Concrete Europe

POSITIONING THE CONCRETE SECTOR IN THE CIRCULAR ECONOMY DISCUSSIONS

Summary

Given the increasing sustainability trends and the need for circular economy principles, this paper represents Concrete Europe's position on the topic aligned with the sector's views and needs. Embracing a collaborative approach, it demonstrates how Concrete Europe perceives circularity as well as what it asks both the policy, industry, and other stakeholders. The first section introduces the topic and the subsequent '*what we need* section articulates the relevant circularity demands of the concrete sector.

INTRODUCTION

1. ***Circularity must be embedded in our society***
Circularity is an issue concerning the sustainability transition which relates the society as a whole. In that way, it is a societal challenge that requiring action in all parts of our society. As the concrete sector, we acknowledge our relevance and are willing to take the necessary steps to ensure circular thinking.

2. ***We need a common understanding on what circularity means for construction***
Reaching a common understanding of circularity at the level of a construction work and over its entire life cycle is critical to define and achieve circular economy related goals.
The whole value chain of construction should contribute to circularity, from the extraction of raw materials to the manufacturing, design, construction, use phase, maintenance, and end-of-life. Due to the complexity and long life of a construction work, each stakeholder should actively be responsible for circular operations of their products and services, whilst considering the impacts upstream and downstream.

3. ***The concrete case***
Most resources are, by definition, finite even though they are not necessarily scarce. Closing the loop is specific to each material, in the case of concrete:

i. When concrete arrives at its end of life and is crushed, one gets "recycled aggregates" (also known as "secondary aggregates"). Moreover, recycled concrete fines can be used as supplementary cementitious materials.
ii. The "functional equivalence" shall therefore be established at the level of aggregates. The properties and the applications of these secondary aggregates shall be compared with the primary aggregates because they can substitute them. These are important as aggregates are required to interlock in both unbound and bound applications, thus achieving the load bearing capacity (road sub-base) and strength (concrete).
iii. Consequently, it is wrong to say that "*using recycled concrete in unbound applications is downcycling*"; on the contrary, the properties of "recycled aggregates" are generally:
   - Equal or better than primary aggregates for use in unbound applications.
   - Equal or lower than primary aggregates for use in bound applications.

4. ***Concrete Europe believes in dialogue with the construction value chain stakeholders, non-governmental organisations and policy makers***
Concrete Europe is involved in the EU built environment policy framework development to enable a full sustainability transition of the construction industry and provide concrete experience.

WHAT WE NEED

A – A CORRECT APPLICATION OF THE HIERARCHY TO THE CONCRETE CASE

5. *We believe in concrete's advantages in terms of circularity*
   a. *We promote the advantages of concrete in circular thinking*
   Concrete brings durability and strength, resilience, energy efficiency, favours renewables and water efficiency. It is manufactured for specific projects and with local means. It results in a permanent carbon sink by absorbing CO_2 from the atmosphere (carbonation). Crushing concrete at the end of life contributes to this phenomenon thanks to the increased surface of the crushed material exposed to CO_2 in the air.

   b. *Concrete specificities which contribute to circularity must be recognised*
   Given the complexity and long-life span of the construction works, the specificities and advantages of the concrete sector in terms of durability, cost-effective maintenance, and recycling at end of life cannot be denied.

   c. *The choice of building materials must be based on science-based lifecycle analyses*
   Concrete Europe opposes the approach taken by some of avoiding building in concrete. Societal needs are the drivers of what is needed to be built. The choice of materials should be based on the technical requirements and the life cycle assessments with the objective of reducing the environmental burden. Thanks to its technical performance and versatility, concrete offers a lot of flexibility to architects and engineering offices to design buildings and civil engineering works with circular principles (e.g., reuse of existing structures, design for multiple application, etc.).

6. *We firmly believe that "prevention" and reduction/minimisation" should be tackled with the same importance or more than "recycling"*
   The hierarchy in the treatment of waste and addressing the circular economy should be followed. Recycling is one solution, but due to its energy consumption and other impacts, it is lower in the hierarchy. Prevention and minimisation should be favoured through design for at least 100 years, maintenance, repair, and reuse of structures. In this case, the durability and flexibility of buildings for re-use or 're-purposing' is a key factor.

7. *We avoid the opposition refurbish versus rebuild*
   Choosing between refurbishment and rebuilding should be carried out through life cycle assessment methodologies, and proper incentives shall be given accordingly. See the BIBM position paper on the topic: BIBM-Position-Rebuilding-and-Refurbishment.pdf.

8. *We advocate for design for less materials and long service life*
   Design for less materials is key for reaching circularity in the construction work and should be applied by architects and designers considering the following principles:
   a. ***Avoid overspecification by using the accurate material at the right place and quantity.***

   b. ***Leaner structures for the same function; structures with less material should be privileged.***

   c. ***Design for deconstruction and reuse.***

   d. ***Consider durability of the materials for a better and longer service life.***

9. *We believe in reuse which is possible thanks to durability*
   a. *of the structures*
      At the design stage, it is significant considering that the function of the building may change during time.

   b. *of (precast) elements*
      Construction works should be dismantled in such a way to reuse the precast elements.

10. *We encourage all recycling that result in a reduced use of virgin materials & energy, be it "open loop" or "closed loop"*
    A case-by-case assessment can determine the most environmentally favourable (and economically feasible) application.

11. *We advocate for a phase out of landfilling of construction and demolition waste*
    Diverting a construction and demolition waste (C&DW) material from landfill keeps a plentiful supply of this material in the economy and encourage the market to find solutions to its use.

B – A PERFORMANCE-BASED APPROACH

12. *We need policy makers to develop performance-based policies for the use of recycled material from C&DW*
    Concrete Europe recommends a performance-based policy for the use of recycled material from C&DW to determine the appropriate use of both secondary and primary materials on the same basis. A performance-based approach allows one to set the goal (e.g., performance of the final product) without setting restrictive requirements on how to achieve it (e.g., x % recycled content).

13. *That is why we advocate for the use of life cycle analysis*
    CEN/TC 350 standards provide appropriate rules for LCA of buildings and infrastructures. Any policy initiative on construction should be based on LCA, as is the case of the European Commission Level(s) building assessment framework.

C – SEE WASTE AS A RESOURCE

14. *On the end-of-waste criteria*
    a. *Would EoW status for recycled aggregates improve the secondary market?*
       Prior to setting EoW criteria for recycled aggregates, a thorough assessment should be carried out to investigate whether such initiative would bring an added value to boost the secondary market.

    b. *What we believe is important is quality assurance*
       Ensuring the quality of the secondary material is key to reuse it in new concrete. Their physical characteristics must conform to the requirements of the appropriate standard for each end use.

15. *As regards targets for construction and demolition waste*
    a. *Concrete Europe supports high targets for secondary aggregates coming from end-of-life concrete*
       Concrete Europe supports high targets for secondary aggregates coming from end-of-life concrete. CD&W collection, separation and treatment, and supply of recycled aggregates need to be further developed.

    b. *Which means a mature secondary market is needed*
       Availability of a mature secondary market is needed which includes demolishing companies and owners.

c. *We want waste from building renovation to be addressed*
The potential waste coming from renovation should be considered, and explicitly addressed in policy.

16. *Secondary aggregates used in concrete should be of good quality and made as much as possible of recycled concrete*
An assessment and quality control of secondary aggregates are necessary before use in concrete; in particular the suitability of secondary material other than concrete need to be established before their inclusion into newly manufactured concrete. Each sector should be responsible of its own end-of-life; other materials should not be diverted to secondary aggregates for concrete.

D – FRAME THE USE OF SECONDARY RAW MATERIALS IN CONCRETE[i]

17. *Setting targets on recyclable content in concrete is not appropriate*

a. *The supply of recycled concrete aggregates will not meet demand (normally believed to cover a limited fraction)*
Diverting secondary aggregates into concrete will never meet the demand for the total amount of the virgin materials. Today, recycled aggregates represent only about 10% of all the need for aggregates against a recycling rate of concrete at around 70%.[ii] Secondary materials are available at specific locations and occasions. It is difficult to match on the regular basis their availability with the need of the concrete manufacturer.

b. *It is not always a given that a recycled material has the lowest environmental impact*
For instance, proximity is a key factor in terms of impact of transport.

c. *For bound uses, quality assurance is key*
Secondary aggregates should be put on the market with quality assurance – and it should be upon the user's discretion to use them.
Secondary aggregates with higher content of concrete are more suitable for use in concrete.

d. *And minimum recycled content more suitable at project level*
Should minimum recycled content be set by legislation, this should be followed at the project level, not at the element level. Some applications may be more suitable than others for the use of recycled materials (e.g., non-structural concrete).

18. *Even if concrete is recyclable, LCA is needed to ensure sustainability*[iii]

a. *Our product is 100% recyclable*
Either bound or unbound, concrete is 100% recyclable.

b. *LCA should be applied for the most sustainable outcome*
Life Cycle Assessment should be conducted for the most suitable actions, e.g., treatment, energy, transport, and technical issues like more water/more cement with recycled aggregates.

E – TAKE INTO ACCOUNT CIRCULARITY FOR CLIMATE MITIGATION

19. *Circularity impact on global warming potential needs to be taken into account*
Each circularity measure has a link with the overall quality, feasibility of the resource use, and global warming potential. The implications of circularity on decarbonisation must be considered when designing and applying circular economy principles. Furthermore, the EU cement industry has set a clear path to decarbonisation, and data suggests that carbon negative cement could become a reality by 2050 and thereby achieve further negative emissions over the value chain.[iv]
The table below demonstrates the link between circularity measures, resources, and global warming potential with its further explanations. Each circularity measure not only has a link with the overall quality and feasibility of the resource use, but also impacting global warming. This

brings the relationship between circularity and decarbonisation, that must be considered while designing and applying circular economy principles. Although usually circular thinking brings benefits to decarbonisation that hinders climate change and mitigates the effects, occasionally the relationship between the two has different implications.

Circularity measures	Resources	GWP	Explanation
Less material for the same function	**+++**	**+++**	**Probably the best option**
Long service life	**+++**	**++**	**Longer service life usually requires more durable products**
Reuse the full structure	**+++**	**++**	**Avoid remanufacturing**
Reuse concrete elements for the same purpose	**++**	**+**	**Dismantling operations reduce the GWP advantages compared to the reuse of the full structure**
Reuse (part of) concrete structure for other purposes	**+**	**+**	**Dismantling operations reduce the GWP advantages compared to the reuse of the full structure**
High quality secondary aggregates (with very high % of concrete) for use in concrete (all types)	**+**	**0**	**Resource saving, but usually neutral in GWP (recycling operations, transport)**
Low quality secondary aggregates for geotechnical works (including backfilling)	**+**	**0**	**Resource saving, but neutral in GWP (recycling operations, transport)**
Low quality secondary aggregates for non-structural concrete	**+**	**0**	**Generally OK, but might have negative GWP impacts (transportation, more resources)**
Low quality secondary aggregates for structural concrete	**+**	**-**	**Often associated with more resources (more cement, more concrete)**
Landfilling	**---**	**0/-**	**The worst-case scenario**

20. *Carbonation is a good example*[v]

CO_2 from the atmosphere is absorbed by concrete during its whole life through natural carbonation, resulting in CO_2 being permanently bound. Crushing concrete at the end of life contributes to this carbon sink phenomenon thanks to the increased surface of the crushed material exposed to CO_2 in the air. This eventually can improve the global warming potential profile of the recycled concrete.

F – DIGITALISATION AS A CIRCULAR ENABLER

Circularity in construction can be enhanced by digital tools and can only be achieved if all actors in the value chain are involved in the digitalisation of the construction sector. Concrete Europe welcomes an open and digital platform bringing together the construction sector, architects and engineers, local authorities, and end-users.

21. ***Building information modelling (BIM)***
BIM technologies provide the data available in digital format which will allow information exchange and enable material efficiency in building design leading. For instance, building logbook creates the link between data and project and allows making use of the materials during its life and end of life which eventually may come out of it.

G – MARKET INSTRUMENTS ARE KEY FOR THE UPTAKE OF SUSTAINABLE SOLUTIONS

22. ***Reward the application of sustainable behaviour in public and private procurement***
Rewarding the carrying out of an assessment of the feasibility to source and use secondary (and primary) materials according to local availability and environmental benefit is preferable to setting specific requirements which may not be achievable in all regions.

23. ***We advise policy makers not to discriminate against primary materials by way of blanket taxes or levies***
Locally available virgin material can have a lower environmental impact than recycled material. Taxation of virgin aggregates has proven to be ineffective in increasing the use of recycled aggregates in the UK. Such taxes are not an effective way to combat the perception of secondary material as being inferior, and therefore are ineffective in creating demand for secondary materials.

Terminology for "recycling"

Recycling is the process of converting waste materials into new materials and products.

- Downcycling: recycling of waste where the recycled material is of lower quality and functionality than the equivalent natural material.
- Upcycling: the process of transforming by-products, waste materials, useless, or unwanted products into new materials or products perceived to be of comparable or greater quality.
- Open loop: any recycling process where the recycled materials are converted into a different product.
- Closed loop: the manufacturing process that leverages the recycling and reuse of post-consumer products to supply the material used to create a new version of the same product.

Terminology for concrete

Primary constituents of concrete are aggregates (together with binders, water, and admixtures).

Aggregates can be of different origins (See: Aggregates Europe):

- Primary aggregates (produced from natural resources)
- Secondary aggregates (both manufactured and recycled)

Aggregates can be used:

- In "bound" applications, i.e., they are "glued" together to form a composite material (concrete when the binder is cement, and asphalt, when the binder is bitumen).
- In "unbound" applications, i.e., they are used "loose" (or with a limited addition of stabilisation material)

Sources

[i] 2014. World Business Council for Sustainable Development, The Cement Sustainability Initiative. **Recycling concrete**. (link)

[ii] Aggregates Europe website: https://www.aggregates-europe.eu/facts-figures/figures/

[iii] 2016. European Concrete Research Academy. **Closing the loop: what type of concrete reuse is the most suitable option?** Technical Report A-2015/1860.

[iv] 2020. CEMBUREAU roadmap.

[v] 2021. IVL Swedish Environmental Research Institute. **CO_2 uptake in cement containing products. Background and calculation models for implementation in national greenhouse gas emission inventories.** ISBN: 978-91-88787-89-7.