this transformation, thermal mass can still be incorporated to reduce the energy demand for heating and cooling throughout the life of the new building, through techniques such as adding concrete mass where relevant or exposing existing internal concrete.

If designed with the future in mind, a concrete building enables disassembly and adaptive reuse of systems and elements. The same principles apply to concrete infrastructure.

There are many good examples where the structural frame of a building has been re-used to enable deep retro-fit and/or renovation of the existing building. It is less common today, however, to disassemble and re-use structural elements in a new building. By utilising the power of digitalisation some companies have already developed technology enabling design and construction methods which incorporate disassembly and re-use principles.

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<sup>1</sup> As identified by Arup and the Ellen MacArthur Foundation

All actors, especially architects and designers, should be encouraged to adopt sustainable, long term, multi-life cycle thinking and costing approach in order to enhance durability and to facilitate deconstruction and adaptability of buildings.

### Case study: George Green Library, University of Nottingham, UK



In this project the existing structural frame was retained, the basement lowered to provide an additional level and an extension added where the concrete surfaces were expressed. Continuous use of the building was maintained during construction. The completed project provided more student friendly spaces while minimising budget and environmental footprint.



### **Case study: La Fabrica - Cement Factory Home by Ricardo Bofill**

In this remarkable project architect Ricardo Bofill has transformed an old cement factory into a fairytale home using the existing industrial concrete structures to create an iconic building.

