9. Circular economy in the construction sector – sand in an eternal cycle?

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9.1. Sand: a finite but not (yet) scare ressource for the construction sector?

The construction sector uses sand in many applications: concrete, mortar, building blocks, glass, foundation layers, …. Distinction is made between the 'fine' sand or filling sand, used in landscaping and 'coarse' sand, coming from rivers, the sea, sand pits and manufacturing processes in quarries.

Currently, the excavation and use of sand worldwide is twice as big as the natural production : 40 vs. 20 billion tonnes.[3] Also in Belgium, about 30 million tonnes of sand is used each year in construction, whereas Belgium only produces half of that amount (2 million tonnes form the sea, 6.8 million tonnes in Flanders and 7 million tonnes in Wallonia) – about 15 million tonnes are imported each year. It is assumed that the upcoming 25 years, no real import and supply problems are to be foreseen. However, incidents like long dry periods in the summer can cause temporal problems. In the upcoming period of 30 years, no real changes in the need for sand for the construction sector are expected – conjuncture may fluctuate, but will remain more or less on the same level.

Although quite stable for the moment, it is important the construction sector looks and thinks ahead, and tries to assure the possible use of qualitative sands in the future. Two main concepts are presented in the following paragraphs as a framework to work out solutions for the use of sand in eternal cycles.

9.2. Circular economy in the construction sector

A concept that is gaining importance and attention in the construction sector is circular economy. "The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended. In practice, it implies reducing waste to a minimum. When a product reaches the end of its life, its materials are kept within the economy wherever possible. These can be productively used again and again, thereby creating further value. This is a departure from the traditional, linear economic model, which is based on a take-make-consume-throw away pattern. This model relies on large quantities of cheap, easily accessible materials and energy."[4]

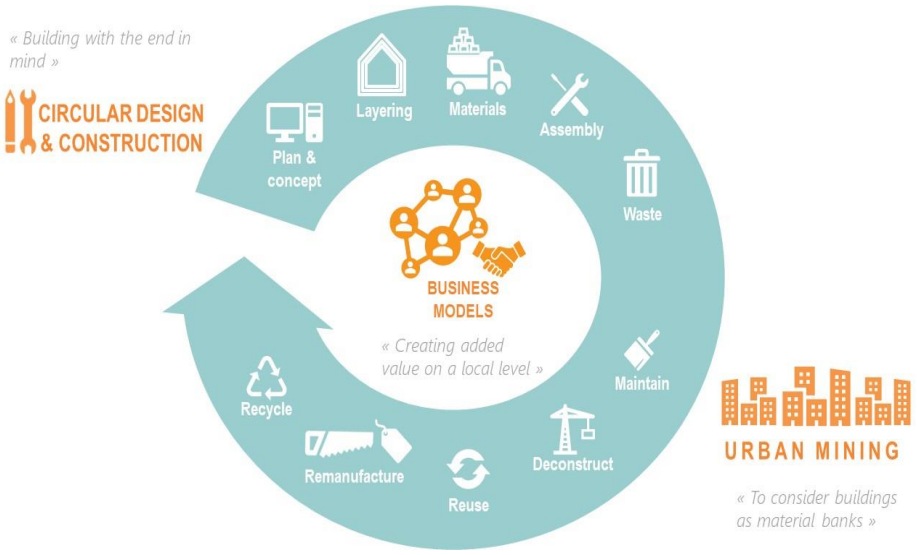
Translated to the construction sector, the concept of circular economy can be structured according to 3 main axes:[5]

- Circular design & construction : creating building from which the materials can be easily recovered at the end and buildings with a long service life, allowing flexibility and adaptability to changing needs & demands.
- Urban mining : using the existing building stock as a source ('mine') of new construction materials, focussing on reuse and recycling.
- Business models : creating an added value throughout the service life of a building or product (eg. through sharing, waste as resource or product-as-a-service).

[3] https://wedocs.unep.org/bitstream/handle/20.500.11822/8665/GEAS_Mar2014_Sand_Mining.pdf?sequence=3

[4] https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits

[5] https://www.wtcb.be/publicaties/monografieen/28/#:~:text=Deze%20monografie%20geeft%20een%20overzicht,nieuwe%20markten%20...).



9.3. Trias materialis: solutions for sand in the construction industry

While in theory there is enough sand available in the mid-long term in Belgium, some factors are and will be limiting in the future, like the availability of excavation sites and the negative impacts of excavation to the environment. Thus considering the 'limitedness' of sand in the future, several options are available (and to be combined) to face the upcoming challenges. In analogy with the energy question, solutions can be developed according to 3 axes – the "trias materialis":

- Reducing the need or demand for sand
  - In principle, reducing construction activities as a whole could be an option; although a growing population and a densification in combination with a renovation wave don't make this scenario plausible
  - Realising a shift from mineral materials to other materials, eg. using PU-glue instead of mortar, or using wood (CLT, ...), steel, plastics, ... instead of concrete
  - Improving soil and geotechnical constructions instead of using sand and/or concrete constructions, using technologies like soil-mix, geocomposites, ...
  - Reusing materials and structures by renovation rather dan demolition, and reusing bricks, concrete elements, tiles, ...

- Using renewable and alternative resources replacing natural sand
  - Upgrading/using fine sands like dessert sand, however this faces a lot of technical challenges
  - Using different types of soil, for eg. rammed earth applications[6]
  - Using construction and demolition waste, or rather the recycled aggregates produced from them. Many research is done and ongoing to realise the potential of using recycled sands in concrete. An important remark to make is that the availability of recycled sands is limited in comparison to the need for sand in Belgium each year.
  - Using other waste flows like cellular concrete, glass, ashes and slags, ... where attention must be paid to the effects on the so called third life (recyclability) and the availability of these material flows in the future.

[6] https://www.bcmaterials.org/concept-nl.html

- Using sand more efficiently where it is needed
  - Efficiency can be found in a better design of concrete structures, a more precise and qualitative execution and using more innovative building concepts.
  - Efficiency can also be found in creating more value with less materials, eg. smaller houses, less infrastructure through densification.

9.4. Conclusions

Many technological developments are ongoing to address the potential scarcity of construction sand in the future. Concepts like the circular economy and the trias materialis can help in the future to use sand efficiently and integrate alternatives in practice.

In order to do so, some non-technical barriers will need to be addressed as well, ranging from more systemic problems in the construction sector (e.g. focus on lowest investment cost, lack of confidence and cooperation throughout the complex construction chain, ...) to societal and political factors (eg. trading off the ability to fulfil in the own material needs against the effects on the environment or the importance of other societal or political goals).