

8. SAND AND CIRCULARITY

Aiming at a symbiosis between the Geosphere and the Anthroposphere

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Natural sands and, in a broader sense fine aggregates under 4 mm, are the building blocks of our modern society. Their role is of utmost importance in the granular assemblage forming the internal structure of concrete, to ensure both optimal mechanical performance and long term durability.

Sand can no longer be considered as a renewable resource as our extraction rate from riverbeds such as the Rhine, far exceeds our annual consumption. Alternative materials have to be sourced either from industrial residues (ex. residual filler fraction from lime operations) or from crushed demolition waste.

In this paper, we will review the characteristics of available non-natural sand sources and analyse how they impact on physical properties of granular assemblages. In particular, we will consider the opportunities to achieve optimal mixes of both natural and non-natural sands and how this impacts on compactness, flowability, etc.

Particle size distributions and particle shape distributions clearly differentiate natural and non-natural sand fractions but they are not the only ones. Differences in mineralogy, particle porosity and trace elements purity are also important. They have to be carefully analysed before considering the possible, partial or total, substitution of natural sands by crushed materials.

As a conclusion the highly celebrated circular economy paradigm also applies to sand resources, but the reality is closer to the one of a spiral economy, where the initial functional value of a natural material is progressively lost. The challenge being to slow down this functional degradation and make sure that future generations will still have access to a unique resource called SAND.

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