

How can the road construction domain contribute to the CE concept?



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Over the last century, our society has been set up on a linear economic system that, based on the concept «make, take and dispose», has promoted an unsustainable development and use of natural resources. In recent years, this has led to a change of paradigm by targeting a more circular approach to meet the increasing environmental requirements dictated by the net-zero emissions goal of 2050.[1] Thus, under the pressing needs for a transition to a more sustainable socio-technical system, the circular economy (CE) concept has gained in popularity.

CE proposes a change of the current linear consumption and production patterns with a new business model promoting sustainable development as an alternative to the traditional one. The new approach introduced by CE involves the whole economic system, including the construction industry. Even though to date there is no unique definition of CE, it is worth mentioning the following definition framed by Geissdoerfer et al. (2017) [2] concerning the construction industry: «[CE is a] regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling.»

It is well known that the construction industry, based on the «historical» linear approach, is responsible for a considerable environmental impact mainly related to the consumption of finite resources, energy, and waste production. It is one of the leading sectors affecting the environment and accounts for 50% of the total use of raw materials, 36% of the global energy use, 39% of energy- and process-related emissions (Global Status Report for Buildings and Construction, 2019)[3].

Despite the significant economic and environmental impact of the construction industry, the application of a CE approach to this sector is still limited, especially in the road construction sector. Among the different challenges faced in this area, one should mention the resources needed, the production processes, and the project uniqueness.

Nevertheless, many concrete actions have been undertaken by the road construction sector to foster such transition, such as the use of reclaimed asphalt in the asphalt mixtures and the extension of the service life of asphalt pavements. Considering the huge impact of transport infrastructure on our society, a gain in sustainability in this field would have social benefits and lead to a higher quality of life.

To this end, the transport infrastructure R&D group of the Institute for Urban Development & Infrastructure at BFH is currently working on numerous projects that contribute to sustainable development, one of these projects being the development of a low noise asphalt with extended service life.

According to the World Health Organization (WHO), noise pollution is a primary environmental concern in Europe. Among the different sources of noise pollution, road noise is the second most important cause of ill health in Western Europe. In Switzerland, one in seven people during the day and one in eight at night are affected by harmful or annoying traffic noise at their homes (FOEN)[4].

Thus, reducing road noise is crucial to obtain economic, social and environmental benefits while preserving a good quality of life.

According to the Swiss standards, semi-dense asphalt (SDA) is the most effective mixture for road noise abatement. In recent years, considering the severity of the issues caused by road noise, the demand for low-noise asphalt applications has increased. However, the experience gathered so far has proven that low-noise asphalt can only be applied in regions without severe climatic conditions and that it has a shorter service life (max. 10-15 years), when compared to traditional asphalt, which can easily reach 20-25 years. These aspects and the lack of optimal maintenance techniques still limit low-noise asphalt applications despite their recently gained popularity.

[2] Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy – A New Sustainability Paradigm? *Journal of Cleaner Production*, 143, pp. 757–768.

[3] Iea, I. E. A. (2019). *Global status report for buildings and construction*.

[4] Federal Office for the Environment: <https://www.bafu.admin.ch/bafu/en/home/topics/noise.html>

In this context, this Innosuisse project, launched in collaboration with the industrial partner Weibel AG, aims to develop a low-noise asphalt product and an innovative maintenance technique that will enhance pavement service life.

Moreover, the development of a low-noise asphalt with improved mechanical performances will enable the tackling of new application domains, for instance at altitudes above 800 m, which so far was not recommended due to the low resistance to freeze-thaw cycles and harsh weather conditions.

To achieve the above-mentioned purpose, the research team started with an extensive market screening and further defined an intensive testing plan to be carried out at the BFH laboratory. The high complexity of the project lies, among other things, in the identification of the degradation mechanisms and of a suitable aging test method, in the development of a new long-lasting mixture based on various additives and in the definition of a new maintenance procedure.

In conclusion, the development of a low-noise asphalt with extended service life and the implementation of an innovative maintenance procedure will lead to an improvement in the quality of life and to sustainable use of resources as well as a CE approach. So, the



answer is «YES»: the road construction sector can and has to provide a substantial contribution to CE and BFH teams are on track thanks to various projects, collaborations and multidisciplinary projects!

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