GREEN W!N
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FEEDBACK REPORT

FIFTY SHADES OF MINERALS !

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SUMMARY

OPENING WORD BY DAVID LAMY, CEO TRADECOWALL, CHAIRMAN OF GREENWIN, BELGIUM

Circular Wallonia Days 2025 – Launching a European dialogue on mineral circularity

Key words: Greater Region, circular construction model, European cross-border cooperation, real-market solutions

This conference marked the first edition of the Circular Wallonia Days dedicated to minerals, positioning Wallonia as an active contributor to the European transition towards circular construction and sustainable mineral value chains. Hosted in Mons, the event brought together European policymakers, researchers, industrial leaders and clusters around a shared ambition: moving from linear construction models to circular, resilient and economically viable systems.

The launch of the 3rd occurrence of the Circular Wallonia Days coincided with Wallonia assuming the Presidency of the Greater Region for 2025–2026, reinforcing its role as a catalyst for cross-border cooperation. The Greater Region unites Wallonia and the Wallonia-Brussels Federation, Grand Est (France), the Grand Duchy of Luxembourg, and the German regions of Rhineland-Palatinate and Saarland, forming a dense ecosystem of industrial, research and policy actors.

The core message of the event was clear: linear construction models are no longer sustainable, neither environmentally nor economically. Circularity must become the new standard for minerals, materials and the built environment. The ambition of the Circular Wallonia Days is therefore practical and action-oriented, focused on translating circular principles into real industrial, regulatory and market solutions.

The Circular Wallonia Days underlined the role of regions as laboratories for Europe, where industrial innovation, policy experimentation and cross-border cooperation converge. The event set a clear direction: building a future where circularity in construction is not an exception, but a mainstream driver of competitiveness, sustainability and resilience for Europe.

Source: Researchgate

OPENING WORD BY NICOLAS MARTIN, MAYOR OF MONS, REGION OF HAINAUT, BELGIUM

From industrial heritage to circular innovation: materials at the heart of Hainaut's transformation

Key words: *circular minerals, applicative industries, local development ecosystems, circular transformation*

There is a deep historical link between the Hainaut region and mineral resources, which have shaped its industrial identity for more than two centuries. From coal and limestone to sand and flint, the exploitation and transformation of underground resources enabled the development of major industrial activities in the 19th century, including steelmaking, glass production and cement manufacturing.

The creation of the School of Mines in Mons in the 19th century marked a turning point by fostering engineering skills tailored to industrial needs. Today, this legacy continues through strong academic and research capacities, notably in the field of materials science, with internationally recognised research centres contributing to innovation and knowledge transfer.

Materials remain a central pillar of the regional economy, not only in extraction and transformation industries, but also across a wide range of applications, from construction and transport to energy, packaging, biomedical and aerospace sectors. Preserving this know-how while adapting to new challenges is a key priority.

As natural resources are finite, the transition towards a circular economy is presented as an obvious and necessary evolution. Concrete examples of circularity in action are showcased through local companies active in mineral recycling and low-carbon construction solutions, alongside major industrial players investing in the cement plant of the future. Connecting these regional strengths with other European ecosystems is identified as a major lever for competitiveness and innovation.

Beyond knowledge sharing, events like the Circular Wallonia Days are seen as catalysts for collaborative projects and economic opportunities in Europe, supported by strong local development ecosystems committed to circular economy and industrial ecology. Strengthening networks, maturing innovation ecosystems and reinforcing European connections are key to ensuring a sustainable and resilient future for the region's materials sector.

There is a clear call to action: transform exchanges into collaborations, discussions into solutions, and ideas into innovations, in the spirit of circular transformation.

OPENING WORD BY PIERRE-YVES JEHOLET, VICE-PRESIDENT AND MINISTER OF THE ECONOMY, INDUSTRY, DIGITAL AFFAIRS, EMPLOYMENT AND TRAINING OF THE WALLOON REGION, BELGIUM

The mineral industry in Wallonia: a strategic pillar for Europe's circular transition

Key words: extractive industries, supply security, decarbonisation, economic driver, structural projects, transregional partnerships

The mineral industry is a strategic economic and environmental pillar for Wallonia and plays a key role in Europe's construction and industrial value chains. Building on a long industrial tradition, the region brings together extraction and transformation activities for aggregates, lime, sand, clay and concrete, supplying not only construction and deconstruction, but also sectors such as agri-food, transport, energy and advanced manufacturing. Overall, extractive industries support a large share of industrial activities and regional employment.

Supply sovereignty and resilience are central priorities. By valorising local mineral resources and developing circular loops, Wallonia strengthens short supply chains, reduces dependency on imports and improves the security of essential construction materials at regional and European levels.

Decarbonisation is both an emergency and a major opportunity. The mineral and construction sectors are among the most energy- and carbon-intensive industries, but they also offer strong levers for impact. Through large-scale innovation projects and industrial transformation, Wallonia is advancing solutions such as carbon capture, low-carbon binders, circular concrete and mineral waste recycling, fully aligned with European climate neutrality objectives.

At the same time, the sector remains a driver of economic value and competitiveness, creating non-relocatable jobs, supporting innovation and reinforcing the resilience of the regional economy.

Like a European laboratory for circular minerals, Wallonia illustrates how circular mineral innovation can be accelerated through collaboration between industry, research and public actors. Several structural projects in the sector focus on low-carbon concrete, alternative binders, deconstruction waste valorisation and the emergence of new circular value chains, positioning Wallonia as a testing ground for scalable European solutions.

GreenWin, the Walloon cleantech cluster for construction, chemistry and environment, plays a central role in structuring circular value chains, coordinating strategic task forces and connecting regional ecosystems with European initiatives. Its activities span eco-design, industrial symbiosis, reverse logistics and international collaboration, contributing to both environmental impact reduction and strategic autonomy.

Thanks to its central position in North-West Europe, Wallonia actively develops transregional partnerships, including with Southern and Eastern European regions, to scale circular solutions for mineral materials. The Walloon Presidency of the Greater Region further reinforces the ambition to share best practices and strengthen cooperation at European level.

Wallonia is not only recycling materials; it is shaping the mineral industry of tomorrow. By combining innovation, circularity and industrial leadership, the region aims to make circular construction a competitive advantage and a visible European reference. Each circular project contributes to greater sovereignty, lower emissions and a more resilient industrial future for Europe.

END-OF-WASTE AND THE “RIGHT MATERIAL IN THE RIGHT PLACE”: FROM REGULATION TO INDUSTRIAL REALITY

The transition towards a circular construction economy critically depends on how mineral waste streams are transformed into reliable, market-ready products. End-of-Waste (EoW) frameworks play a central role in this transformation by determining when waste ceases to be waste and can legally, technically, and economically re-enter value chains. This session explored how regulatory clarity, quality standards, and industrial practices must align to unlock circular mineral materials at scale.

Across regional, national, and European perspectives, a common message emerged: EoW is not a barrier to valorisation, but a structuring tool that provides legal certainty, improves product quality, and strengthens market confidence. Where frameworks are clear and operational - such as for recycled aggregates - industrial uptake has been significant. Where they are less mature, uptake remains limited, highlighting the need for better communication, simplification of procedures, and continued dialogue between authorities and industry.

The discussions illustrate how different regional approaches coexist within a European context, with examples of Wallonia and Flanders which have developed distinct but increasingly sophisticated EoW systems, combining technical standards, environmental controls, third-party certification, and traceability requirements. At European level, the revised Construction Products Regulation (CPR) introduces new expectations around performance, environmental sustainability, and digital product information, reinforcing the principle that construction products, whether primary, recycled, or remanufactured, must be used according to their intended function and verified performance.

From an industrial standpoint, the session highlights both opportunities and constraints. EoW frameworks have enabled high-value applications for recycled mineral materials in infrastructure works, cement production, prefabrication, and soil remediation. At the same time, challenges remain for small operators, mobile installations, complex waste streams, and cross-border recognition of EoW status. Several speakers stress that circularity only works if quality, logistics, and regulatory compliance evolve together - placing “the right material in the right place” as much a technical issue as it is a market and governance one.

Innovation features prominently, with examples ranging from alternative binders and clinker substitutions to advanced sorting technologies and large-scale redevelopment of industrial brownfields. These cases demonstrate that circular mineral solutions are no longer niche experiments but increasingly industrial realities, if permitting procedures, standards and stakeholder acceptance are addressed from the start.

The interactive Q&A sessions and panel debates reinforced these insights. Participants raised practical questions on regulatory harmonisation, on-site versus off-site reuse, certification pathways, economic viability, and the limits of technological transposition from high-value metal streams to bulk mineral flows. The exchanges confirmed that EoW remains a voluntary but strategic instrument: while not mandatory, it can significantly strengthen business cases, de-risk investments, and support dialogue with authorities and clients.

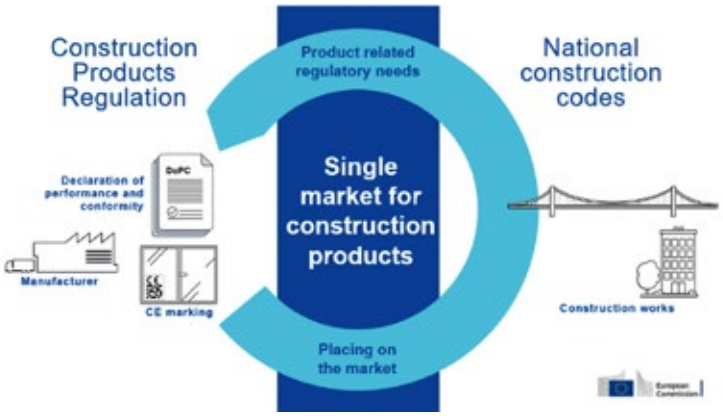
This session sets the scene for the detailed contributions that follow in the report. Together, they show that EoW is not an abstract regulatory concept, but a concrete lever for industrial competitiveness, resource efficiency, and climate action, if co-developed by policymakers, industry, and research actors.

KATHARINA KNAPTON-VIERLICH, HEAD OF UNIT CONSTRUCTION, DG GROW, EUROPEAN COMMISSION

The European integrated circular construction sector

Key words: *construction sector, CPR, aggregates, single market, circular construction, waste legislation*

The current EU policy orientations for the construction sector have a strong focus on competitiveness, digitalisation and sustainability, in the context of the transition towards a net-zero and circular built environment. The construction sector is a key leverage point, given its scale and impact: buildings account for around 42% of EU energy consumption and more than one third of energy-related emissions.



EU action is structured around six main building blocks, combining environmental performance with economic and social dimensions. These include skills and talent, an enabling regulatory framework, research and innovation, technology uptake, funding, and the objective of a fair and safe built environment. Digital tools such as Building Information Modelling (BIM), digital permitting and digital product passports are cross-cutting enablers to support these objectives.

Circular construction is a central pillar of this approach. There is a strong need to address the full life cycle of construction products and works, from design and manufacturing to use, deconstruction, reuse, recycling and waste management. The interface between product legislation, waste legislation and national building codes needs particular attention to soften barriers to circularity and improve the functioning of the single market.

The **Construction Products Regulation** (CPR) plays a key role in this framework. Manufacturers are required to provide declarations of performance and conformity and to apply CE marking when placing products on the EU market. The move towards performance-based standards is intended to better accommodate both natural and recycled materials, including aggregates. For aggregates, the CPR acquis process has started, with a technical annex for standardisation expected in late 2026, followed by a multi-year standardisation process.

CPR developments also need to be situated in relation to the broader ESPR regulatory framework, underlining the ambition to remove cross-border barriers, support innovation, and create a functioning single market for sustainable construction products. Overall, the message is that regulatory coherence, digitalisation and standardisation are essential to enable a competitive, circular and climate-neutral European construction sector.

CHRIS VAN DE VOORDE, ENGINEER, FOUNDER OF JUNOO AND CO-FOUNDER OF THE CIRCULAR VALUE INSTITUTE, BELGIUM

How to speed up the circular transition by measuring the Value of Circularity

Key words: circular construction, value of circularity, circular value index, economic attractivity

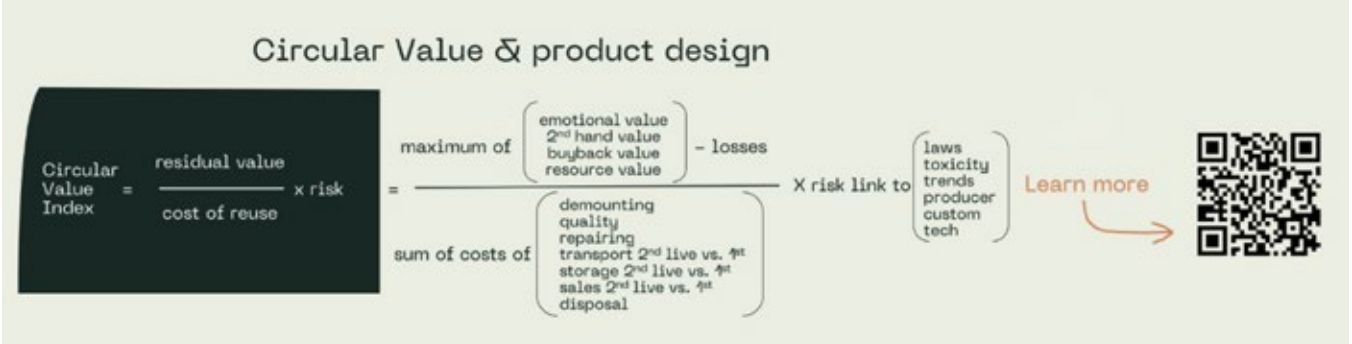
How to accelerate the circular transition by making circularity measurable and economically explicit? It starts with the observation that the construction and materials sector faces increasing pressure due to scarcity of resources, productivity constraints and a rapidly changing global context. These pressures put at risk a very large amount of economic value, estimated at around €14 trillion globally.

The core argument is that circularity will only be scaled if it is framed as a value-creating proposition rather than as an environmental add-on. To this end, the Circular Value Institute proposes to quantify the "**Value of Circularity**" through a **Circular Value Index**, combining residual value, cost of reuse and risk factors. This allows comparison between linear and circular options on an economic basis, rather than relying on qualitative claims such as "can be reused".

Several concrete examples from the construction sector could illustrate this approach. A comparison between traditional drywall installation and a reusable modular wall system shows a drastic reduction in installation time (from more than two hours to under thirty minutes) and labour costs, clearly demonstrating that productivity gains can outweigh higher upfront material costs. This illustrates how **reuse** can become economically attractive when it reduces operational complexity and time on site.

Reuse only creates value when it is standardised and organised on a scale. Ad hoc or "random" reuse leads to inefficiencies, whereas standardised components, predictable logistics and repeatable processes enable efficiency gains like those observed in other industries, such as containerised shipping. In this context, reuse becomes an industrial process rather than a one-off optimisation.

The link between circular value and business models is evident. As circular value increases, business models can evolve from linear "take–make–waste" approaches towards take-back schemes, buy-back mechanisms, reuse-based products and circular leasing. Financial instruments such as funds dedicated to circular valuable products and mechanisms for trading reuse rights are presented as concrete enablers to support this transition. Measuring circular value is a prerequisite for aligning design, finance and market uptake, and for making circular construction economically mainstream.



PROF. DR. IR. JOS BROUWERS, EINDHOVEN UNIVERSITY OF TECHNOLOGY, THE NETHERLANDS

Keys to a profitable and sustainable circular model of building materials: case study from The Netherlands

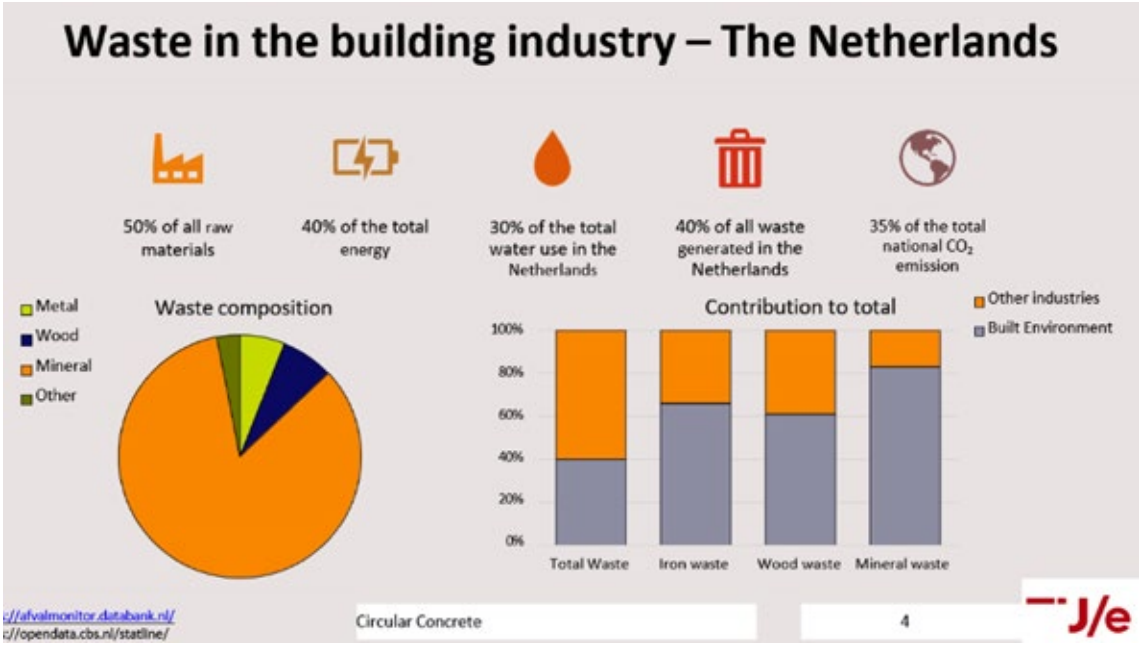
Key words: circular building materials, profit and sustainability, waste strategy, high-end circular concrete

The presentation focuses on the technical and systemic conditions required to make circular building materials both profitable and sustainable, using concrete as a central case study, with a particular emphasis on the Dutch context. The building sector is a major leverage point, accounting for around 50% of raw material use, 40% of energy consumption, 40% of waste generation and 35% of national CO^2 emissions in the Netherlands.

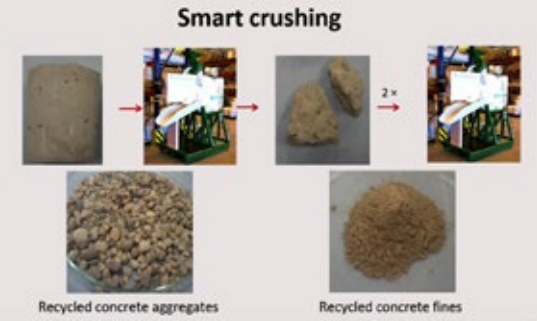
A key enabling factor for circularity is the long-standing **Dutch waste strategy** based on landfill bans and source separation. Since the introduction of the landfill ban in 1997, construction and demolition waste streams have increasingly been separated into monostreams (e.g. metals, wood, glass, stone). Today, close to 100% of C&D waste is reused in some form. However, much of this reuse remains low-grade, with recycled concrete often downcycled into road base material rather than reintegrated into high-value concrete applications.

Achieving high-end **circular concrete** requires going beyond traditional crushing. Conventional recycled concrete aggregates suffer from high water absorption, lower density and attached cement paste, leading to reduced mechanical performance. To address this, the concept of “smart crushing” is introduced. By optimising crushing parameters (particle size distribution, crushing speed, jaw width), it becomes possible to separate clean aggregates from cement-rich fines. Experimental results demonstrate that this approach can yield aggregates suitable for 100% replacement in new concrete, alongside fine fractions rich in cement paste.

Concrete examples illustrate the potential of these recovered fines. Recycled concrete fines can partially replace Portland cement or



supplementary cementitious materials, with mortar tests showing strength activity indices of around 70–80% over time. When thermally treated or carbonated, these fines exhibit performance comparable to low-calcium fly ash and can even activate blast furnace slag, leading to measurable strength gains. Different carbonation routes (wet, dry and semi-dry) are compared, highlighting trade-offs between efficiency, water use and process complexity.



Beyond stationary recycling plants, mobile "clearing kits" with capacities around 15 tonnes per hour are practical solutions for processing concrete debris after natural disasters or in constrained contexts, enabling local material recovery and reducing transport needs.

Overall, circular concrete is technically feasible at high performance levels, if waste is properly separated, processing is optimised and material properties are well characterised. Circularity in building materials is not limited by material quality, but by process design, system integration and the ability to move from low-grade recycling to controlled, high-value reuse pathways.

JOS BROUWERS, PROFESSOR BUILDING MATERIALS, EINDHOVEN UNIVERSITY OF TECHNOLOGY, THE NETHERLANDS

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Jos Brouwers is a Full Professor and Chair of Building Materials at Eindhoven University of Technology (TU/e). The chair Building Materials is devoted to the advancement and diffusion of knowledge concerning sustainable and functional building materials. Current research interests include Sustainable building (materials, energy, water), Granular mix design and concrete/mortar rheology (Self-Compacting Concrete, soil grouts, earth moist concrete, fiber reinforced concrete, oil well cement etc), Microstructure and pore water chemistry of hydrating cement/lime/gypsum and cementitious by-products (slag, fly ash etc.), and their dehydration (e.g. fire response), Treatment of contaminated soils, dredged sediments, industrial waste, etc, with the help of air/steam (cleaning), carbonation, and by immobilisation/stabilisation, Transport properties and durability of cement/lime/gypsum based materials, Functional materials: self-cleaning, air-purifying, translucent, thermally buffering, etc. The group also assists with material processability evaluation. This is done with a broad combination of processing and material characterisation

Projects:

In 2023 the 3-year project (EU Horizon): «Recycle, Repurpose and Reuse end-of-life wind blade composites – A coupled pre- and co-processing demonstration plant» (Acronym: Blades2Build) has started. In total two PhDs (S. Tumkur Karnick M.Sc. and C. Duyal-Kulak M.Sc.) and one post-doc (Dr. N. Lushnikova) will work on recycling of windmill blade waste and their application in building materials.

In 2024 the 2-year post-doc project (sponsored by C2CA and M2i): «Flash calcination of recycled concrete fines» has started (Dr. Y. Luo).

In 2024 the 3.5-year project (EU Horizon): «UpCycling mIneral and timbeR-based waste from Construction & manUfacturing process industries through eco-design, advanced logistics, quality control and digital solutions» (Acronym: CIRCULess) has started. In total one PhD (T. Hullerum M.Sc.) and one post-doc will work on recycling of mineral and bio-based C&D waste, and their use in building materials.

OLGA MARTIN GARCIA, GENERAL DIRECTOR, AND ASIER ETXEBARRIA ZULUETA, PROJECT TECHNICAL EXPERT, BASQUE ENVIRONMENT CLUSTER ACLIMA, SPAIN

The Basque approach to circular economy: regional strategies and industrial opportunities

Key words: embedded circularity, structural transformation, CDW, structural industrial transformation, Basque Circular 2030

The Basque Country (Euskadi) is one of the leading European regions in circular economy, combining long-term industrial policy, strong governance and an operational ecosystem driven by clusters such as Aclima, the Basque Environment Cluster. With a population of around 2.2 million, the region has a highly industrialised economy, with approximately 25% of GDP generated by industry, and an environmental sector representing about 5% of GDP.

This positioning is the result of a structural transformation initiated after the severe industrial crisis of the 1980s–1990s. The launch of the Basque Competitiveness Programme in 1990, early cluster policies inspired by Michael Porter, and the creation of Aclima in 1995 laid the foundations for a coordinated, innovation-driven model. Today, Aclima brings together 139 members (companies, public entities, technology centres and universities), employs over 6,300 people within its member organisations, and has experienced sustained growth in both turnover and employment.

At policy level, the Basque approach is framed by an integrated strategy aligned with the EU Green Deal. The Basque Circular Economy Strategy "**Basque Circular 2030**" defines clear, measurable targets, including a 30% increase in material productivity, a 30% increase in circular material use, a 30% reduction in waste generation per GDP, a 50% reduction in food waste and 100% recyclable plastic packaging. Circularity is embedded across industry, construction, materials, waste management and innovation, rather than treated as a standalone environmental policy.

This strategic orientation has been recognised at EU level. An OECD report published in

April 2025 identifies Euskadi as a benchmark region among 64 European territories, highlighting early adoption of circular economy policies, collaborative governance involving public authorities, industry and research, and strong integration of eco-design and lifecycle thinking.

Concrete implementation is illustrated through a combination of regulatory tools, infrastructure and innovation projects. In construction and demolition waste, Euskadi has developed detailed good-practice manuals, traceability systems and advanced recycling facilities. At the same time, policy gaps are identified: excavated soils represent the largest waste stream, with around 80% still landfilled, highlighting the need for new circular solutions.

The **C&DW Good-Practice Manual** developed by the Public Environmental Management Company IHOBE provides an operational framework to ensure effective implementation of C&DW Management Plans in the Basque Country. It translates regulatory requirements into on-site practice by clearly defining roles and responsibilities across the construction value chain and by offering sector-specific guidance for different types of works (building, civil engineering, rehabilitation, industrial construction and demolition). Its practical tools (templates, control sheets, contractual clauses and a site-level case study) support selective demolition, source separation and traceability, thereby improving the quality and reliability of secondary materials and facilitating their reintegration into construction markets.

From a strategic perspective, the Basque experience highlights both challenges and opportunities for circular construction. Key challenges include the limited market uptake of secondary materials relative to recycling capacity, regulatory fragmentation across territories, and the need for new skills and organisational changes within SMEs. At the same time, strong opportunities exist through the combination of clear operational guidance, industrial-scale recycling facilities, digital traceability tools and public procurement as a market driver. When aligned, these elements enable the transition from pilot initiatives to stable circular value chains, reducing dependency on primary raw materials while maintaining competitiveness in the construction sector.

YURY VILLAGRAN-ZACCARDI, RESEARCHER, VITO, BELGIUM

ROTATE (HE 2022-2026): Facilitating the generation of synergies between diverse industrial sectors related to mining and quarrying

Key words: *mining and quarrying, recovering valuable and critical materials, innovative crushability, environmental management platform, material valorisation*

ROTATE is a Horizon Europe project aimed at facilitating synergies between industrial sectors linked to mining and quarrying, with the objective of accelerating the transition towards zero-emission, resource-efficient and circular extractive activities. The project addresses extraction, processing and post-processing stages, integrating circularity, industrial symbiosis, waste valorisation and environmental footprint management.

ROTATE is implemented by a consortium of 21 partners from 9 EU countries and is supported by an international advisory board and a steering committee of follower projects representing **different raw material value chains** (e.g. celestite, limestone, granite, sand and gravel, and critical raw materials such as coltan, monazite, zircon and ilmenite). This structure allows industrial challenges to be directly fed into the project and translated into technical and operational solutions.

Several **concrete processing** solutions are presented. For example, improved celestite recovery is pursued through hydrocyclones, spiral technologies and sieves combined with sludge super-thickening, enabling both mineral recovery and water reuse. In parallel, dedicated processing lines using hydrocycloning, spirals and shaking tables are being developed to recover valuable minerals and critical raw materials from aggregates production sites, transforming what is currently a by-product into a resource stream.

Efficiency improvements are another core focus. ROTATE is developing energy-efficient **mobile crushing technologies** with reduced noise and dust emissions, directly targeting the environmental footprint of quarrying operations. In addition, innovative rock crushability characterisation methods and artificial-vision-based granulometry systems are being tested to optimise crushing

energy demand, improve process control and reduce equipment failure risks.

Monitoring and assessment are addressed through the development of an Environmental Management Platform, designed to integrate data from multiple sources and support decision-making. The platform includes modules for biodiversity, CO_2 footprint assessment, emission estimation, environmental risk prediction, energy efficiency and mine closure and remediation, providing a structured approach to environmental management across the life cycle of extractive sites.

The project also places strong emphasis on **valorisation** pathways. Examples include the use of aggregate and natural stone sludges for additive manufacturing (3D printing of cement and concrete elements), advanced valorisation of mine tailings supported by geophysics and remote sensing, and the development of environmentally friendly flocculants to improve water treatment. Further work targets the use of aggregate washing residues as fillers, supplementary cementitious materials (after thermal activation) and lightweight aggregates, alongside standardisation and certification activities to support market uptake.

Social and policy dimensions are explicitly integrated. ROTATE addresses social engagement with local communities, business models for sustainable mining and quarrying, and structured interaction with policymakers. The overall approach positions circularity and environmental performance not as constraints, but as drivers for innovation, competitiveness and long-term viability in the extractive sector.

NIELS HULSBOSCH, R&D EXPERT, BUILDWISE (BELGIAN INNOVATION CENTER IN THE CONSTRUCTION), BELGIUM

Pioneers (H2020): Recovery and valorisation of sand from excavated soil in concrete

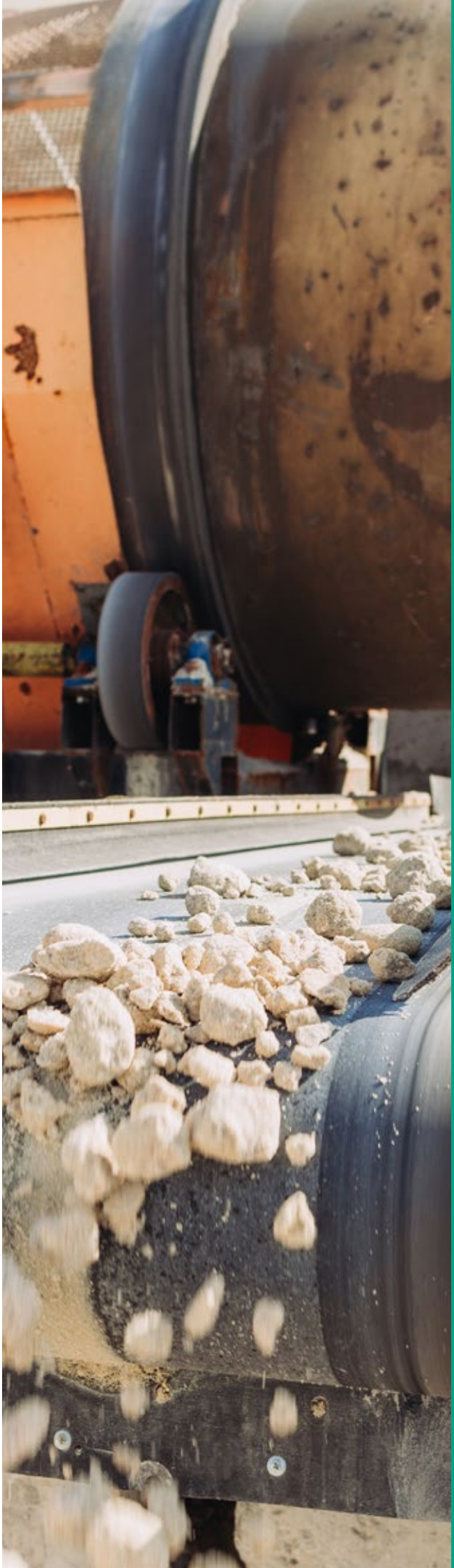
Key words: valorisation of sands, port infrastructure, high-performance concrete, reuse of sand

The H2020 Pioneers project focuses on local resource recovery through the valorisation of sands from excavated soil for use in high-performance concrete. The case study is the construction of a new tidal dock in the **Port of Antwerp**, involving around 3 km of quay walls and approximately 350,000 m^3 of high-performance concrete. Under business-as-usual conditions, concrete production relies on natural marine sand, while dock excavation generates around 30 million m^3 of sandy soil. The project explores whether part of this excavated material can be recovered and reintegrated into concrete, reducing environmental impact and improving resource efficiency.

The key challenge addressed by the project is the **reuse of sand** recovered from excavation works, which differs significantly from conventional construction sand. This material is extremely fine and contains glauconite, a mineral that interferes with standard concrete additives and makes fresh concrete difficult to handle. In addition, any alternative solution must remain economically competitive, work at industrial scale, meet certification and insurance requirements, and guarantee a service life of at least 100 years under harsh conditions such as seawater exposure, frost and chemical attack.

To tackle these constraints, the project followed a progressive and pragmatic approach, moving from laboratory testing to real construction conditions. Initial screening tests helped identify how the excavated sand interacts with cement and additives and revealed rapid loss of workability over time. This issue was resolved by adapting the concrete formulation, combining adjusted mixing procedures with stabilising additives that limit unwanted interactions. These solutions were then transferred to full-scale concrete mixes representative of real construction practice.

The resulting concretes achieved the required strength and durability levels, even when replacing a significant share of natural sand with recovered material. Concretes with up to 30% recycled sand showed performance comparable to conventional high-performance concrete in terms of resistance to carbonation, freeze–thaw cycles with de-icing salts, and chloride penetration. The approach was further validated through on-site demonstrations, including the casting of prototype quay wall elements that are now under long-term monitoring. Service life assessments indicate a potential lifespan well beyond current design requirements, confirming that locally recovered sand can be safely used in demanding infrastructure applications. Overall, the project shows that excavated materials can become **reliable construction resources** when supported by targeted innovation, opening the way for more circular, locally sourced concrete in large-scale infrastructure projects.



DAVID MONIC, CONSULTANT CIRCULAR CONSTRUCTION AT IDEA CONSULT, BELGIUM

MOBICCON–PRO (HE 2022-2027): Integrated innovative circular solutions to recover resources from C&DW

Key words: territorial circular clusters, mobile recycling, high-quality recycling

The project aims to scale up the production and use of high-quality recycled construction materials in South-Eastern Europe. The project is built around a mobile pilot recycling plant designed to process construction and demolition waste locally, reducing transport needs while delivering calibrated, dry and certified recycled materials. The technical concept integrates innovative milling and drying processes, complete water recycling (no wastewater discharge), and the prototyping of new equipment, positioning the solution as both environmentally efficient and industrially robust.

Beyond its technological aspects, MOBICCON-PRO focuses on system-level change through the creation of **Territorial Circular Clusters**, designed to strengthen cooperation between public authorities, industry and academia. These clusters aim to better coordinate material flows, support joint initiatives and address regulatory barriers affecting construction waste management and the uptake of recycled materials, while also helping to overcome persistent doubts about their quality and reliability.

From an environmental perspective, the mobile plant concept delivers clear benefits. By shortening transport distances (up to 35 km avoided), the project achieves significant greenhouse gas emission reductions. Resource efficiency is improved through high recovery rates and closed water loops, reinforcing the circular economy rationale of treating construction waste as a local resource rather than a disposal problem.

The project's market analysis shows that demand and price competitiveness are no longer the main barriers: local demand is sufficient to absorb production capacity, and certified recycled materials can compete with primary resources, even at comparable or slightly higher prices. The key bottleneck lies upstream, in securing a **stable supply** of suitable construction waste, which is affected by low urban renewal rates, internal reuse by infrastructure projects, illegal dumping and the availability of nearby disposal sites. As a result, future progress depends less on technology or market demand than on governance and coordination, including stronger partnerships with infrastructure actors, supportive urban and land-use policies, and regulatory measures influencing dumping practices and gate fees.

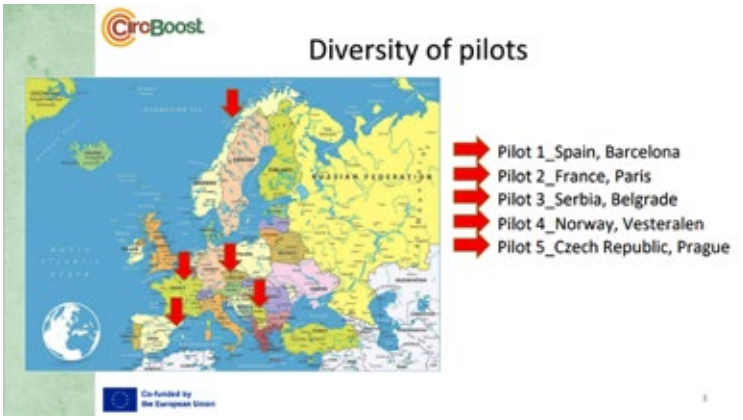
IVAN IGNATOVIĆ, PH.D., ASSOCIATE PROFESSOR, UNIVERSITY OF BELGRADE, FACULTY OF CIVIL ENGINEERING, SERBIA

Circ-Boost (HE, 2023-2027) - Boosting the uptake of circular integrated solutions in construction value chains

Key words: replicable circular construction models, digital enablers for circular value chains, large-scale demonstration pilots

The project aims to accelerate the large-scale uptake of integrated circular solutions across construction value chains and seeks to extend the lifespan of mineral resources by moving beyond isolated recycling solutions and demonstrating systemic, replicable circular approaches through **five large-scale** pilots across Europe.

CIRC-BOOST addresses circularity along the full construction life cycle, from selective demolition and decontamination to material reuse, recycling and reintegration into new buildings. A strong emphasis is placed on **digital and organisational enablers**, including BIM-based selective demolition, material traceability using RFID, digital platforms for material exchange, and design-for-deconstruction principles. Environmental, economic and social impacts are assessed through integrated life-cycle approaches to support evidence-based decision-making.



The five pilots illustrate different circular construction pathways in diverse territorial and regulatory contexts. In Barcelona, the focus is on BIM-based selective demolition and soil decontamination to valorise over 90% of recovered materials in high-value applications. In Paris (Plaine Commune), the project structures reuse and recycling through a combined physical and digital platform, aiming to centralise material flows and connect supply and demand at metropolitan scale. In Belgrade, a pilot house is being built almost entirely from recycled and reusable materials, demonstrating the technical feasibility of recycled aggregate concrete, reused masonry and dismantlable structural systems.

Further pilots extend the scope to challenging environments and large-scale deployment. In Norway, an entire “demolition-to-construction” process is demonstrated in the Arctic region, using waste from demolished buildings and industrial containers to build a new museum with a target of 95% recycled material use. In Prague, the project supports the industrial use of concrete with 100% recycled aggregates across multiple building components, while addressing regulatory and performance constraints linked to current standards.

Across all pilots, a recurring insight emerges: technical solutions are largely available, but regulatory frameworks, quality requirements and risk perception still limit market uptake. By combining real-world demonstrations, digital tools and performance data, CIRC-BOOST aims to de-risk circular construction solutions and support the **evolution of standards and practices**. Overall, the project positions circular construction not as a niche innovation, but as a scalable, system-level transformation of how mineral resources are used in the built environment.

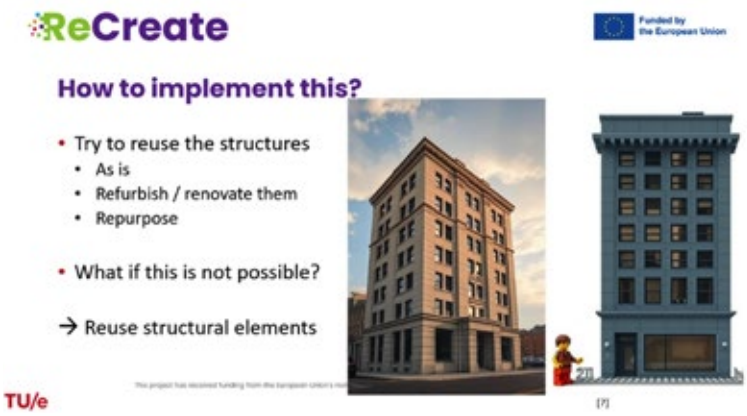
THIJS LAMBRECHTS, DOCTORAL CANDIDATE, BUILT ENVIRONMENT, INNOVATIVE STRUCTURAL DESIGN, EINDHOVEN UNIVERSITY OF TECHNOLOGY (TU/E), THE NETHERLANDS

ReCreate (H2020): Turning the reuse of concrete elements into a profitable business

Key words: structural reuse of concrete elements, component-level end-of-life, mineral resource lifetime extension

A growing structural challenge in Europe lies in the coexistence of large stocks of empty buildings and an ongoing demand for new construction. In Western Europe, many office buildings stand vacant, while in Eastern Europe older housing projects are reaching the end of their functional life. Rather than framing this as a shortage of buildings, the project seeks to answer a more fundamental question: what exactly reaches end-of-life - the building, or specific layers and components within it?

Building on circular economy principles, the presentation positions reuse as a priority strategy, ahead of recycling. Whenever possible, existing structures should be reused as-is, refurbished or repurposed. When this is no longer feasible, attention shifts to the reuse of structural elements, particularly load-bearing components that still retain significant technical and environmental value. This perspective challenges the dominant demolition-and-rebuild paradigm and highlights the **untapped potential** of structural reuse.



ReCreate, a Horizon 2020 project, is dedicated to the **reuse of precast concrete** structural elements. The project brings together partners from Finland, Germany, the Netherlands, Sweden and Croatia, combining complementary expertise while working on pilot projects in different national contexts. Each pilot addresses specific aspects of structural reuse, such as deconstruction strategies, logistics, design integration and performance verification, while contributing to a shared methodological framework.

Several key challenges are identified. Technical issues include how to safely deconstruct existing buildings, assess the structural reliability of recovered elements, and integrate them into new designs. Environmental questions relate to how to robustly quantify the benefits of reuse compared to new production. Economic, legal and social dimensions are equally important, covering business models, liability, standardisation and acceptance by clients, designers and regulators.

The presentation underlines that reusing structural elements is not only a technical problem, but a **system challenge** requiring coordination across the value chain. ReCreate aims to provide evidence, methods and real-world examples to support this transition. Overall, the project illustrates how structural reuse can move from an experimental concept to a credible option for reducing material use, embodied carbon and waste in the built environment, while extending the service life of existing mineral resources.

ALEXANDRE FOLMER, PROJECT COORDINATOR GREATER GREEN+, GRAND EST DÉVELOPPEMENT, REGIONAL AGENCY FOR INDUSTRIAL TRANSFORMATION, FRANCE

Greater Green+ (Interreg, 2024-2028): Greater Region ecosystem to accelerate the ecological transition and economic resilience through the development of greener technologies

Key words: green technologies, territorial scale innovation, cross-border ecosystem building

Greater Green+ is a cross-border ecosystem initiative designed to accelerate ecological transition and economic resilience in the Greater Region through the development and deployment of green technologies. The initiative targets five strategic thematic areas: clean energy, sustainable construction and renovation, recycling technologies, water and the environment, and bioeconomy. Its ambition is to strengthen cooperation between regions, reduce fragmentation, and support the emergence and scaling-up of innovative green solutions.

Greater Green+ is built on a large and diverse consortium bringing together 11 operational partners from France, Belgium, Luxembourg and Germany, complemented by a wide network of methodological partners including regional authorities, innovation agencies, clusters, research organisations and chambers of commerce. This multi-level governance structure reflects the project's ecosystem approach, aiming to connect SMEs, research, public actors and support organisations across borders.

A central component of Greater Green+ is its structured pathway to help projects emerge and accelerate. This pathway is designed in synergy with existing regional support and funding schemes, allowing project holders to navigate different territorial ecosystems while benefiting from coordinated support. Rather than creating parallel instruments, Greater Green+ acts as a facilitator and connector, helping ideas mature into concrete cross-border projects.

The initiative also deploys a set of animation and matchmaking tools to stimulate innovation. These include ideation workshops, thematic challenges and flagship events such as the GreenTech Solutions Awards and the GreenTech Solutions Summit. For example, workshops on water reuse in buildings and industry have generated several pre-project ideas, while thematic sessions on steel decarbonisation and cross-industry data management (including AI-supported LCA optimisation) address industrial transition challenges shared across sectors.

Overall, Greater Green+ positions itself as an enabling platform rather than a traditional R&I project. Its added value lies in its territorial scale, cross-sectoral scope and capacity to bridge innovation ecosystems across borders. By combining strategic themes, structured support pathways and community-building activities, Greater Green+ aims to turn regional complementarities into concrete green innovation and investment opportunities in the Greater Region.

DR. IR. JEAN-MARC ALDRIC, DIRECTOR, DIRECTORATE FOR WASTE MANAGEMENT INFRASTRUCTURE AND WASTE POLICY, DEPARTMENT OF SOIL AND WASTE (DSD), PUBLIC SERVICE OF WALLONIA (SPW), BELGIUM

Exiting Waste Status in Wallonia: From Legal Framework to Practical Implementation

Key words: by-product, end-of-waste material, Waste Framework Directive

Dr. Ir. Jean-Marc Aldric provided an in-depth overview of how Wallonia implements the European "waste or not waste" framework, focusing on the legal, technical, and administrative processes that allow materials to either avoid becoming waste or to exit waste status after valorisation.

At the European level, the reference framework is the Waste Framework Directive 2008/98/EC, as amended in 2018, which defines two key concepts: by-products and end-of-waste (EoW / SSD). While several EU regulations already define EoW criteria for specific materials (iron, steel, aluminum, glass cullet, copper), most material streams remain governed at national or regional level.

In Wallonia, this framework has been fully transposed through the Decree of 9 March 2023 on waste, material circularity and public cleanliness, notably via:

- Article 8 for by-products (SP),
- Article 9 for end-of-waste (SSD / EoW), supported by implementing decrees (AGW)

Waste or not Waste: that's the question!

A by-product is a substance resulting from a production process whose primary purpose is not its production, and which meets four cumulative conditions: certainty of further use, no additional treatment beyond standard industrial practices, integration into a production process, and lawful use without adverse environmental or health impacts. In this case, the material never becomes waste, and responsibility lies with the producer.

An end-of-waste material is a substance that has undergone a recovery operation and meets four cumulative conditions, including the existence of a market or demand, compliance with technical and regulatory requirements, and absence of harmful impacts. Here, the material does pass through waste status, and responsibility lies with the valorisation operator, under Walloon law.

The presentation offered a behind-the-scenes look at how dossiers are constructed and assessed, illustrated through the example of foundry sands. Depending on the context, similar materials have been recognised either as by-products or as end-of-waste, demonstrating that outcomes depend not only on the material itself, but also on intended use, process organisation, and compliance mechanisms.

When a material is eligible but not covered by existing annexes, Wallonia follows a co-construction approach to develop a dedicated reference framework. Applicants propose

operational criteria, which are reviewed, benchmarked, and refined through dialogue with the administration and technical experts (notably ISSeP). This process is supported by standardised documents, digital procedures ("Mon Espace"), and technical benchmarking inspired by existing EU regulations.

The final decision results in a formal recognition that establishes a new set of operational criteria. A subsequent registration procedure then verifies whether a specific operator and site can apply these criteria in practice.

In conclusion, Wallonia is developing a dynamic and progressive approach to by-products and end-of-waste, aligned with European principles while remaining flexible and case-based. Ongoing European work on construction and demolition waste and plastics is closely monitored, as future EU-level rules would prevail and facilitate cross-border circulation by removing waste shipment constraints.

JEAN-MARC ALDRIC, DIRECTOR PUBLIC SERVICE OF WALLONIA – DEPARTMENT OF INFRASTRUCTURE MANAGEMENT AND SUSTAINABLE PLANNING, BELGIUM

https://sol.environnement.wallonie.be/home.html

https://www.linkedin.com/in/dr-ir-jean-marc-aldric-52a35918/

Jean-Marc Aldric, a chemical engineer with a PhD in sciences, has developed extensive expertise in the field of environmental technologies. He has made significant contributions to the development of the legal and technical framework for contaminated soil management and waste management.

Jean-Marc currently serves as Director within the Department of Infrastructure Management and Waste Policy. This department plays a key role in shaping and implementing regional policies, including the Walloon Waste-Resource Plan (PWD-R). It also oversees funding for household waste treatment facilities and supports projects focused on waste prevention and management.

Additionally, he remains engaged with future generations by giving lectures and participating in various academic initiatives.

STÉPHANE NEIRYNCK, GENERAL DIRECTOR OF THE RESEARCH CENTRE CENTRE PIERRE ET TERRE (CTP)

REMIND Wallonia - Contributions to the European Mineral Valley

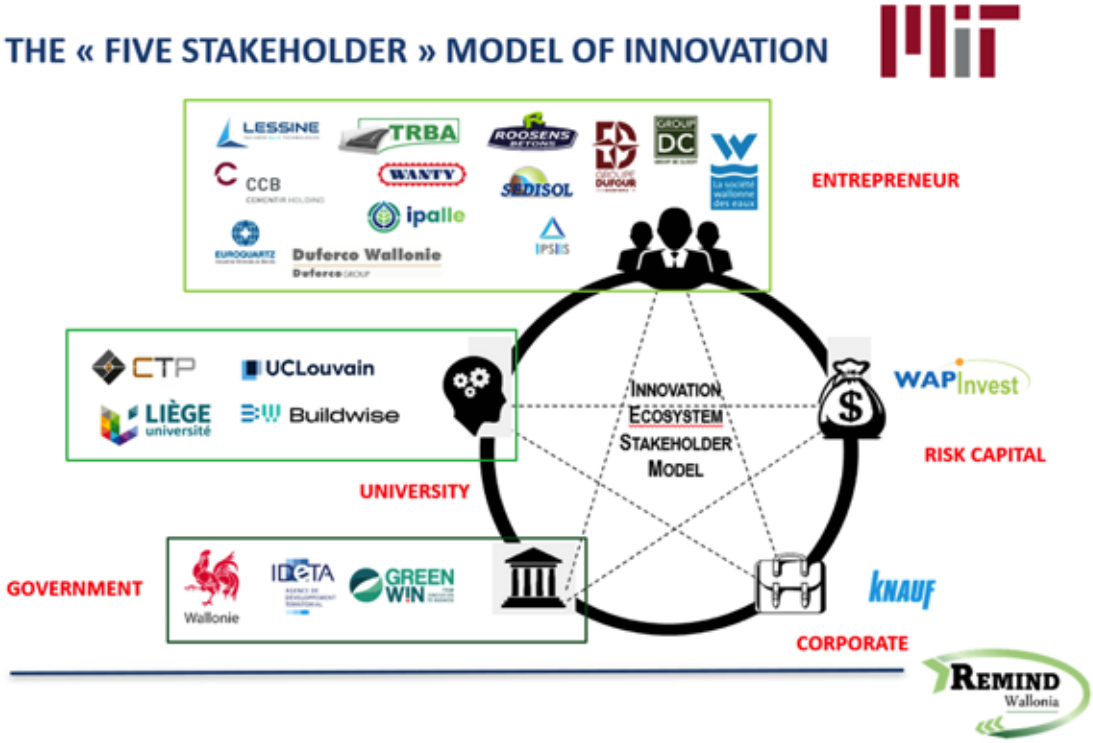
Key words: European Mineral Valley, recycling, secondary mineral industry, Wallonia

REMIND Wallonia is a platform of industrial, technological and scientific excellence aimed at accelerating the circularity of mineral materials in Wallonia. Built on a strong industrial heritage and a forward-looking innovation strategy, REMIND Wallonia positions the region as a future "Mineral Valley" of North-Western Europe by 2030.

Wallonia has a long-standing history with earth and stone-based industries, including quarries, cement and lime production, concrete, bricks and ornamental stone. In 2025, this primary mineral industry represented around 5,000 direct and 10,000 indirect jobs. In parallel, Wallonia has become a pioneer in recycling, with a strong secondary mineral industry built on construction and demolition waste, dredging materials, and public waste streams. This recycling ecosystem alone accounts for approximately 2,000 direct and 5,000 indirect jobs, supported by efficient logistics, waterways, and a dense network of authorised treatment and recycling centres.

The strategic positioning of the sector is analysed through Porter's Diamond, highlighting Wallonia's competitive advantages:

- abundant natural and secondary mineral resources,
- a highly qualified workforce,
- strong logistics infrastructure (roads and waterways),
- demanding domestic markets driven by construction standards (BENOR, QUALIROUTE, CCTB),



- robust R&D capacity (universities and research centres such as Buildwise and Centre Terre et Pierre (CTP)),
- and intense local competition combined with world-leading industrial players.

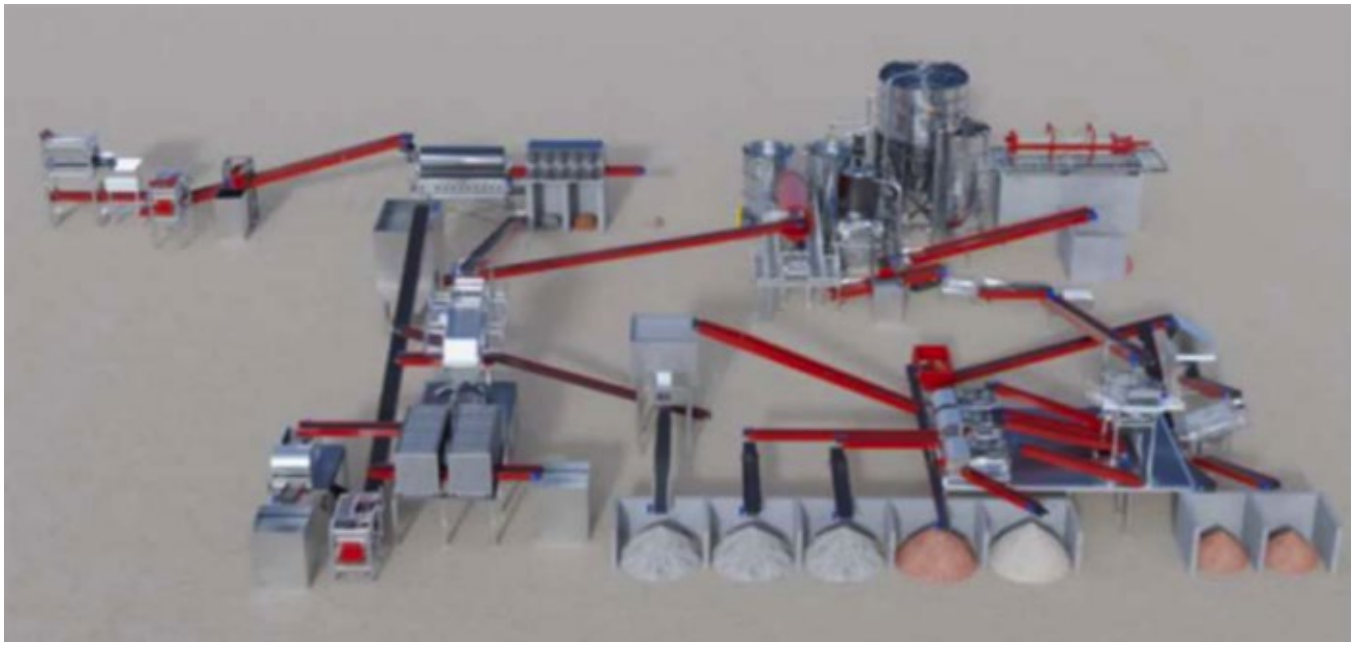
REMIND Wallonia builds on this foundation through an ecosystem-based innovation model, bringing together industry, research, public authorities, finance and end users. The platform currently coordinates 7 large-scale R&I projects, representing a total budget of €23 million, including €13.5 million in subsidies, focused on sustainable building materials, high-performance and low-carbon concrete, alternative binders, and carbonated materials.

Construction of a plant in Sambreville, Wallonia

Concrete industrial impacts are already visible. One example of flagship, CIBER, demonstrates the circular upcycling of recycled concrete through a fully automated processing line located along a waterway. The project has secured a single permit, with installation in 2025 and full operation planned in 2026, representing a €20 million investment for 200,000 tonnes/year of high-quality recycled materials.

Beyond technological innovation, REMIND Wallonia has developed an innovative governance model, including the creation of a cooperative company in 2022 to ensure coordination and long-term continuity, supported by a strong board composed of industry CEOs. Several additional R&D projects are already in the pipeline.

Overall, REMIND Wallonia illustrates how regional industrial strength, circular economy objectives and European R&I dynamics can be combined to deliver tangible economic, environmental and employment benefits, while reinforcing Wallonia's strategic position in the mineral materials value chain.



LOÏC DELHUVENNE, DEPUTY DIRECTOR AT THE TERRITORIAL DEVELOPMENT AGENCY (IDETA)

MC² (Mineral Circular Centre) - Walloon reference hub for the decarbonisation of the earth and stone industry, and the circularity of mineral materials

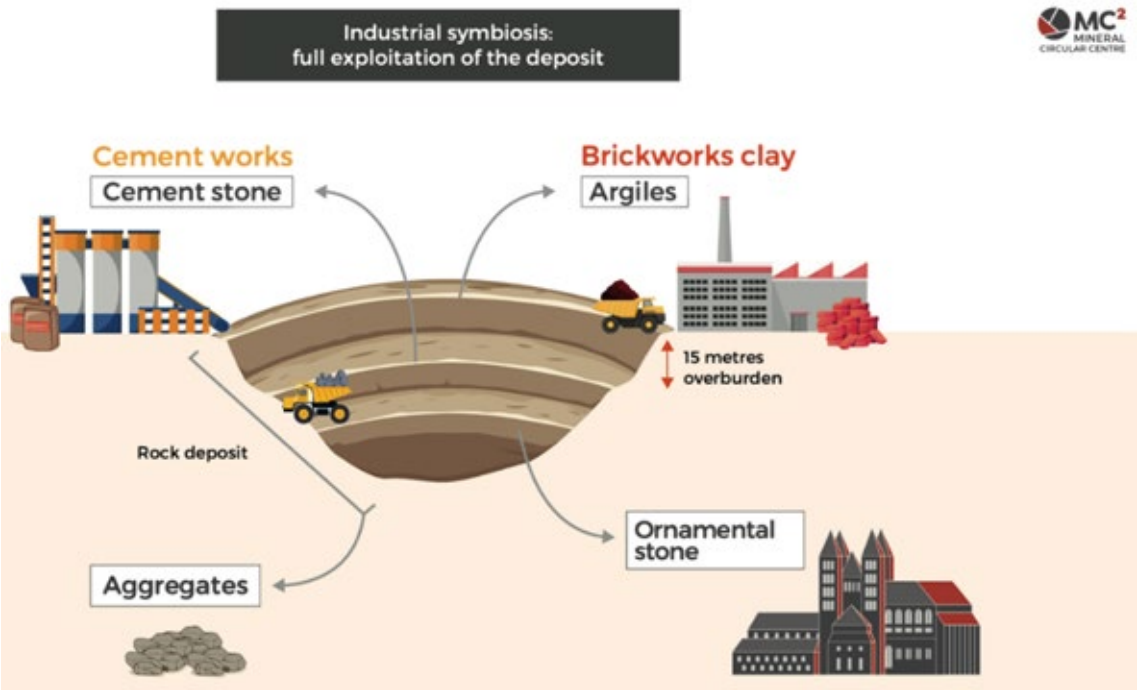
Key words: Wallonia, decarbonisation, BIM, digital twin model, advanced data analysis

MC² - Mineral Circular Centre – is a Walloon reference hub supporting the decarbonisation of the earth and stone industry and the circular use of mineral materials. MC² positions itself at the intersection of industrial transformation, digital innovation and circular economy, addressing the structural challenges faced by quarries and mineral production sites.

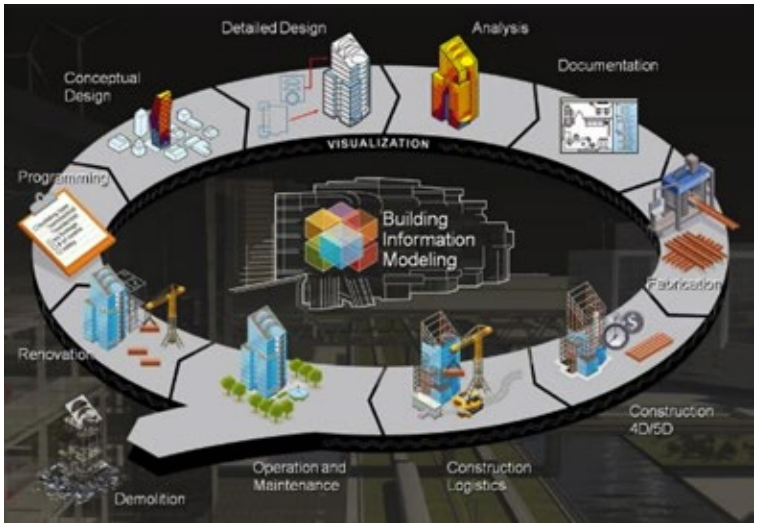
A key focus of the presentation is the application of Building Information Modelling (BIM) beyond traditional construction, as a collaborative digital process supporting the entire lifecycle of industrial installations. BIM enables the coordinated creation and use of digital data, covering geometry, physical and functional characteristics, scheduling, costs, energy performance and maintenance. By doing so, it strengthens collaboration between stakeholders, improves coordination, reduces errors and delays, and facilitates long-term asset management.

In the context of quarries, BIM is deployed through the creation of a digital twin of the site or plant. This digital model integrates comprehensive information on equipment, buildings, materials, safety standards, maintenance procedures, emergency plans, operating costs, energy consumption and performance indicators. The model is continuously enriched through real-time data collection, notably via IoT sensors installed on equipment and processes.

The combination of BIM, data analytics and artificial intelligence enables a shift towards predictive and data-driven operations. Advanced data analysis and machine learning techniques are used to identify trends, predict equipment failures, optimise production parameters and support informed decision-making. One major outcome is the implementation of predictive maintenance systems, allowing operators to



anticipate breakdowns, reduce unplanned downtime, extend equipment lifespan and improve overall operational efficiency.



The benefits of BIM-based quarry digitisation are multiple: reduced operating costs, improved equipment durability and performance, lower operational risks, and better control over energy consumption and environmental impacts. BIM also supports better integration of maintenance, safety and future site development already at the design phase, while improving site organisation, planning and communication during execution.

Pilot projects in quarries demonstrate the concrete applicability of this approach, positioning MC^2 as a practical enabler of digital, circular and low-carbon transitions for the mineral sector. Overall, MC^2 illustrates how digital tools can act as powerful levers to modernise a traditional industry, reinforce circular material flows and contribute to Wallonia's long-term decarbonisation objectives.

SACHA DRUART, PRODUCT INNOVATION AND STRATEGY MANAGER, HEIDELBERG MATERIALS, BELGIUM

COSMOCEM - Transforming Walloon Waste Streams into Reactive Mineral Additives

Key words: new reactive materials, reactive mineral additives, replacement of clinkers

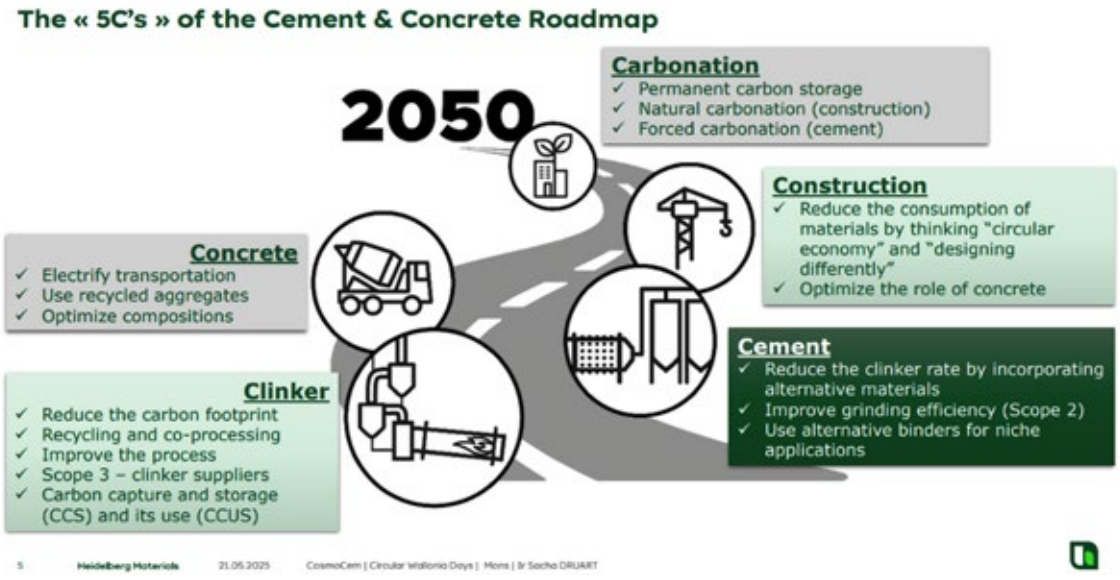
COSMOCEM is an ambitious industrial and R&I initiative led by Heidelberg Materials Benelux, aiming to transform local Walloon waste streams into reactive, low-carbon mineral additives for next-generation cements and concrete. The project directly contributes to the sector's Roadmap 2050 for circular and carbon-neutral construction.

Wallonia currently generates around 10 million tonnes per year of inert waste, including quarry fines, overburden, concrete plant residues, construction and demolition waste, dredging sludges and other industrial co-products. COSMOCEM builds on the idea that these underutilised local materials can become strategic secondary raw materials, reducing reliance on clinkers and imported supplementary cementitious materials (SCMs).

The project is structured around the "5 Cs" of the cement and concrete roadmap: Construction, Cement, Clinker, Concrete and Carbonation. Key levers include reducing material consumption through circular design, lowering clinker content, improving process efficiency, using recycled aggregates, and enabling permanent or accelerated carbonation. Emphasis is placed on developing new reactive materials that can partially replace clinkers while maintaining performance.

At the core of COSMOCEM lies a technology platform combining mechanical processing and thermal activation. Through treatments such as amorphisation, calcination (850–900°C) and mechano-chemical nucleation, low- or non-recovered waste streams are converted into reactive mineral additives. These processes enhance hydration reactions, improve mechanical performance and enable the production of low-carbon cements suitable for a wide range of applications.

The project follows a clear path from research to industrialisation. Launched in 2019, it represents a total budget of €10.35 million, including €6.3 million of Walloon Region support, and brings together a strong consortium of industrial partners, research centres and a university. After laboratory and semi-industrial phases,



COSMOCEM is now moving towards industrial deployment, with a pilot installation under construction and investments of €2.8 million. Product standards are being adapted at national level to enable market uptake.

Concrete results already demonstrate the potential impact: replacing part of clinker with reactive COSMOCEM materials can lead to CO_2 reductions of around 19% per tonne of cement, while maintaining compressive strength and performance. Integrated monitoring tools allow simultaneous assessment of technical performance, costs and environmental impact, from waste input to final concrete product.

Beyond technical outcomes, COSMOCEM delivers significant collateral benefits: contribution to the circular economy, reinforcement of Wallonia's industrial know-how, influence on standards and regulations, competitive advantage for industry, and a strong positive image at national and international levels. Overall, COSMOCEM illustrates how industrial leadership, regional waste valorisation and European decarbonisation objectives can converge into a market-oriented, scalable solution for the construction sector.

SACHA DRUART, PRODUCT INNOVATION & STRATEGY MANAGER, HEIDELBERG MATERIALS BENELUX

http://www.heidelbergmaterials-benelux.com/fr/belgique

Areas of Expertise:

- Innovation & Product Development
- Circular Economy & Low Carbon Cement
- Quality - Standards & Certifications

Sacha Druart, a civil engineer from the Faculty of Polytechnics in Mons, began his career at Heidelberg Materials (formerly CBR) in 1997. Over the years, he has held various positions, including Laboratory Manager, Production Manager, Alternative Raw Materials Manager, Quality Manager, and Project Manager in new technologies and low-carbon cement. He currently serves as Product Innovation & Strategy Manager.

In addition to his role at Heidelberg Materials Benelux, Sacha is the President of the Technical Committee of the Belgian Cement Federation (Febelcem) and leads the Belgian delegation in European cement standardisation. A pioneer in research projects on reactive materials for clinker substitution and circular economy initiatives, he has developed sustainable solutions for the valorisation of by-products and residual fractions from quarries and cement plants.

His extensive experience and dedication to innovation and sustainability make him a recognised and respected professional in the cement industry.

Projects:

COSMOCEM Project: The objective of COSMOCEM is to transform currently underutilised or unvalued waste streams from Wallonia into reactive mineral additions, compensating for the recurring shortage of blast furnace slag and fly ash. This innovative project aims to create an alternative to clinker, the main component of cement, whose production is responsible for most of CO2 emissions in the cement industry.

Tribocem Project: Based on by-products or ultimate fractions from clinker and cement production, this project focuses on the circular economy and the valorisation of these fractions, resulting in a positive impact on the carbon footprint. Several formulas have been developed to produce hydraulic road binders. This initiative serves as the foundation for modifications to regional Belgian specifications.

THOMAS VAN HOYE, QUALITY MANAGER, ELOY, AND AUDREY VAN DER WIELEN, RESEARCHER AT BELGIAN ROAD RESEARCH CENTRE (BRRC), BELGIUM

Monocrete - Thick Single-Layer Coating Based on Alternative Binders and Recycled Aggregates

Key words: *durable concrete pavements, recycled concrete aggregations RCA, vibration, mechanical performance*

MONOCRETE is a GreenWin collaborative R&I project (2021–2024) addressing a key challenge for circular construction: how to design and implement durable, low-carbon concrete pavements while integrating recycled aggregates and alternative binders, without compromising performance.

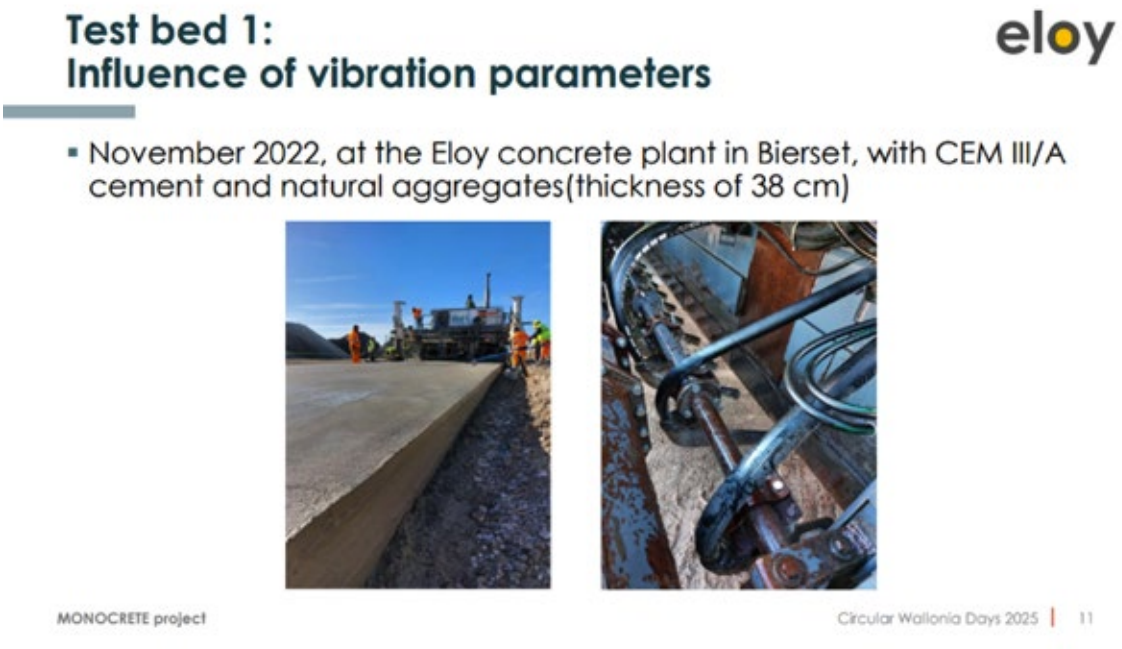
The project originated from a real-life issue observed on an airport pavement in 2019, where surface defects appeared after vibration during placement. This highlighted the need for a better understanding of the interactions between concrete formulations, vibration parameters and construction processes, especially for thick, single-layer pavements.

MONOCRETE aims to:

- Improve the sustainability of concrete pavements through recycled concrete aggregates (RCA) and low-carbon cements
- Study the impact of vibration parameters on mechanical and surface performance
- Validate solutions through laboratory work, test beds and life-cycle assessment (LCA)

Key innovations and results:

- Development of a new low-carbon CEM V cement, incorporating reclaimed fly ash and increasing the use of locally sourced materials
- Successful integration of recycled concrete aggregates, with satisfactory mechanical performance (>50 MPa at 90 days), even at high RCA rates
- Large-scale test beds (up to 2,400 m^2) confirming industrial feasibility and identifying best vibration practices



- Clear evidence that vibration settings strongly influence surface quality and durability, making process control a critical factor
- Life Cycle Assessment showing a CO_2 reduction of up to ~15%, mainly driven by transport reduction, alternative binders and recycled materials

The main technical challenge identified concerns freeze–thaw resistance, particularly when combining alternative binders and high RCA content. Additional R&D is ongoing to optimize air-entraining solutions and ensure compliance with demanding road infrastructure standards.

MONOCRETE demonstrates that circular concrete solutions for infrastructure are achievable, if materials innovation, process control and lifecycle thinking are addressed together. The project delivers practical knowledge for industry, supports policy objectives on low-carbon construction, and contributes to the scaling-up of circular materials in transport infrastructure, in line with European sustainability ambitions.

STEVEN BECKERS, CIRCULARITY EXPERT ARCHITECT, BELGIUM

Systemic Approach to Circularity in Urban Development: The Needs for Minerals Too!

Key words: circular urban development, urban mining, digital tools, sustainable value creation

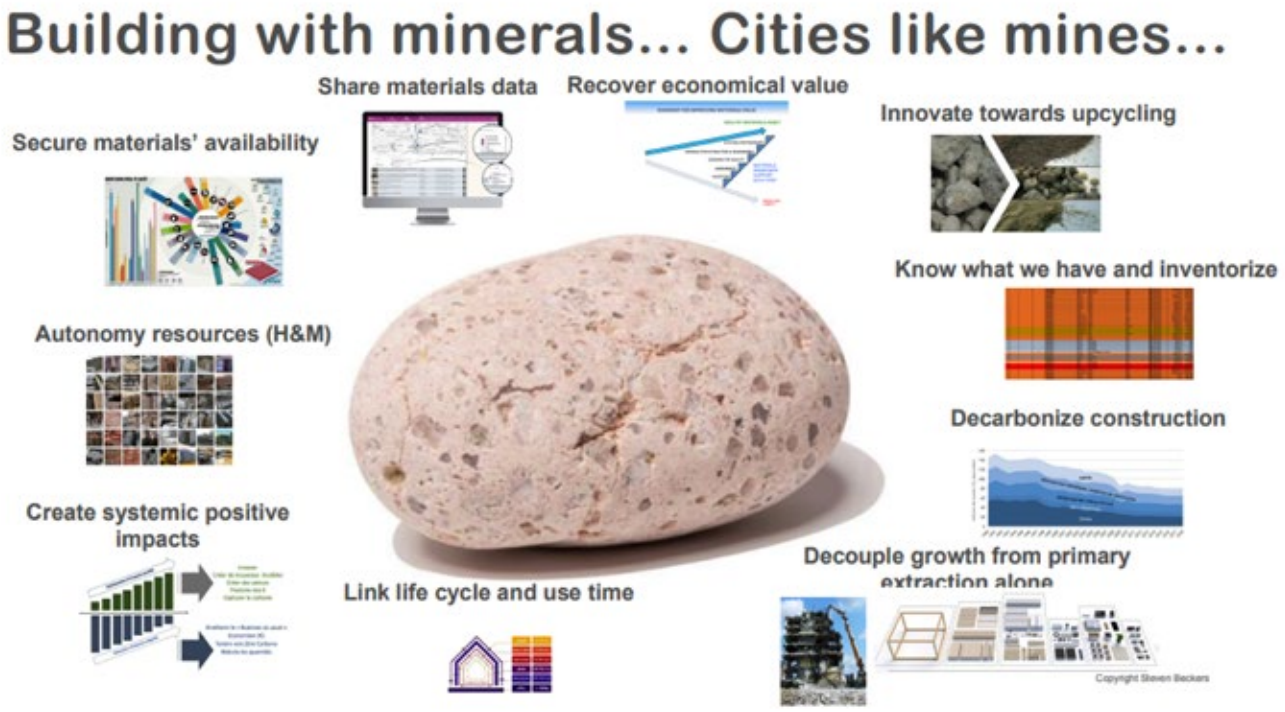
Steven Beckers proposes a systemic vision of circularity in urban development, positioning cities not only as consumers of resources, but as active reservoirs of materials, value and positive impacts. Moving beyond traditional recycling approaches, it advocates for a regenerative circular economy that integrates materials, land use, energy, biodiversity and social well-being.

At the urban scale, circularity starts with optimising what already exists: improving, densifying and transforming current developments instead of expanding into new land. Strategies such as building extensions, raising existing buildings, dismantling and reconstructing obsolete structures, and reconverting derelict sites help preserve soil, limit urban sprawl and retain materials within the region. Cities are reframed as “urban mines”, where materials are identified, inventoried and reused over time.

A strong focus is placed on mineral resources, which remain central to construction. The presentation highlights the need to secure material availability, reduce dependency on primary extraction, and decouple economic growth from virgin resource use. By linking material life cycles with building use time, and by improving traceability and data sharing, materials can retain economic value far beyond their first use.

Digital tools play a critical enabling role. BIM, material passports and digital platforms allow stakeholders to identify, quantify and qualify materials before demolition, renovation or new construction. These tools make it possible to assess circularity impacts on carbon emissions, costs and asset value, while supporting certification, traceability and the development of second-hand material markets.

The approach also emphasises design for disassembly and reassembly, off-site prefabrication (2D and 3D), modularity and separable construction systems. Local prefabrication,



combined with digital planning and logistics, improves quality, reduces waste, shortens transport distances and creates new economic margins. Circularity is thus not only an environmental strategy, but also a value creation model for industry.

Crucially, the author moves beyond efficiency alone. It contrasts reducing negative impacts (low carbon, zero waste, toxicity reduction) with creating positive impacts, such as clean water and air, biodiversity enhancement, healthier materials, collaborative industrial ecosystems and resilient local employment. Circularity is presented as a lever for climate action, biodiversity protection, pollution control, public health, social well-being and economic resilience.

Overall, this systemic approach positions circular urban development as a strategic framework that aligns design, materials, digitalisation, finance and governance. It demonstrates how circularity in construction and infrastructure can become a driver of long-term value, resilience and regeneration, fully aligned with European sustainability and decarbonisation ambitions.

LIONEL FOURDRINIER, COORDINATOR WIN4C, PARTNER CRM GROUP (METALLURGICAL RESEARCH CENTER), BELGIUM

Perspectives of the Walloon Strategic Innovation Initiative Win4C

Key words: Wallonia, circular technological materials, collaborative platform, reverse logistics, secondary raw materials, ecodesign

Win4C - Walloon Initiative for Circular Materials – is a large-scale collaborative innovation platform designed to accelerate the transition towards a circular economy for technological materials in Wallonia. It aims to balance economic development with environmental boundaries, positioning circularity as a driver of industrial resilience and competitiveness.

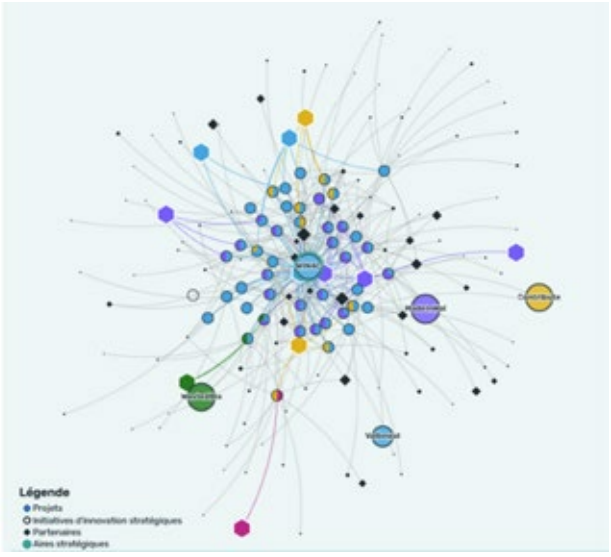
Win4C focuses on circular technological materials across several strategic sectors, including energy transition, ICT, construction and mobility. The initiative has reached a critical level, bringing together more than 80 partners and supporting over 100 actions and R&I projects.

These activities are strongly connected to broader innovation dynamics in manufacturing, digitalisation and artificial intelligence, reinforcing Wallonia's position within European industrial value chains.

At the core of Win4C are Collaborative Innovation Platforms, structured around major circular economy challenges and driven by a clear value proposition for industry ("What's in it for me?"). One key challenge addressed is reverse logistics, enabling the recovery, sorting and reuse of materials for different purposes and stakeholders, and transforming waste streams into secondary raw materials.

Several projects illustrate this approach. In recycling and secondary raw materials, DU3NES focuses on the sustainable use of sand resources by promoting circularity and the reuse of sand-containing by-products. FREEDOM develops innovative technologies for sustainable magnesium production through the recycling of refractory materials and process optimisation.

In the field of ecodesign, Win4C supports projects that integrate circularity at the design stage. ECODECO develops eco-design rules for coatings and decoating processes, enabling extended lifetimes and improved end-of-life management, with pilot-scale validation at TRL 6. WI3NING addresses sustainable additive manufacturing through ecodesign, multifunctional materials, interface optimisation and material repair (e.g. aluminium), targeting



applications such as electrification and thermal management, also validated at pilot scale.

Beyond regional action, Win4C is strongly embedded in European and international innovation ecosystems. The platform actively contributes to programmes and initiatives such as Vanguard Initiative, ERAMIN, Interreg, CIRKLA, LIFE, Horizon Europe, Innovation Fund, EIT Raw Materials and ERMA. Cross-border collaborative platforms and dedicated ecosystems are developed to build shared strategies at European scale, supported by regular meetings, site visits, conferences, international networking and joint participation in calls for proposals.

Overall, Win4C demonstrates how collaborative innovation, critical mass and international connectivity can transform circular materials from an environmental constraint into a strategic opportunity for industrial value creation, supporting both regional development and Europe's long-term sustainability and industrial autonomy goals.

EXTENDING THE LIFESPAN OF CONSTRUCTION MATERIALS: FROM DEMONSTRATION TO INDUSTRIAL UPTAKE

Extending the lifespan of construction materials is increasingly recognised as a cornerstone of circular construction, yet its large-scale deployment remains uneven across markets. This workshop explores how reuse, recycling and eco-design of materials - particularly mineral materials - are already technically feasible, while highlighting the systemic conditions required to move from demonstration projects to industrial deployment.

A recurring theme is the gap between technical maturity and market readiness. Many circular solutions exist today, but they often struggle with sobriety, relocalisation and long-term sustainability at scale. Beyond technology, the transition requires a cultural shift across the construction ecosystem, affecting procurement strategies, design practices and decision-making processes.

Reuse emerged as a particularly powerful lever. Experiences shared by practitioners and researchers demonstrate that salvaging and reusing materials delivers multiple benefits at once: reduced environmental impact, waste prevention, local economic value and stronger territorial anchoring. However, reuse remains

complex to organise, especially for small and fragmented actors. Public procurement rules, tendering procedures and liability frameworks are identified as major bottlenecks, calling for adapted procurement strategies that make reuse easier to implement in public projects.

Material performance and eco-design were central to the discussions, particularly in the context of reuse-oriented strategies. Research and field experience show that reused materials and components can meet the required technical and durability standards when they are properly identified, assessed and integrated into design at an early stage. Lifetime assessment, material diagnostics and selective reuse approaches allow designers and contractors to work with existing materials while maintaining performance and safety expectations.

Several contributions highlighted that reuse is not simply a fallback option, but a deliberate design choice that can preserve material value, reduce transformation needs and significantly lower environmental impacts. When reuse is anticipated upstream—through inventory, documentation and compatibility checks—it enables solutions that are both technically reliable and economically viable. This reinforces the idea that performance and circularity can go hand in hand, provided reuse is embedded into design and procurement processes rather than treated as an afterthought.

The discussions also underlined the need to clearly distinguish reuse from recycling in industrial practices and regulatory frameworks. While recycling remains essential for materials that cannot be reused, reuse requires different tools: quality assessment methods, traceability, liability management and adapted standards. The Q&A sessions revealed that, even where reuse solutions are technically ready, uptake remains limited by market confidence. Clear certification pathways, recognised assessment protocols and stronger demand signals—particularly from public and large private clients—were repeatedly identified as key enablers to scale reuse beyond pilot projects.

Prefabrication and reuse of entire components further demonstrate that circular construction is no longer theoretical. Fully prefabricated buildings using CDW-derived materials already exist, proving technical feasibility. However, participants stress that policy and framework conditions - such as better waste identification, separation at source and quality assessment - are decisive for replication.

The discussion on reuse operators shows how the journey from demolition site to construction site requires early inventory, cost–benefit analysis and clear allocation of roles. Quality assurance, warranties and transparent information are key to building trust. The contrast between project-based reuse and more “factory-like” approaches illustrates the challenge ahead: stabilising supply, standardising processes and reducing uncertainty for buyers.

Finally, the exchanges highlight the importance of collective tools and platforms, such as material passports and digital traceability systems, to support decision-making and transparency across the value chain. While scaling remains a challenge, the workshop confirms that circular materials and reuse are no longer marginal experiments - they are emerging industrial realities that now require alignment between innovation, standards, procurement and market demand.

This session lays the foundation for the detailed contributions presented in the following sections of the report, each exploring specific solutions, business models and framework conditions to accelerate the industrial uptake of circular construction materials.

DIDIER GOHY, SENIOR ADVISOR DEPARTMENT OF INFRASTRUCTURE MANAGEMENT AND WASTE POLICY, PUBLIC SERVICE OF WALLONIA, BELGIUM

End-of-Waste: Building a Reliable Regulatory and Technical Framework – Insights and Challenges for Wallonia

Key words: *recycled aggregates, EU waste framework directive, EOW and by-product regulation*

This presentation is a logical follow-up to Jean-Marc Aldric's presentation (cfr. above). It addressed one of the key enablers of circular construction: the End-of-Waste (EoW) status for materials, with a particular focus on recycled aggregates in Wallonia. It provided insight into how a robust technical and regulatory framework can transform waste streams into trusted secondary resources for the construction sector.

At European level, the Waste Framework Directive establishes the legal basis for recognising when waste can cease to be waste. Wallonia has progressively translated this framework into regional legislation, notably through dedicated decrees and implementing regulations that define conditions for by-products and EOW materials. However, legislation alone is not sufficient: practical implementation requires clear reference frameworks, technical criteria and continuous dialogue with stakeholders.

Recycled aggregates represent the most mature and widely adopted EOW flow in Wallonia. Thanks to a predefined regulatory annex and a structured registration system, recycled aggregates have successfully transitioned from waste to recognised construction materials. This has provided legal certainty for producers and users, while supporting circular material loops in infrastructure and building projects.

Several factors have been decisive in this success. These include the development of standardised technical dossiers, close cooperation with professional federations and public authorities, and the creation of thematic working groups involving certification bodies, research centres and technical experts. These exchanges have led to regulatory improvements, clarified sampling and quality management procedures, and laid the foundations for certification schemes.

Beyond regulation, strong emphasis has been placed on communication, guidance and enforcement. Awareness-raising campaigns, technical guides, dedicated websites and participation in conferences have helped disseminate best practices and build confidence in recycled aggregates. At the same time, inspections and targeted actions ensure a level playing field and prevent unfair competition.

Looking ahead, while recycled aggregates have clearly found their place, EOW and by-product frameworks remain underused for other material streams. Some actors still prefer to remain within traditional waste regimes, even when circular valorisation is possible. The Walloon administration encourages stakeholders to move beyond this comfort zone, emphasising that dialogue and support are central to the approach.

Finally, Wallonia remains attentive to ongoing European developments, particularly regarding construction and demolition waste. Future EU-level provisions may complement or supersede regional decisions, reinforcing the need for alignment between regional practice and European policy.

Overall, it is highlighted how clear rules, technical credibility and trust between authorities and industry are essential to unlock circular mineral value chains and scale up the use of secondary materials in construction.

For more information, please visit
https://www.granulatsrecycles.be/fr

ALEXIS DE MEY, ENVIRONMENTAL EXPERT SODEA, BELGIUM

EOW Status: The Case of Recycled Aggregates in Wallonia

Key words: *EOW regulation, recycled aggregates, onsite/offsite reuse, regional environmental rules harmonization*

Alexis De Mey provides a practical overview of how EOW regulation has been implemented for recycled aggregates in Wallonia, highlighting both its achievements and remaining challenges after five years of experience. He illustrates how regulatory frameworks can enable circular construction - provided that technical credibility, traceability and market trust are ensured.

Wallonia has progressively transposed the EU Waste Framework Directive into regional regulation, defining conditions under which recycled aggregates can move from waste status to product status. This shift is essential to ensure that materials derived from construction and demolition activities are reused in the right applications and at the right place, rather than being landfilled.

Two main reuse pathways coexist. On-site reuse, where recycled aggregates are produced and reused directly at the deconstruction site, remains governed by waste recovery rules. Off-site reuse, through dedicated recycling plants, falls under the End-of-Waste framework and allows recycled aggregates to be marketed as construction products, subject to technical, environmental and quality requirements.

The presentation highlights that recycled aggregates are now the most mature EOW material stream in Wallonia, supported by harmonised technical standards, environmental testing protocols and quality management systems. CE marking, performance declarations and traceability documentation have significantly improved market confidence and product quality. This regulatory experience has since inspired similar EOW frameworks for other mineral streams, such as slag, foundry sand and washed soils.

Several key lessons emerge from this experience. On the positive side, the EOW framework has driven a strong quality mindset, improved transparency and enabled circular material flows at scale. However, it has also introduced higher costs, longer procedures and increased administrative burden, which can be challenging for smaller operators. Environmental thresholds remain difficult to meet for certain materials, and the system's complexity leads some actors to remain outside the formal framework.

Another important limitation is the regional nature of EOW recognition. While CE marking is governed by EU legislation, EOW status depends on regional environmental rules. As a result, recycled aggregates recognised as products in Wallonia may still be considered waste in other regions or EU Member States, highlighting the need for better alignment at European level.

Overall, this intervention demonstrates that EOW regulation is a powerful enabler of circular mineral value chains, but also a learning process. Clear rules, realistic environmental criteria, proportional administrative requirements and continued dialogue between authorities and industry are essential to ensure that recycled materials can genuinely compete with primary resources and contribute to Europe's circular construction objectives.

PIETER KEPPENS, UNIT MANAGER, IMPARTIAL PRODUCT CONTROL BODY FOR CONSTRUCTION (COPRO), BELGIUM

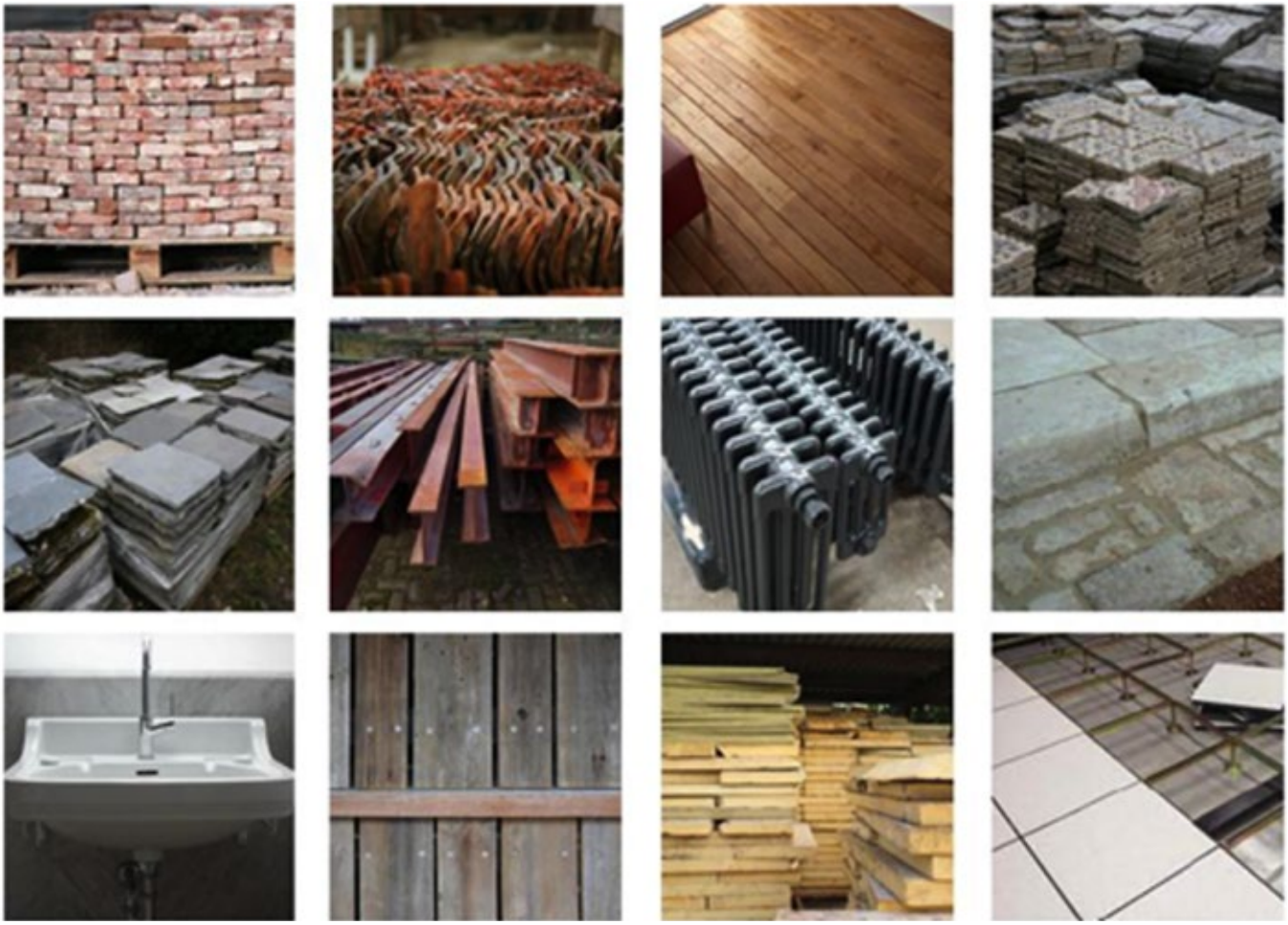
Circular Mineral Materials EOW in Flanders

Key words: EU Waste Framework Directive, material decree, reuse vs recycling of aggregates, highly mature recycled aggregates, mineral waste streams, fit-for-use

Pieter Keppens provides an overview of how Flanders has structured a mature and operational EOW framework for mineral materials, enabling large-scale circular use while maintaining high environmental and technical standards for construction.

Flanders bases its waste and materials policy on a multi-layered legislative framework, rooted in the EU Waste Framework Directive and transposed through regional instruments. At the core lies the Material Decree, complemented by more detailed implementing regulations and ministerial decrees. This framework aims to support the transition towards a circular economy, while ensuring environmental protection and construction quality.

A key distinction is made between reuse and recycling. Reuse - where materials are applied again for their original purpose without processing - remains outside waste legislation and is considered the most circular option. A flagship example is the direct reuse of reclaimed asphalt in new asphalt, which is not considered waste and represents a fully circular loop.



In contrast, recycled aggregates produced through processing follow EOW rules.

Flanders has developed a collective EOW approach for recycled aggregates, supported by a ministerial decree that defines accepted waste streams, risk categories, production requirements, environmental thresholds and quality management systems. Third-party certification and inspection play a central role, ensuring credibility and market trust. As a result, recycled aggregates have reached a very high level of maturity, with recycling rates exceeding 98% and widespread use in road construction and infrastructure.

For other mineral waste streams - such as slags, bottom ash, railway ballast or soil-derived materials - a more case-by-case approach applies. In these cases, the Public Waste Agency of Flanders (OVAM) can grant a “declaration of resource”, confirming EOW status for a specific material, origin and application. This declaration defines technical suitability, environmental monitoring requirements and quality follow-up, ensuring that variable materials remain fit for use.

A strong emphasis is placed on quality management throughout the entire lifecycle. Environmental performance is monitored through sampling and testing, including long-term impacts when materials enter a second, third or even fourth life cycle. Technical performance, durability and fitness for the intended application remain non-negotiable principles.

Overall, the Flemish approach demonstrates how flexible regulation, robust certification systems and close cooperation between authorities and industry can unlock circular mineral value chains at scale. By combining collective frameworks for high-volume flows with tailored solutions for more variable materials, Flanders provides a pragmatic and reliable model for circular construction materials that balances circularity, safety and long-term construction quality.

KVETA KABATNIKOVA, SECONDED NATIONAL EXPERT, DG GROW, EUROPEAN COMMISSION

CPR-2024 and the Right Use of Construction Products

Key words: CPR 2024, right material in the right place, technical performance, environmental sustainability, EPD, DPP, construction product market

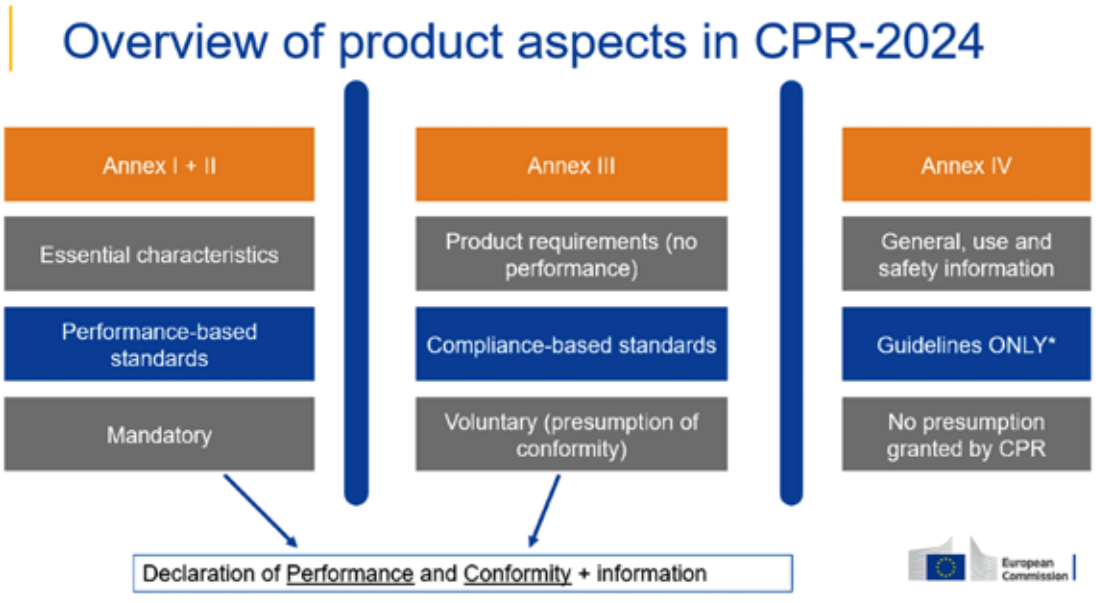
Kveta Kabatnikova introduces the new Construction Products Regulation (CPR) 2024 and its implications for the right use of construction products in Europe. The revised CPR strengthens the link between product information, regulatory compliance and sustainability, placing greater responsibility on all actors involved in the construction value chain.

A key message is that CPR alone does not grant a presumption of suitability for use. The correct application of construction products ultimately depends on national building codes, as well as on proper design, execution and installation practices. CPR provides the framework for product information and performance, while Member States remain responsible for defining how products are used in construction works.

The regulation reinforces the role of the Declaration of Performance (DoP) and Declaration of Conformity, expanding the scope of information to be provided. Beyond technical performance, manufacturers must supply information related to safety throughout the product lifecycle, including transport, installation, maintenance, deconstruction and demolition. Requirements also cover compatibility with systems, maintenance needs, safe use, training requirements and risk mitigation.

A major novelty of CPR 2024 is the stronger integration of environmental sustainability. Annex II introduces a list of essential environmental characteristics, based on life-cycle assessment indicators (EN 15804) and Environmental Product Declarations (EPDs). This strengthens transparency on environmental impacts and supports more informed decision-making by designers, contractors and public authorities.

The presentation also addressed how the new CPR supports circular construction practices. Used and remanufactured products can be covered either through harmonised standards, European Assessment Documents (EADs) or European Technical Assessments (ETAs). This



flexibility allows innovative and circular products to access the market, while maintaining trust and safety. However, national building codes may still require additional assessments depending on the application.

A central pillar of the new framework is the Digital Product Passport (DPP). The DPP is a set of digital documents linked to the product placed on the market, providing regulatory, technical and sustainability information. Interoperable with BIM and other digital tools, DPPs aim to improve transparency, traceability and information management throughout the product lifecycle. Their full potential will be realised only if harmonised at EU level, enabling reuse, recycling and better end-of-life management.

Finally, the presentation clarified the timeline for the transition to the new CPR, including the treatment of existing EADs and ETAs. While current assessments remain valid for a defined period, future products will progressively align with the new CPR framework, reinforcing consistency and predictability for the market.

Overall, CPR 2024 marks a significant step towards a more transparent, circular and digitally enabled construction products market, balancing innovation, safety and sustainability while clarifying responsibilities across European and national levels.

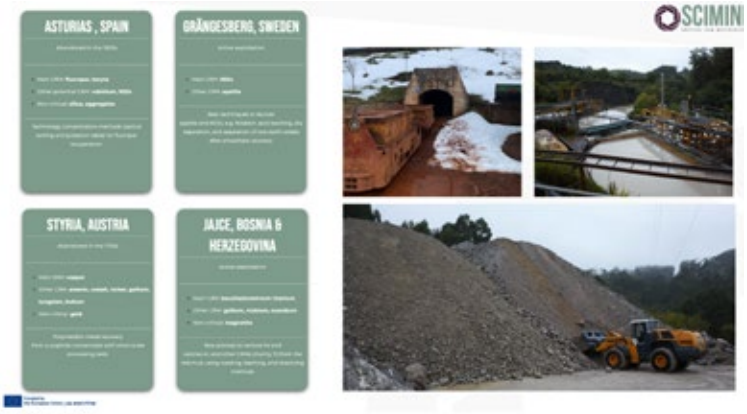
LORENA VILADES, PROJECT MANAGER, ANEFA, NATIONAL ASSOCIATION OF AGGREGATE MANUFACTURERS, SPAIN

Horizon Europe SCIMIN-CRM: Unlocking Critical Raw Materials through Circular Mining in Europe

Key words: *raw materials recovery, circular mining, EU raw material policy, advanced digital tools, environmental performance, extractive waste management*

SCIMIN https://scimin.eu/ is a European collaborative project that anticipates and supports the implementation of the Critical Raw Materials Act (CRM Act), in particular Article 27 on the recovery of critical raw materials from extractive waste. The project positions circular mining as a strategic lever to strengthen Europe's raw materials security, sustainability and industrial autonomy.

The core objective of SCIMIN is to boost the circular economy in the mining sector by enabling the recovery of both critical and non-critical mineral raw materials from extractive waste streams. By valorising existing waste deposits and tailings, the project aims to reduce dependency on primary extraction and imports, while contributing to Europe's strategic autonomy and responsible sourcing of raw materials.



Environmental performance is a central pillar of the project. SCIMIN seeks to minimise environmental impacts and historical liabilities associated with extractive waste sites, reduce the presence of dangerous substances in processes and materials, and improve the overall environmental footprint of mining activities. At the same time, it addresses a key societal challenge: enhancing the social acceptance of mining through transparency, improved practices and tangible environmental benefits.

Technological innovation plays a major role. The project explores the application of advanced digital tools and artificial intelligence to mining production systems, supporting better resource identification, process optimisation and decision-making. These technologies are tested and demonstrated to assess both their technical feasibility and scalability.

SCIMIN also places strong emphasis on transferability and policy impact. The methodologies, tools and models developed are designed to be applicable to other mining regions across Europe, providing concrete guidance to governments, authorities and industry stakeholders. By demonstrating real-life applicability, the project contributes to the practical implementation of European raw materials policy.

The project brings together a large and diverse consortium, with partners from multiple European countries, including industry representatives, research organisations, universities, technology providers, environmental NGOs and public authorities. This diversity reflects the project's ambition to address circular mining from a holistic, value-chain and ecosystem perspective.

Overall, SCIMIN demonstrates how circular approaches to extractive waste can simultaneously support environmental restoration, resource security, technological innovation and social acceptance, making it a flagship example of how European mining can evolve in line with the CRM Act and broader sustainability objectives.

STÉPHANE VERSTRAETE, CONSULTANT GROUP DE CLOEDT, BELGIUM

STUDY CASE: Scaling Circular Sand and Mineral Materials: From Waste to New Resources

Key words: secondary raw materials, EOW regulatory framework, circular mineral sector, substitution of virgin materials

This presentation highlights the transition of the mineral sector towards circularity through the concrete example of Aggremix by Bioterra, a producer of secondary raw materials based in Genk (Belgium).

Sand, after water and air, is one of the most consumed resources worldwide. The challenge today is to find the right balance between primary raw materials and recycled mineral streams, while maintaining quality, performance, and regulatory compliance.

Since 2016, Bioterra has progressively developed industrial-scale facilities to process contaminated soils, polluted clays, sands and mineral waste into valuable secondary raw materials. Located along the Albert Canal, the Genk site has evolved from a 9-hectare installation to a 14.5-hectare industrial hub, with continuous expansion planned between 2023 and 2026.

A key enabler of this transition is the regulatory framework, notably the evolution towards the *end-of-waste status*, which allows treated mineral fractions to be reintroduced into construction value chains. This regulatory clarity is essential to unlock circular business models at scale.

Aggremix products demonstrate high substitution rates of virgin materials:

- Substraton® screed: 100% recycled content
- Concrete elements: up to 92% recycled materials
- Road concrete: 53% recycled content
- Prefabricated elements: up to 100% recycled materials

These applications cover a wide range of construction uses, from prefabricated panels to structural concrete and road infrastructure.

The presentation concludes that circularity in the mineral sector is not a solo performance but a “dance for two”: requiring alignment between industry and regulation, innovation and market uptake, environmental ambition and economic viability. When these elements move together, circular mineral value chains can scale successfully and sustainably.

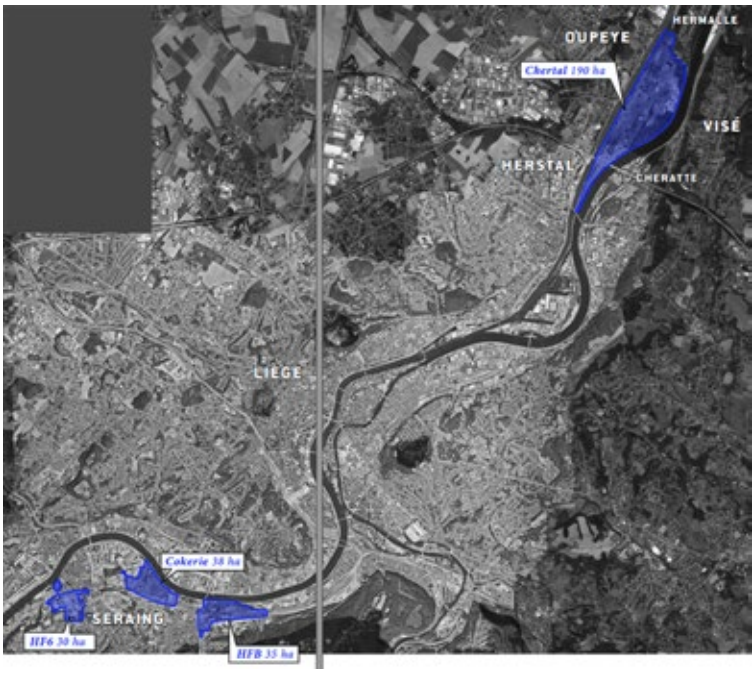
For more information please visit: https://www.groupdecloedt.be/en

STÉPHANIE STEVENART, PROJECT MANAGER WALLONIE-ENTREPRENDRE, BELGIUM

STUDY CASE: From Legacy Industrial Sites to Circular Mineral Value Chains: The Chertal Case

Key words: slug management, material recovery, reuse and recycling

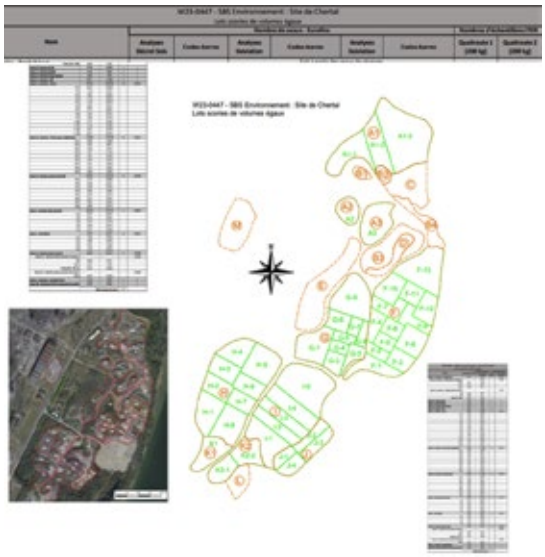
This presentation focuses on the management and valorisation of slag as part of the acquisition and redevelopment of the Chertal industrial site in Liège, led by Wallonie Entreprendre on behalf of the Walloon Region.



Following a delegated mission from the Walloon Government, Wallonie Entreprendre was tasked with negotiating the acquisition of major disused steelmaking sites formerly operated by ArcelorMittal, including Chertal, and preparing their redevelopment through public and public-private models. Beyond land regeneration, a central challenge lies in managing large volumes of mineral materials, notably slag, in a safe, compliant and economically viable way.

The Chertal site extends over approximately 3 km, split longitudinally by a railway line, and contains around 1 million m^3 of materials, including:

- ~700,000 m^3 of slag,
- ~215,000 m^3 of soils,
- additional reusable mineral fractions suitable for recovery.



A robust and pragmatic sampling and analysis strategy was developed to overcome the technical and financial limits of standard protocols. The site was divided into 18 distinct zones, with adapted batch sizes and analysis frequencies depending on material volumes. This approach enabled a risk-based assessment aligned with actual land use and zoning, while remaining operationally feasible.

The results show that the slag stockpiles do not present significant risks for human health or groundwater, provided they are managed in compliance with their intended uses. This finding is a key enabler for material recovery pathways, allowing slag and soils to be redirected towards appropriate reuse and recycling channels instead of disposal.

A critical element of the process is the transfer of responsibility for slag management at

the moment of site acquisition. This required extensive legal and administrative validation, modelling of recovery scenarios, financial assessments, and negotiations with the former operator. The objective is to secure clear responsibility while maximising material valorisation.

Looking ahead, site access is expected by end of 2026, with priority given to redeveloping the canal-side zone as an industrial economic activity park. For the 30-hectare slag zone, a public tender will seek an operator capable of preparing materials for multiple recovery pathways, including sampling, testing, permitting and operations.

The broader ambition goes beyond Chertal alone: to structure a genuine slag recovery industry in Wallonia, maximise technical added value from mineral residues, and create links with other slag deposits across the region. This project illustrates how industrial heritage, environmental responsibility and circular economy principles can be aligned to support regional competitiveness and sustainable industrial transformation.

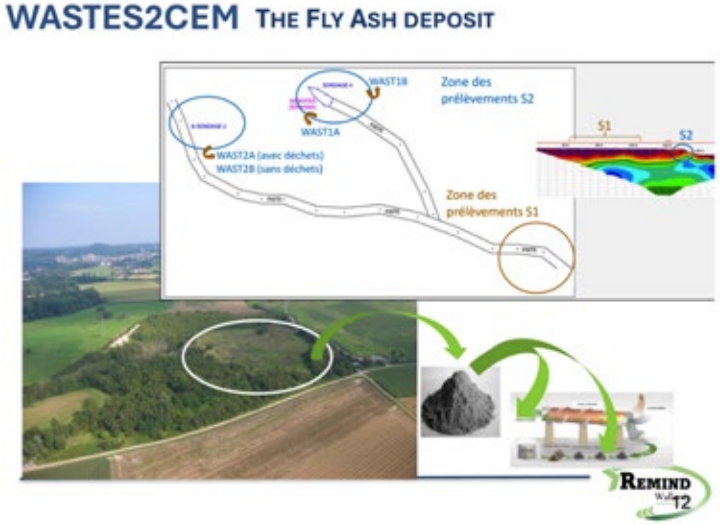
CLAUDIA NECULAU, PROJECT COORDINATOR REMIND WALLONIA, BELGIUM

CASE STUDY: WASTES2CEM: Minimising the Environmental Impact of Clinker by Incorporating Secondary Mineral Materials (SMM) into the raw mix

Key words: secondary mineral materials, circular binders, slag, ash deposits, clinker production

WASTES2CEM is a flagship project of REMIND Wallonia, aiming to reduce the environmental impact of clinker production by incorporating secondary mineral materials (SMM), notably steel slags and fly ash, into the cement raw mix.

The context is clear: Europe consumes nearly 100 billion tons of materials each year, with over 90% becoming waste, while the EU circularity rate remains limited to 11.5%. In Wallonia, the mineral industry plays a major economic role, generating 5,000 direct and 10,000 indirect jobs, but also accounting for a significant share of CO_2 emissions, particularly from cement and lime production.



WASTES2CEM addresses this challenge by creating alternative circular binders based on historical slag and fly ash deposits, often located on brownfield sites. Instead of treating these materials as liabilities, the project seeks to reintegrate them into industrial value chains, reducing the need for virgin raw materials and lowering clinker-related emissions.

Extensive sampling, characterisation and testing campaigns have been conducted. Results show that:

- Pre-treatment of LD and white slags is technically feasible and validated for use in cement raw meal, with substitution rates of up to 4%.
- Approximately 90% of the fly ash deposits studied comply with the chemical and performance requirements of EN 450-1 and EN 197-1, with only a limited fraction deemed unsuitable.
- Remaining challenges relate mainly to pre-treatment processes, such as drying, and the associated energy requirements.

Beyond technical validation, the project highlights key regulatory, operational and cultural challenges, including EOW status, permitting procedures, standards such as Qualiroutes, and the need for a shift in mindsets to fully embrace circular mineral solutions.

WASTES2CEM is part of a broader REMIND Wallonia portfolio structured around four pillars: sustainable construction materials, high-performance concretes, alternative binders, and carbonated materials. Together, these projects demonstrate how industrial innovation, research excellence and public support can converge to make Wallonia a European reference for circular mineral materials.

Looking ahead, REMIND Wallonia aims to scale up these solutions through new partnerships, European funding (Horizon Europe, LIFE, Innovation Fund), and the creation of a REMIND-Circular label to certify products and processes. The long-term ambition is clear: transform mineral waste into strategic resources while strengthening industrial competitiveness and contributing to Europe's climate objectives.

For more information:
https://www.remind-wallonia.be/project/wastes2cem/

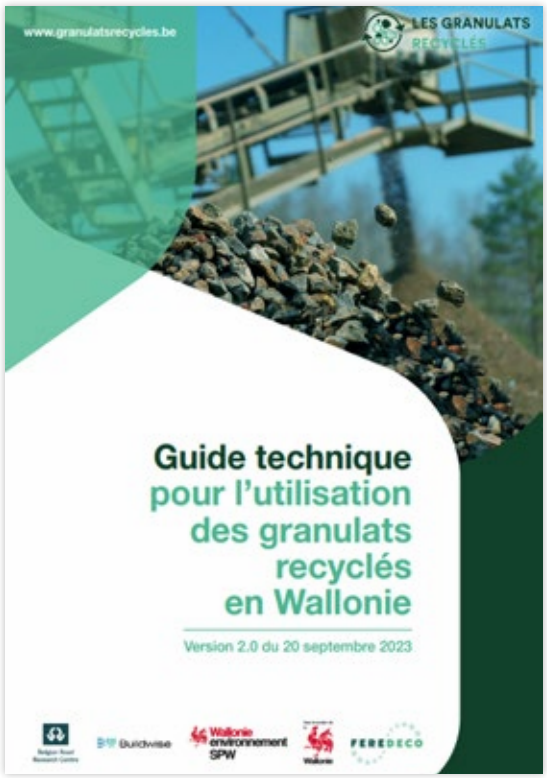
THIBAULT MARIAGE, DIRECTOR FEDERATION OF CONSTRUCTION WASTE RECYCLERS (FEREDECO), BELGIUM

Case study of applications of recycled aggregates in public work

Key words: EOW, upcycling, downcycling, shortening supply chain, Qualiroutes, recycled aggregates, public works

This presentation showcases how recycled aggregates can be effectively and safely used in public works, illustrating the practical application of EOW principles and the concept of "the right material in the right place." Delivered by FEREDECO, the professional federation representing recycled aggregate producers in Wallonia, it highlights the sector's contribution to circular construction.

FEREDECO brings together a large network of recycling operators across Wallonia, ensuring that a recycling plant is located close to virtually every construction site. This territorial proximity supports short supply chains, reduces transport impacts and facilitates the integration of recycled materials into infrastructure projects.



A key focus is the distinction between upcycling and downcycling. Upcycling refers to recycling approaches that increase the value of materials, such as concrete produced with recycled mixed aggregates. Downcycling, by contrast, involves reuse in lower-value applications, such as technical backfilling. Both approaches have a role, but the objective is to maximise value retention wherever technically and economically possible.

The presentation is supported by a practical guide composed of six fact sheets, designed to help contracting authorities, designers and contractors understand how to specify and use recycled aggregates correctly in public works. These tools aim to build confidence and ensure compliance with both technical standards and regulatory requirements.

A concrete case study illustrates this approach: the use of TERACALCO, a CE-certified recycled mixed gravel, for the construction of a cycle path along the E411 motorway in Wavre, carried out under the Qualiroutes specifications. This example demonstrates that recycled aggregates can fully meet performance requirements while delivering environmental and economic benefits.

The presentation also compares recycled aggregates with alternative materials that could have been used, such as natural sand and aggregates - non-renewable resources with higher added value - or excavated soils, which often present challenges related to heterogeneity, compaction and moisture sensitivity. In this context, recycled aggregates emerge as a technically reliable and resource-efficient solution.

Overall, circular construction is already operational in Wallonia. When supported by clear standards, certification (including CE marking), guidance tools and local supply chains, recycled aggregates can be confidently integrated into public works, contributing to resource efficiency, reduced environmental impact and resilient regional value chains.

For more information, please visit
https://www.granulatsrecycles.be/fr

ROBERT BAUDINET, CO-FOUNDER AND CEO, MATVISION, BELGIUM

CASE STUDY: Matvision - From Waste to Resources

Key words: *mixed waste streams, high-quality secondary resources, AI, sorting technologies, recycling value chain*

Matvision is a technology company addressing one of the most critical challenges of the circular economy: recovering value from complex, mixed and low-grade waste streams that are still largely exported or underexploited in Europe.

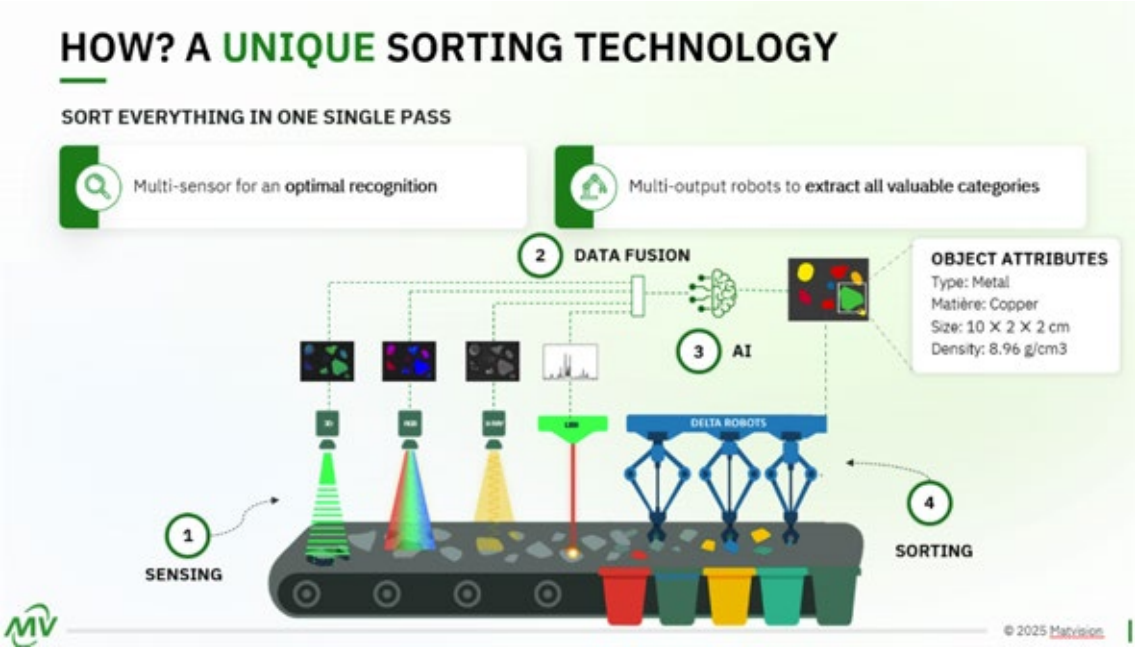
Today, around 90% of non-household waste consists of complex material mixtures. Each year, Europe exports approximately 20 million tonnes of metallic waste, often to Asia, resulting in a significant loss of economic value and strategic materials. Matvision positions itself as a key enabler to keep this value within Europe by transforming waste into high-quality secondary resources.

At the core of Matvision's solution lies a unique sensor-based sorting technology, capable of sorting everything in a single pass. By combining advanced sensing, high-speed sorting, data fusion and artificial intelligence, the system can identify and separate valuable materials that traditional processes fail to recover. The technology is modular and adaptable, allowing it to be tailored to the complexity and value of each material stream.

The solution has reached industrial maturity, operating 24/5 since 2023, with more than 2 million pieces detected daily and a throughput of 1–2 tonnes per hour. Depending on the material stream, the technology generates an added value of €200 to €600 per tonne, demonstrating clear economic relevance alongside environmental benefits. Several ongoing validation tests further support scalability and deployment across different sectors.

Matvision's technology is applicable to a wide range of high-impact use cases, including:

- Plastics (ABS, PP, PS, PE), including flame-retardant detection,
- Automotive shredder residues and post-consumer metal fractions (e.g. ZORBA, ZURIK, aluminium, zinc, stainless steel),
- Rubbers and end-of-life tyres,
- Printed circuit boards (PCBs), WEEE and batteries,



- Mineral streams such as construction waste, refractories and mining ores.

By enabling high-precision recovery of metals, plastics and minerals, Matvision contributes directly to resource efficiency, supply-chain resilience and industrial sovereignty. Its approach illustrates how digital technologies and AI can redefine recycling value chains, shifting Europe from waste exporter to producer of high-quality secondary raw materials.

Overall, advanced sorting technologies are a cornerstone of circular industrial ecosystems, enabling new business models, reducing dependency on primary resources and supporting Europe's transition towards a more resilient and competitive circular economy.

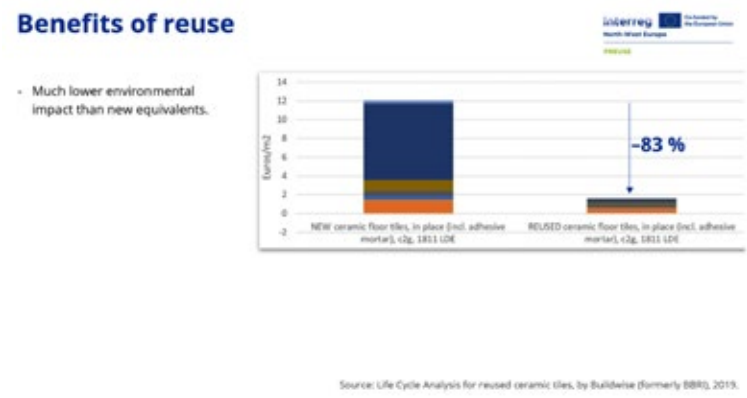
For more information, please visit: https://matvision.eu/

MICHAËL GHYOOT, ARCHITECT, ROTOR, BELGIUM

Reusing Building Elements: From Niche Practice to Scalable Circular Solution

Key words: reuse, circular value chain, short supply chain, cultural barriers, reducing environmental impact

Michaël Ghyoot focuses on reuse of building elements as one of the most impactful strategies to reduce the environmental footprint of the construction sector. Delivered by Rotor, a Belgian non-profit organisation and cooperative company active since 2006, his presentation highlights how reuse can move from a marginal practice to a structured and scalable circular value chain.



Source: Life Cycle Analysis for reused ceramic tiles, by Buildwise (formerly BBRI), 2019.

Reuse differs fundamentally from recycling: instead of breaking materials down, it preserves the functional and embedded value of building components such as tiles, radiators, timber structures or façade elements. Life-cycle assessments consistently show that reused elements have a much lower environmental impact than new equivalents, while also preventing waste generation and supporting local economic activity. In practice, around 90% of salvaged materials travel less than 500 km, reinforcing short supply chains.

Rotor's work spans the entire reuse chain: assistance to project owners, design and engineering support, dismantling, conditioning, storage, stock management and resale. Through real projects, such as housing renovations and public facilities, reuse is demonstrated as technically feasible and compatible with architectural quality and regulatory requirements.

Two major Interreg North-West Europe projects, coordinated by Rotor, play a key role in scaling up reuse:

- FCRBE (2018–2023) focused on structuring the market for reclaimed building elements by improving visibility, knowledge and professional practices.
- PREUSE (2024–2027) builds on these results by supporting public authorities in integrating reuse into procurement strategies.

Three main challenges are addressed:

1. Making the reuse market visible, through online directories of salvage operators and statistical analyses of the sector.
2. Adapting procurement strategies, notably by introducing minimum reuse targets and award criteria in public tenders. Pilot projects in cities such as Quimper and Strasbourg demonstrated that measurable quantities of materials can be reclaimed and reused within standard procurement frameworks.
3. Demonstrating fitness for use, through adapted technical procedures combining testing, controlled dismantling, storage, design adaptation and validation by control bodies.

Beyond technical and regulatory aspects, the presentation stresses that the main barrier to wider adoption of reuse remains cultural. Scaling up reuse requires a shift in habits and mindsets across the construction sector, from designers and contractors to clients and public authorities.

Overall, this intervention shows that reuse is not a backward-looking practice, but a forward-looking solution combining environmental performance, economic value and local job creation.

With the right tools, procurement models and collaboration, reuse can become a mainstream pillar of circular construction in Europe.

For more information, please see: nweurope.eu/fcrbe, preuse.nweurope.eu

MICHAËL GHYOOT, PROJECT MANAGER AT ROTOR ASBL, BRUSSELS, BELGIUM

https://rotordb.org/en

Michaël Ghyoot is an architect and researcher in the fields of ecology, reuse, and architecture. He joined Rotor in 2008 and has developed numerous projects on the reuse of building materials. In 2024, Michaël curated the exhibition Entangled Matter, presented at Bozar, Brussels. He is the lead partner of the Interreg NWE PREUSE project (2024-2027). Between 2018 and 2023, he was a lead partner of the Interreg NWE FCRBE project, where he oversaw the production of various deliverables aimed at promoting the reuse of building elements. Michaël directed the publication of the book *Deconstruction and Reuse: How to Circulate Building Elements* (EPFL Press, 2018) [Déconstruction et Réemploi. Comment faire circuler les éléments de construction]. He regularly contributes to discussions on circular construction through publications, lectures, and training sessions.

Projects:

PREUSE: https://preuse.nweurope.eu/

FCRBE: https://vb.nweurope.eu/fcrbe

OPALIS.EU: https://opalis.eu

PIERRE BOLLEN, SENIOR RESEARCHER, INSTITUTE OF MECHANICS, MATERIALS AND CIVIL ENGINEERING (IMMC), CATHOLIC UNIVERSITY OF LOUVAIN (UCL), BELGIUM

How to integrate circularity principles into a rational material eco-selection methodology?

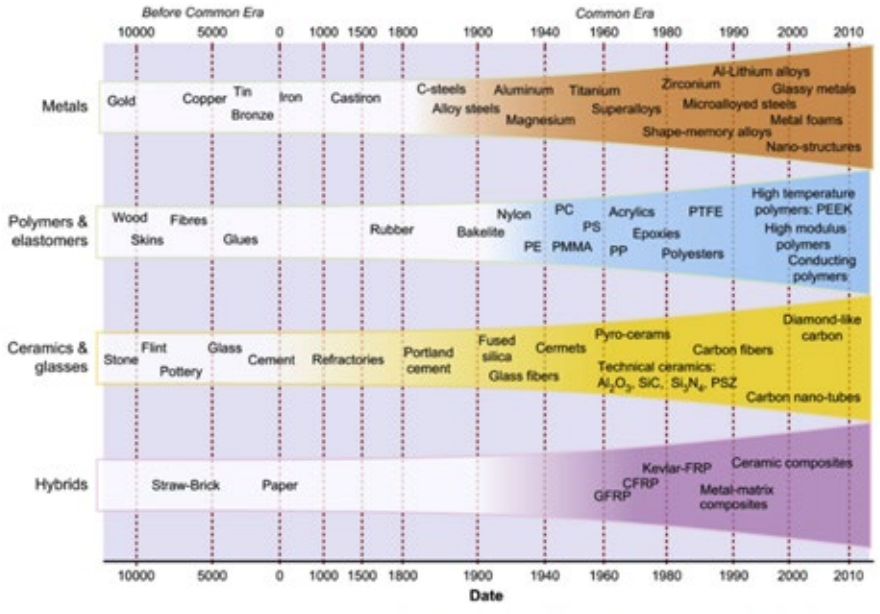
Key words: material selection, eco-selection, material design, eco-audit, material lifespan

This presentation addresses a central challenge for industry and designers: how to select the right material in a context of extreme complexity, while integrating environmental performance and circularity from the earliest design stages.

Today's designers face an overwhelming choice: tens of thousands of materials, thousands of processes, and countless combinations (composites, hybrids, assemblies). Trial-and-error approaches are no longer viable. Pierre Bollen argues that robust material selection methodologies are essential to guide innovation efficiently and responsibly.

The proposed approach is based on material eco-selection, a structured method that starts with design requirements rather than from materials themselves. The method follows a clear logic:

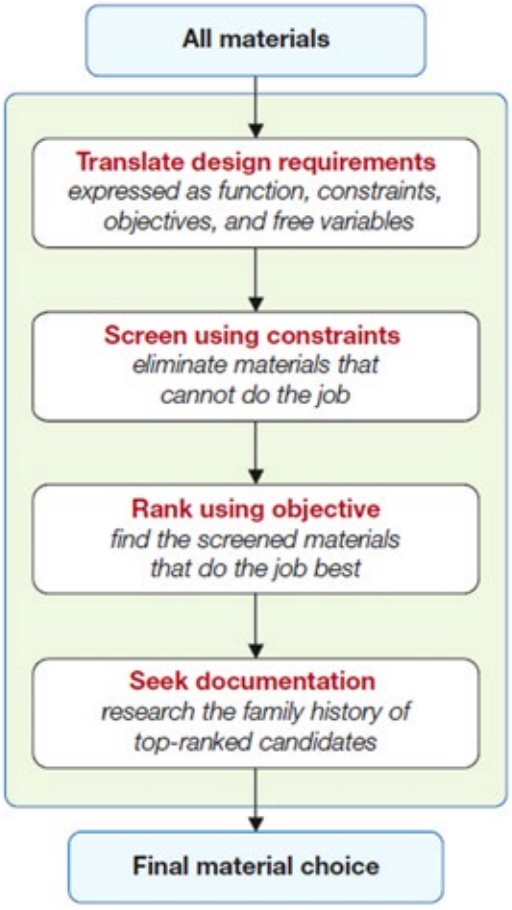
- defining the function of the material in the application,
- identifying hard (non-negotiable) and soft constraints,



Ashby, Shercliff, Cebon, *Materials – Engineering science, processing and design*, Elsevier **2014**

- selecting a clear objective to maximise or minimise (e.g. mass, cost, environmental impact),
- and determining the free variables available to the designer.

A key strength of the approach is its property-based selection, allowing materials to be compared independently of component size or geometry. Performance is visualised through log–log charts, making trade-offs explicit and supporting informed decision-making early in the design phase.



Environmental impact is fully integrated into the methodology. Rather than relying on full Life Cycle Assessments - which are time-consuming, costly and uncertain at early stages - the method uses a simplified eco-audit, focusing on key indicators such as CO_2-equivalent emissions and grey energy. This allows designers to compare materials, replace existing solutions, identify the best applications for new materials, or guide material development.

An important innovation is the integration of material lifetime into the selection process. Materials with longer service lives can outperform lighter or lower-impact alternatives over time, particularly when transport, replacement frequency and durability are considered. Case studies illustrate how transport distances or lifespan assumptions can significantly shift optimal material choices.

The presentation also highlights limitations. Regulatory standards may restrict design freedom, sometimes leaving little room for optimisation. Certain niche or qualitative material properties remain difficult to quantify within simplified frameworks.

This approach positions eco-selection as a practical design tool, not a retrospective assessment method. By embedding circularity, durability and environmental performance into material choice from the outset, it supports industrial innovation, resource efficiency and better circular construction outcomes.

AGNESE ATTANASIO, TECHNICAL PROJECT MANAGER, CETMA (CENTRO DI RICERCHE EUROPEO DI TECNOLOGIE DESIGN E MATERIALI), ITALY

ICLIMABUILT (H2020) – Developing, upscaling and testing innovations in building envelope materials and technical systems

Key words: *OITB, recycled materials, waste-based materials, modular components, advanced insulation, resource-efficient buildings*

ICLIMABUILT is designed to accelerate the development, testing and industrial uptake of innovative building envelope materials and systems. Coordinated by the National Technical University of Athens, the project brings together 27 partners across 13 European countries, positioning itself as a key European open innovation ecosystem for circular and energy-efficient construction.

At the heart of ICLIMABUILT lies an Open Innovation Test Bed (OITB), offering companies, including SMEs and start-ups, direct access to pilot lines, testing facilities, and expert support. Through a Single-Entry Point (SEP), industrial actors can validate, upscale and de-risk new materials and components, bridging the critical gap between laboratory research and industrial deployment.

A strong focus of the project is on circularity and the use of recycled and waste-based materials. One example is Pilot Line 6, dedicated to insulation components made from construction and demolition waste and recycled plastics. Innovative lightweight concrete and insulation solutions were developed, combined into modular components, and validated through real-scale demonstrations in different European climatic contexts. This approach confirms that recycled materials can meet structural, thermal, durability and fire performance requirements for building applications.

Beyond technology development, ICLIMABUILT actively supports market uptake. Eight innovative projects were selected through open calls and received tailored support for testing, upscaling and commercialisation. These projects illustrate how circular materials, advanced insulation, and energy-efficient envelope solutions can move towards real industrial applications.

Importantly, the ICLIMABUILT SEP will remain operational beyond the project's lifetime, ensuring long-term access to infrastructure, services and expertise for the construction sector. By combining technological innovation, industrial validation and regulatory support, ICLIMABUILT demonstrates how European collaboration can turn circular construction concepts into scalable, market-ready solutions.

The project stands as a concrete example of how circularity, performance and industrial competitiveness can be aligned to support Europe's transition towards low-carbon, resource-efficient buildings.

For more information, visit https://iclimabuilt.eu/

DAVID GARCIA-ESTEVEZ, SENIOR RESEARCHER ENERGY, CLIMATE AND URBAN TRANSITION, TECNALIA, BASQUE RESEARCH AND TECHNOLOGY ALLIANCE, SPAIN

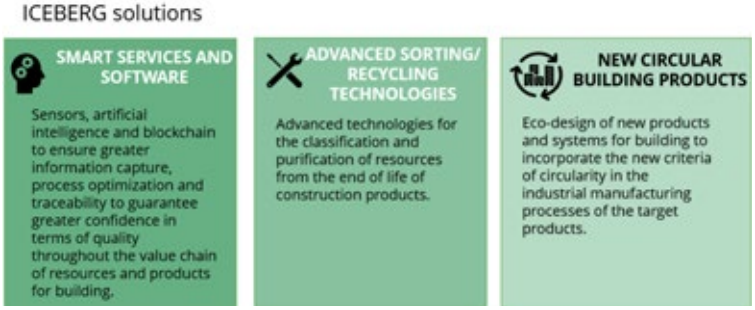
ICEBERG (H2020) – Circular economy-based solutions for EoL building materials

Key words: CDW, upgrade of EOL materials, reuse, advanced processing technologies, circular products

The ICEBERG project addresses one of Europe's most pressing circular economy challenges: construction and demolition waste (CDW), which represents nearly one third of all waste generated in the EU. While metals are efficiently recycled, most other building materials are still downcycled or landfilled, preventing their reuse at high value.

Funded under Horizon 2020 (€15.7 million), ICEBERG aims to recover, upgrade and reuse end-of-life building materials across six material streams: concrete, ceramics, wood, gypsum, foams and glass, with large-scale demonstrations in six European countries.

The project tackles both technical and non-technical barriers such as, lack of material traceability and quantification before demolition, low purity of recovered materials, fragmented regulations and low market acceptance of secondary raw materials, limited confidence in recycled products due to insufficient quality data.



ICEBERG combines digital tools, advanced processing technologies and new circular products:

- Smart digital services using sensors, AI and blockchain to ensure traceability, quality control and trust along the value chain
- BIM-based pre-demolition tools (BIM4DW) enabling accurate (>80%) material audits at low cost, supporting better demolition planning and circular business models
- Mobile automated sorting lines using hyperspectral imaging and machine learning to improve the separation of mixed CDW on-site
- Advanced recycling technologies, including thermal attrition, in-line quality monitoring and accelerated carbonation to upgrade recycled concrete and capture CO_2

The project demonstrates the production of market-ready circular construction products, such as, eco-hybrid cements and structural concretes with very high recycled content; carbon-stored precast elements reducing CO_2 emissions by more than 100 kg per ton of product, and multi-life gypsum boards incorporating recycled gypsum.

It paves the way for:

- Digital Product Passports (DPP) to increase market confidence
- Better matching supply and demand for secondary materials
- Replication across Europe, adapted to regional contexts
- Policy alignment to support circular construction at scale

By combining technology, digitalisation and industrial deployment, ICEBERG demonstrates how circular construction materials can move from pilot stage to industrial reality, contributing to Europe's climate goals, resource efficiency and industrial competitiveness.

For more information, visit https://iceberg-project.eu

LUC COURARD, PROFESSOR FACULTY OF APPLIED SCIENCES, URBAN AND ENVIRONMENTAL ENGINEERING, UNIVERSITY OF LIÈGE, BELGIUM

Recycled sands: problem or solution?

Key words: recycled sands, recycled fine aggregates, CDW, sand extraction, accelerated carbonation of mineral residues

The presentation addresses a critical and often underestimated question for the construction sector: is recycled sand a problem, or a solution? In the context of growing material demand, environmental constraints and pressure on natural resources, recycled fine aggregates emerge as a **strategic opportunity** rather than a limitation.

Globally, the construction sector faces increasing challenges linked to sand extraction, including ecosystem degradation, erosion of rivers and coastlines, and geopolitical dependency on sand imports. At the same time, CDW generates significant quantities of fine recycled materials, which are still underexploited compared to coarse aggregates.

Recycled sands can reach technical and regulatory compliance, provided that **proper processing** is applied. Key steps include controlled crushing methods, grading and washing to reduce fine content, shape and flakiness optimisation, and specific treatments adapted to the intended application.

When correctly processed, washed recycled sands meet regulatory requirements across several European countries and show stable and predictable behaviour in concrete and other building materials.

Comparative studies of natural and recycled sands show that fresh and hardened concrete properties can meet standard performance classes (e.g. C30/37), durability and mechanical performance are compatible with structural uses, and environmental impact is reduced through substitution of natural resources.

Beyond conventional concrete, recycled sands demonstrate **strong potential** in high value-added applications, including:

- prefabricated concrete elements (the CIBER project),
- 3D-printed concrete, enabling 100% recycled sand formulations combined with alternative binders (Interreg NEW CIRMAP),
- rammed concrete and earth-based construction, offering low-tech, low-maintenance and cost-effective solutions (the DUN^{3}ES FTJ project),
- compressed bricks and blocks, reusing ultra-fine particles from concrete recycling (the CARBOC project, Interreg FWV VALDEM).

Innovative approaches such as accelerated carbonation of mineral residues (e.g. municipal solid waste incineration bottom ash) further enhance the circular value of recycled fines. These processes enable CO_2 capture and storage within mineral matrices, production

of alternative aggregates, and contribution to climate mitigation alongside material recovery.

The core message is clear: recycled sands are not a secondary option, but a resource with multiple circular pathways, provided that “the right material is used in the right place.” With appropriate processing, quality control and design strategies, recycled fine aggregates can replace natural sands in a wide range of applications, from infrastructure to advanced construction technologies.

This work highlights how scientific validation, industrial processes and circular design together can transform an abundant waste stream into a cornerstone of a resilient, low-carbon and resource-efficient construction sector.

For more information, visit https://www.remind-wallonia.be/project/ciber/, https://www.ctp.be/en/projet/dun%c2%b3es/, https://www.remind-wallonia.be/project/carboc/, https://interreg5.interreg-fwvl.eu/fr/valdem#, INTERREG NEW CIRMAP Cirmap - CIrcular economy via customisable furniture with Recycled MAterials for public Places | Interreg NWE

DR. IR. SHIZHE ZHANG, R&D PROJECT MANAGER RENEWI MINERALZ & WATER, THE NETHERLANDS

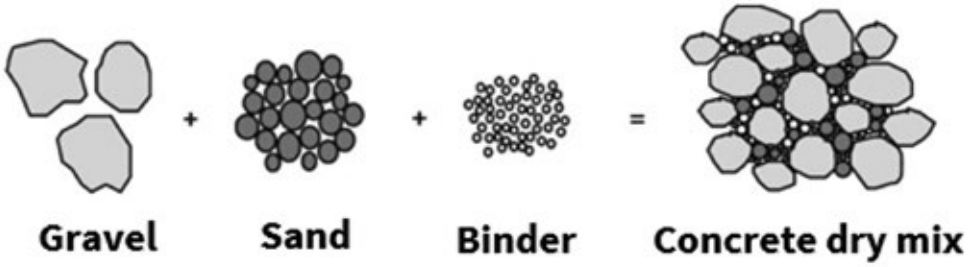
Smart reuse of secondary raw minerals in sustainable concrete - insights from particle packing model

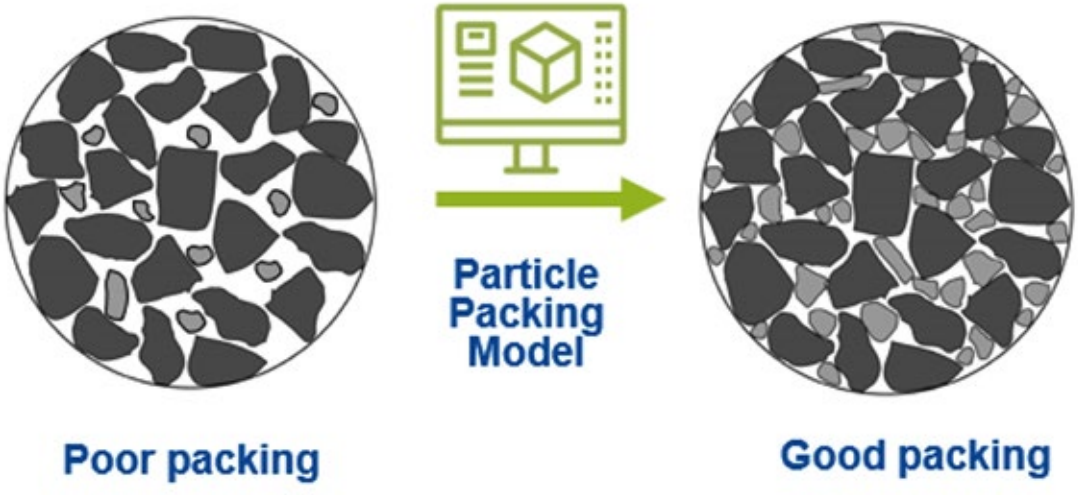
Key words: advanced processing, contaminated soils, concrete mix design optimisation, particle packing model, secondary mineral fillers

The presentation highlights how secondary raw minerals recovered from contaminated soils and tar-containing asphalt can be transformed into high-performance, low-carbon concrete, contributing to both circular economy objectives and industrial decarbonisation. It showcases how waste streams traditionally considered problematic can become valuable construction resources when supported by advanced processing, material science and industrial validation.

In countries like the Netherlands, several million tons of contaminated soil and tar-containing asphalt are treated every year. Through thermal remediation, these materials can be cleaned at high temperatures, removing organic pollutants and allowing their mineral fractions to be safely reused. The resulting secondary materials - such as FORZ® sand and filler - can replace natural aggregates and fillers in concrete applications.

A key innovation by RENEWI is the use of a **particle packing model** to optimise concrete mix design. By carefully controlling particle size distribution, it is possible to reduce





porosity and cement demand, maintain excellent workability, achieve high mechanical performance, and maximise the use of secondary raw minerals.

This approach allows designers and producers to tailor concrete formulations for different applications while improving resource efficiency.

Concrete mixes incorporating secondary sand and filler demonstrate comparable or improved fresh and mechanical properties relative to conventional solutions. At the same time, environmental assessments show a lower global warming potential and reduced environmental cost, excluding the cement fraction. Thermal treatment also enhances the reactivity of secondary minerals, making them competitive with conventional fillers.

The presentation underlines the importance of certification and standardisation to enable market acceptance. Voluntary certification schemes and contributions to evolving European standards help ensure traceability, quality and ease of use for industry. Looking ahead, secondary mineral fillers could evolve from non-structural uses toward structural applications and even cement constituents, in line with the shift toward performance-based standards.

The work demonstrates that collaboration across the entire concrete value chain, from waste processors to material scientists, producers and regulators, is essential to scale up circular solutions. By combining industrial processes, smart mix design and regulatory alignment, secondary raw minerals can play a central role in building a resilient, low-carbon and circular construction sector.

For more information, visit https://www.mineralz.com/producten-en-diensten/forz

SONIA SARACINO, PROJECT COORDINATOR CETMA (CENTRO DI RICERCHE EUROPEO DI TECNOLOGIE DESIGN E MATERIALI), ITALY

RE4.eu (H2020) – REuse and REcycling of CDW materials and structures in energy efficient pREfabricated elements for building REfurbishment and construction

Key words: reusable building components, prefabrication, CDW value chain, industrial validation, circular design, digital tools, replicability

The RE4.eu project demonstrates how CDW can be transformed into high-performance, reusable building components, contributing to both energy efficiency and circular construction.

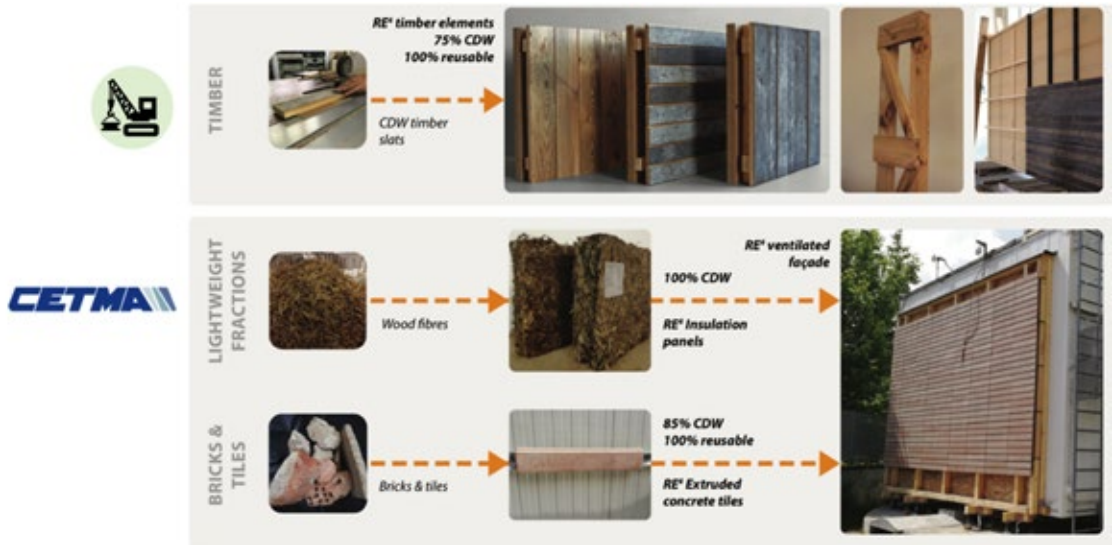
Coordinated by CETMA, the project focuses on the development of a fully prefabricated, energy-efficient building system designed for **easy assembly, disassembly and reuse**. The concept integrates concrete and timber components containing up to 65% CDW-derived materials by weight, proving that circular solutions can meet industrial, technical and performance requirements.

The entire CDW value chain is addressed, from waste identification to final building performance: source separation and collection of CDW, logistics and processing of waste streams, quality management and classification of recycled materials, manufacturing of CDW-based elements and components, digital tools supporting design for reuse and life-cycle management, and policy and framework conditions enabling market uptake.

This systemic approach ensures that recycled materials are not only reused but reused at the right quality level and in the right application.

The project validated its solutions through four pilot buildings across Europe, covering both new construction and refurbishment scenarios. Demonstrations showed that:

- CDW-derived materials can replace 50–85% of conventional materials in prefabricated components,



- construction time can be reduced by up to 40% thanks to off-site prefabrication,
- buildings can be designed for 100% reusability at end of life.

These pilots confirm that circular construction is not limited to laboratory conditions but can be deployed in real projects under different climatic and regulatory contexts.

RE4.eu shows that reuse and recycling of construction materials can be **industrialised**, provided that design, material quality, prefabrication and policy frameworks are aligned. By combining digital tools, prefabrication and circular design principles, the project offers a replicable model for reducing waste, extending material lifespans and accelerating Europe's transition towards resource-efficient, low-carbon buildings.

For more information, visit http://www.re4.eu/

SONIA SARACINO, SENIOR PROJECT MANAGER/RE4 PROJECT COORDINATOR, CETMA - CENTRO DI RICERCHE EUROPEO DI TECNOLOGIE DESIGN E MATERIALI, ITALY

http://www.cetma.it

Sonia Saracino is an Architect and Senior Project Manager at CETMA, specialising in fundraising and the management of European and national R&D projects supported by public funds. With extensive experience as a project coordinator, she oversees the entire project lifecycle—from proposal development to execution and closure—managing multidisciplinary teams and fostering strategic relationships with funding institutions, including the European Commission, Ministries, and Regional Authorities. Her technical expertise lies in advanced materials, sustainability, and circular economy in the construction sector.

Projects:

RE4 project - REuse and REcycling of CDW materials and structures in energy efficient pREfabricated elements for building REfurbishment and construction

SANTERI PARONEN, ARCHITECT AT SPOLIA DESIGN, FINLAND

Concrete circular economy solutions: from demolition to installation

Key words: industrialisation of reuse, factory-like reuse, operator-led reuse, value creation, circular construction economy

This presentation showcases how reuse of building components can move beyond bespoke, one-off projects to become a structured, scalable and market-ready circular solution. Through the work of Spolia Design Oy, based in Finland, it demonstrates how reuse can be integrated into construction value chains from demolition to installation.

Spolia Design specialises in reclaiming and reintroducing demolished building parts and materials, notably glulam timber beams and columns, but also concrete-based products such as turfstone. The company operates as a reuse operator, managing the entire process from selective disassembly, refurbishment and storage to resale and installation.

A central message of the presentation is that reuse only works when all stakeholders benefit. Successful reuse solutions must create **value simultaneously** for the owner of the donor building, the disassembly company, the reuse operator, the new construction project, public authorities, and the environment.

Finding these "win–win" situations requires early coordination, transparency on costs and timing, and clear responsibilities along the value chain.

Today, reuse often follows a project-specific process: unique batches of reclaimed materials are matched to a specific new construction project. While effective, this approach is complex and time-sensitive, involving multiple actors and making scheduling challenging.

Spolia's vision for the future is a **factory-like reuse** process. This model ensures constant production of selected reused building products; that materials are stored, maintained and quality-controlled by the reuse operator; that the buying process becomes closer to that of a new construction product; and uncertainty for designers and contractors is significantly reduced.

Dedicated storage and maintenance buildings play a key role in closing material loops, enabling reuse products to be available when needed rather than only when a matching demolition occurs.

Some real-world examples of the project include:

- refurbishment and reuse of glulam timber structures from donor buildings in Tampere,
- reintegration of reclaimed beams and columns into new buildings,
- development and sale of standardised reused products through the Spolia Store, an online marketplace.

Spolia Design demonstrates that reuse can be industrialised if processes are organised, responsibilities clarified and supply stabilised. By shifting from ad hoc reuse to a managed, operator-led model, reuse becomes more predictable, scalable and attractive for the construction market.

This approach positions reuse not as an exception, but as a normal, reliable and competitive option within a circular construction economy.

TANIA NOEL, ENVIRONMENTAL PSYCHOLOGY, UNIVERSITY OF LIÈGE

Psychosocial Barriers and Drivers to the Adoption of Recycled Materials

Key words: *circular innovations, human factor, adoption of circular practices, social acceptance*

Even when price, technical performance, availability and regulation are no longer real barriers, circular innovations in the construction sector often struggle to spread. This paradox highlights a critical but frequently underestimated dimension of the transition towards circular construction: the human factor.

Research in behavioural sciences shows that the adoption of circular practices is strongly influenced by perceptions, habits and social norms, rather than purely rational or technical considerations. Innovation uptake depends on how actors evaluate the behaviour, how much social pressure they perceive, and how easy they feel it is to implement change in practice. These elements largely determine whether circular solutions are seen as credible, desirable and feasible.

In the construction sector, decision-making is rarely individual. It is shaped by complex interactions between clients, designers, contractors, suppliers and public authorities. Even when circular solutions offer clear environmental benefits, their adoption may be slowed by uncertainty, lack of confidence, or fear of deviating from established practices.

Conversely, positive drivers such as image improvement, commercial opportunities, better tender scores and extended landfill lifetime can significantly outweigh perceived costs when properly communicated and recognised.

Studies on construction waste management and recycled materials consistently show that acceptance improves when stakeholders feel supported, when practices are perceived as normal within the sector, and when circular behaviour aligns with professional identity and expectations. In this sense, circularity is not only a technical challenge, but also a cultural and psychological transition.

Understanding these mechanisms is essential to accelerate the spread of innovation. Technical solutions must be accompanied by clear narratives, trust-building measures, peer examples and enabling frameworks that reduce perceived risk and complexity. Addressing the human dimension helps explain why some innovations succeed while others stall, despite comparable technical performance.

Ultimately, advancing circular construction requires more than better materials or processes. It calls for changing mindsets, routines and collective norms, ensuring that circular solutions are not only technically sound, but also socially accepted and widely adopted across the value chain.

TANIA NOEL, POSTDOCTORAL RESEARCHER IN SOCIAL AND ENVIRONMENTAL PSYCHOLOGY, UNIVERSITY OF LIÈGE - PSYNCOG RESEARCH UNIT, WALLONIA, BELGIUM

https://www.psyncog.uliege.be/cms/c_4267499/fr/psychology-neuroscience-of-cognition?id=c_4267499

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Tania Noël holds a PhD in social and environmental psychology. Her work has an interdisciplinary and applied approach, bridging research and field application. She explores how various psycho-socio-environmental factors shape attitudes, behaviors, and emotions, influencing interactions between individuals and their physical and social environments. Through her research at the University of Liège (Psychology and Neuroscience of Cognition Research Unit - PsyNCog) and later postdoctoral positions at the University of Applied Sciences Potsdam (Institute for Applied Research – Urban Futures) and the Université libre de Bruxelles (Centre d'Études Économiques et Sociales de l'Environnement - CEESE), she collaborates with experts and professionals from various disciplines on projects aimed at developing evidence-based solutions to real-world challenges.

JOHN WANTE, ADVISOR ON CIRCULAR ECONOMY POLICY, PUBLIC SERVICE OF FLANDERS FOR WASTE, MATERIALS, AND SOIL POLICY (OVAM), BELGIUM

Strategies to Foster Greater Social Acceptance

Key words: social acceptance, regulatory clarity, economic incentives, innovation networking, R&D funding, accessible implementation

The transition towards circular construction is not only a technical or regulatory challenge; it is also a matter of social acceptance. Circular economy policies can only deliver their full potential if they are understood, trusted and supported by the actors expected to implement them. Experience shows that acceptance grows when circularity is embedded into clear rules, economic signals, practical tools and collaborative ecosystems.

A first key lever is the establishment of a robust and coherent regulatory framework. Requirements for separate collection and recycling, clear EOW criteria for building materials, certification schemes and obligations related to asbestos removal all contribute to building confidence in circular practices. Regulatory clarity on circular design requirements further helps designers and contractors integrate circularity from the outset, reducing uncertainty and perceived risk.

Regulation alone, however, is not sufficient. Economic incentives play a decisive role in shifting behaviours. Landfill and incineration taxes, combined with targeted subsidies and support schemes, can rebalance the cost structure in favour of reuse, recycling and detoxification of material cycles. Public procurement is another powerful driver, creating stable demand for circular solutions in demolition, renovation and new construction. Extended Producer Responsibility schemes can also help finance separate collection, recycling and prevention, while addressing hazardous substances such as asbestos.

Social acceptance is further strengthened through awareness-raising and networking. Innovation networks dedicated to circular construction allow stakeholders to exchange experiences, align practices and build trust. Communicating good practices and success stories helps normalise circular solutions and demonstrate their feasibility. At the same time, aligning agendas across different government departments ensures that circular economy objectives are consistently supported by housing, infrastructure, environment and industrial policies.

Investment in research and demonstration is another cornerstone. Funding research on circular construction and developing living labs as real-world demonstration projects enables solutions to be tested at scale, under real conditions. These pilots play a crucial role in reducing uncertainty, proving performance and accelerating market uptake.

Finally, circular policies gain acceptance when they are supported by user-friendly systems and tools. Designers and project developers need accessible tools to measure the environmental impact of design choices, standard terms of reference for circular construction, reliable information on toxic substances, and efficient collection and logistics systems. Making circularity easier to implement in daily practice is often the most effective way to change behaviour.

Taken together, these elements show that social acceptance of circular construction policies is built through a combination of regulation, incentives, knowledge, collaboration and practical support. When these levers are aligned, circular economy principles move from policy ambition to normal practice across the construction value chain.

ALINE VERGAUWEN, ENERGY & SUSTAINABLE SOLUTIONS DEPARTMENT, BUILDWISE, BELGIAN INNOVATION CENTER IN THE CONSTRUCTION

«Living Lab Circulair Beton» in Flanders: Solutions to Overcome Technical and Non-Technical Barriers to the Adoption of Circular Concrete

Key words: circular solutions, adoption blockage, limited demand, limited supply, lack of trust, systemic approach, collective approach, widespread market adoption

Circular concrete solutions are technically feasible and already proven in real construction projects. Over the past two decades, recycled aggregates, blended cements and alternative binders have been successfully used in in-situ concrete, architectural exposed concrete and infrastructure elements, achieving CO_2 reductions of up to 70%. Yet despite these achievements, circular concrete remains far from mainstream adoption.

The main obstacles are not technical. They are systemic. Decision-making in construction is still dominated by short-term financial considerations, with limited room for innovation perceived as “non-standard”. Risk aversion remains high across the value chain, especially when solutions are not covered by familiar certification schemes such as BENOR. For many actors, the absence of a recognised label is enough to block adoption, regardless of proven performance.

At the same time, demand remains limited. Building owners and users often lack a sense of urgency, prioritising planning certainty and budget control over long-term environmental performance. Circular solutions are frequently seen as “interesting ideas”, but postponed in favour of more immediate constraints. On the supply side, producers and concrete plants are reluctant to adapt installations for single projects, making it difficult to scale circular solutions beyond pilot cases.

A lack of trust within the value network further reinforces this deadlock. Engineers hesitate to specify unfamiliar materials, contractors question liability, and producers struggle to convince clients without clear, collective validation mechanisms. As a result, circular concrete solutions face the same barriers as many other innovative products in construction: limited demand, limited supply, and fragmented responsibility.

Overcoming these barriers requires a systemic approach. Information must be tailored to each stakeholder, focusing on their specific role in decision-making rather than on generic sustainability arguments. Upscaling also depends on collective ambition at sector level, supported by knowledge-sharing and networking that involve all actors, from producers and designers to clients and authorities.

ALINE VERGAUWEN, R&D EXPERT, BUILDWISE, BELGIUM

https://www.buildwise.be/fr/

Actively contributing to the transition toward a sustainable and circular construction sector, Aline dedicates herself to this every day with great enthusiasm at Buildwise. Through research, innovation, and knowledge sharing, she supports construction professionals in applying sustainable and circular principles in practice.

Projects:

- Proeftuin Circulair Bouwen
- Living Lab Circulair Beton
- Living Lab Brug
- Living Lab Sloopteams

Collective instruments play a crucial role. Research and testing must feed directly into the normative framework, enabling certification and labelling of innovative solutions. Support structures such as innovation desks, pilot projects and testing facilities help reduce perceived risk, build confidence and accelerate learning across the sector.

Ultimately, the transition to circular concrete is not a question of inventing new technologies, but of aligning systems. Practical support, ecosystem thinking, trust-building and adaptation of existing institutions are essential to move from pioneering projects to widespread market adoption. When these conditions are met, circular concrete can become not an exception, but a normal, competitive and reliable solution for the construction industry.

JEAN-FRANÇOIS NIVART, FACULTY OF APPLIED SCIENCES, MINERAL GEO-RESOURCES & GEOLOGICAL IMAGING, URBAN AND ENVIRONMENTAL ENGINEERING, UNIVERSITY OF LIÈGE

UniGR-CIRKLA: Building an Industrial Circular Economy for Materials and Metals in Europe

Key words: *scalable circular value chains, circular business model, cross-border industrial cooperation, industrial resilience, skills*

The UniGR-CIRKLA project positions the Greater Region as a strategic industrial hub for the circular economy of materials and metals. Co-funded by Interreg Greater Region, this four-year initiative brings together universities, research centres, public authorities and industrial partners from Wallonia, Lorraine, Luxembourg, Rhineland-Palatinate and Saarland to move from linear resource use to scalable circular value chains.

At its core, UniGR-CIRKLA addresses a major industrial challenge: how to protect the value of materials while responding to increasing demand, resource scarcity, energy constraints and environmental pressure. The project focuses on keeping materials in use for as long as possible through better design, repair, reuse, dismantling and recycling, while ensuring that virgin and recycled materials are used for the right applications.

For industry, the added value lies in practical outcomes. UniGR-CIRKLA supports the development of robust circular business models, improved recycling and processing technologies, and smarter logistics for end-of-life materials. It works on intelligent mapping of material flows and regional resources, helping companies better secure supply chains, reduce dependency on primary raw materials and anticipate future regulatory constraints.

The project also strengthens cross-border industrial cooperation. By connecting regions with complementary resources and know-how, UniGR-CIRKLA facilitates industrial symbioses, shared infrastructures and joint innovation projects. Construction, metals, demolition, recycling, logistics and processing industries are directly involved alongside clusters and innovation platforms.

Beyond technology, UniGR-CIRKLA invests in skills and decision-making. Executive training for professionals, targeted workshops, applied research projects and access to shared databases support companies in integrating circular strategies into their operations. The ambition is clear: enable faster industrial uptake of circular solutions and turn regional ecosystems into competitive advantages at European level.

UniGR-CIRKLA demonstrates how circular economy is not only an environmental necessity, but also a lever for industrial resilience, regional autonomy and long-term competitiveness. By combining innovation, territory and industry, the project contributes to making the Greater Region a reference for circular materials in Europe.

Collective instruments play a crucial role. Research and testing must feed directly into the normative framework, enabling certification

LIONEL BONJEAN – DIRECTOR GENERAL OF SPW ECONOMY, EMPLOYMENT AND RESEARCH (SPW EER)

Supporting Innovation from Regional to European Level: Perspectives from the Walloon Administration

This contribution offers a policy-oriented perspective on how public authorities, industry and research can work together to turn innovation into tangible industrial impact, at regional and European levels.

Lionle Bonjean focuses on the future of public support for innovation, highlighting how Wallonia aligns its regional priorities with European frameworks, notably through the Smart Specialisation Strategy (S3) and EU research and innovation instruments. From the administration's standpoint, creating favourable conditions for innovation means ensuring policy coherence, long-term visibility and strong coordination between regional and European funding mechanisms.

A key message is how companies and innovation actors can maximise their chances of success. Experience shows that projects most likely to reach industrial deployment are those that combine:

- a clear industrial ambition and market perspective,
- strong collaboration between industry, research and public actors,
- early integration of regulatory, environmental and scalability considerations,
- and alignment with regional and European strategic priorities.

Successful innovation projects are not only technologically sound; they are embedded in robust ecosystems, capable of mobilising the right partners, financing instruments and skills at the right time.

Lionel Bonjean also addresses the strategic role of materials, and particularly mineral resources, in current and future innovation projects. As construction and industry face increasing pressure to decarbonise and secure supply chains, mineral materials emerge as key levers for circularity, resilience and industrial sovereignty. The Region sees strong potential in projects that link materials innovation with circular economy, low-carbon processes and industrial scalability.

Looking ahead, Wallonia aims to reinforce its position as a testing ground for industrial innovation, where regional strengths in materials, construction and process industries can be connected to European value chains. Supporting such projects requires not only funding, but also strategic guidance, ecosystem coordination and a clear pathway from innovation to market.

LIST OF ABBREVIATIONS

DPP – Digital Product Passport

EoW – End-of-Waste

C&DW – Construction & Demolition Waste

EC – European Commission

BIM – Building Information Modelling

CPR – Construction Product Regulation

CE – Conformité Européenne

ESPR - Ecodesign for Sustainable Products Regulation

HE – Horizon Europe project

H2020 – Horizon 2020 project

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