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Creating materials banks  
from digital urban mining

# D1.2 Report on regulatory framework

VERSION [1.0]

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Creating materials banks from digital urban mining

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## **EXECUTIVE SUMMARY**

This study presents a review of the requirements of the legal framework for **secondary materials, components and products to retain or to obtain the product status**. The specific research objectives are (i) to present the bottlenecks for the recovery of construction products and materials for second life use and recycling in the EU regulatory framework, as well as the legal framework for secondary materials, components and products to retain or to obtain the product status, (ii) to present the local policies and legal procedures supporting and promoting circularity of buildings in countries where the demo cases take place, also highlighting the best practices for overcoming legislative bottlenecks, and (iii) generating policy recommendations related to the recovery of construction products and materials for second life use and recycling at EU and regional level.

Data collection was implemented through literature studies, expert interviews and a survey.

- Mapping of key policies and regulations of relevance for the construction sector was done by literature survey.
- The local best practices for overcoming legislative barriers and promoting circularity were divided into three parts: first, a literature review of the local policies was conducted, followed by the generation of an outline for the stakeholder engagement, which was then further refined into an interview outline and an online survey.
- Supported by literature, the outcomes of the studies on EU regulation and the local best practices were used to find the solutions to overcome identified barriers and identify potential policy gaps that need to be addressed.

### **EU Legislation**

The key EU legislative documents include regulations and directives and policy/strategy documents. There are numerous policies and pieces of legislation related to the construction sector along the lifecycle of buildings. While regulations and directives have binding legal force, the policies and strategies are non-binding but indicate the ambitions and goals that may later be implemented in legislation. Thus, knowledge and follow-up on the policies are important for understanding the upcoming legislation and future priorities in the sector.

In general, in the construction sector, the EU legislation focuses on the following sustainability goals that are covered by several EU regulations:

- resource efficiency
- climate aspects
- hazardous substances (related to toxicity and biodiversity)

The identified key bottlenecks with a significant legislative impact were related to such as supply and demand, which is a traditional chicken-egg problem, where both parties are interested in increasing reuse and recycling but in the absence of a systemic change, specifically reuse remains marginal. Lack of guidance on acceptability procedures for circular products, mandatory requirements for predemolition auditing, selective demolition, tools for quality testing, environmental and technical criteria, standards and uncertainties in CE-marking for circular products further prevents supply and demand from meeting. In addition, high costs related to circular solutions combined with lack of data, knowledge, experience and skills prevents further uptake of circular solutions in the construction industry.

### **Local policies**

Norway promotes circular construction through a mix of legal, economic, technical, and informational measures. Building regulations in force require buildings to be designed to minimize waste throughout their lifespan, choosing products suitable for reuse and material recycling as well as facilitating design for future deconstruction within practical and economic limits. In line with the EU Waste Framework Directive, Norway mandates waste management plans and requires recycling or reuse quotes for CDW. Economic instruments are key for

supporting circularity in Norway, particularly through Green Public Procurement (GPP), which incentivizes reuse by prioritizing circularity in public tenders supported by online platforms. Technical support to circular construction is provided by guidelines for material mapping before demolition and for promoting the design of buildings for disassembly and the digital tracking of materials. Different platforms operate marketplaces for reused/recycled materials. Meanwhile, sustainability certification systems have been adapted to award reuse and recycling in design or rehabilitation of construction. The use of Building information modeling (BIM) and digital databases in connection with circular construction practices is still an exception in Norway. Norwegian startups provide online registry for materials and products and enable the creation of material passports based on user-provided BIM models.

The Netherlands has established a comprehensive policy framework to promote circular construction, positioning itself as a European frontrunner in sustainability. Key instruments include the National Circular Economy Programme and the sector-specific Transition Agenda for Construction, which emphasize lifecycle thinking, urban mining, and circular procurement. Regulatory frameworks provide technical guidance, while procurement legislation and Green Deal initiatives foster public-private collaboration. Non-legislative tools like Madaster and Het Nieuwe Normaal enhance traceability and standardization. Despite this progress, challenges persist in regulatory enforcement and harmonization with EU-level directives, pointing to the need for continued policy innovation and integration across governance levels.

Spain's circular economy policies in the construction sector are primarily governed by Law 7/2022 on waste and contaminated soils, which aims to reduce environmental impact and promote resource efficiency. This law introduces the concept of end-of-waste (EoW) status, allowing certain materials to cease being classified as waste when they meet specific criteria: intended use, existing market demand, compliance with technical standards, and no adverse environmental or health impacts. However, the practical application of EoW status remains limited, with only a few materials having received official EoW recognition. The national strategy, España Circular 2030, further supports these initiatives by setting targets to reduce resource consumption and waste generation, thereby fostering a more sustainable construction industry. Circularity is mainly promoted through mandatory CDW recovery targets. GPP also encourages the use of recycled products. At regional level, several Spanish autonomous communities, like Basque Country and Catalonia, have developed specific instruments to facilitate the valorisation of materials like recycled aggregates and steel slags, and to promote circularity in buildings. These include selective deconstruction guidelines, dedicated funding calls, collaboration platforms and digital tools to track material flows.

### **Policy recommendations**

Based on the findings of this study, the SUM4Re project presents six policy recommendations for enhancing circularity of construction products as follows:

#### **Legal instruments**

1. Harmonising rules for categorisation of products and waste

#### **Technical instruments**

2. Methods for performance assessment and quality
3. Design for disassembly and reuse

#### **Information instruments**

4. Development of digital competences

#### **Economic instruments**

5. Circular public procurement practises
6. Economic policy instruments

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## 1. Introduction

Construction and demolition waste (CDW) represent the largest waste stream in the EU in terms of mass and the generation of CDW is rising (EEA 2020<sup>1</sup>). In 2022, the total amount of CDW generated in EU27 was 330 Mt (excluding excavated soil) (Eurostat 2025<sup>2</sup>). In EU, the recovery rate of CDW is high but the waste is mainly used in low-grade applications like earth construction.

SUM4Re aims to support uptake of recovered materials and reusable construction products in buildings by a reduction in CDW generation and an increase in the supply of secondary materials. SUM4Re is demonstrated through to 3 case studies in three European regions (i.e. Basque country, the Netherlands and Svalbard, Norway), each with its own specific operational and regulatory boundaries.

### 1.1. Goal, scope and focus

The aim of this study is to analyse boundaries for the use of deconstructed products from a regulatory perspective. This study focuses on reviewing the requirements of the legal framework for **secondary materials, components and products to retain or to obtain the product status**. The overall goal of this study is to bring up policy gaps and potential solutions that could support uptake of recovered materials and reusable construction products in buildings. This information will be used in task 8.3, where policy recommendations are formulated. The focus is especially on the construction products recovered in the pilots.

Research objectives:

- a) to present the bottlenecks for the recovery of construction products and materials for second life use and recycling in the EU regulatory framework, as well as the legal framework for secondary materials, components and products to retain or to obtain the product status. (Section 2)
- b) Present the local policies and legal procedures supporting and promoting circularity of buildings in countries where the demo cases take place. Highlighting the best practices for overcoming legislative bottlenecks. (Section 3)
- c) Identification of legislative barriers and generating policy recommendations related to the recovery of construction products and materials for second life use and recycling at EU and regional level. (Section 4)

SUM4Re focuses on 5 material categories: asphalt, structural steel, reinforced concrete, timber, and concrete, which will be considered in this report. In addition to the SUM4Re materials, we have identified products that are of specific interest for the demo cases, presented in Table 1.

**Table 1. Pilot cases in SUM4Re – key constructions products to be recovered and their circularity strategies**

Pilot case	Products	Circularity strategy
	1) Steel beams	Reused from industrial buildings as structural frames in new developments

<sup>1</sup> EEA, 2020. Construction and demolition waste: challenges and opportunities in a circular economy. Briefing. <https://www.eea.europa.eu/publications/construction-and-demolition-waste-challenges>

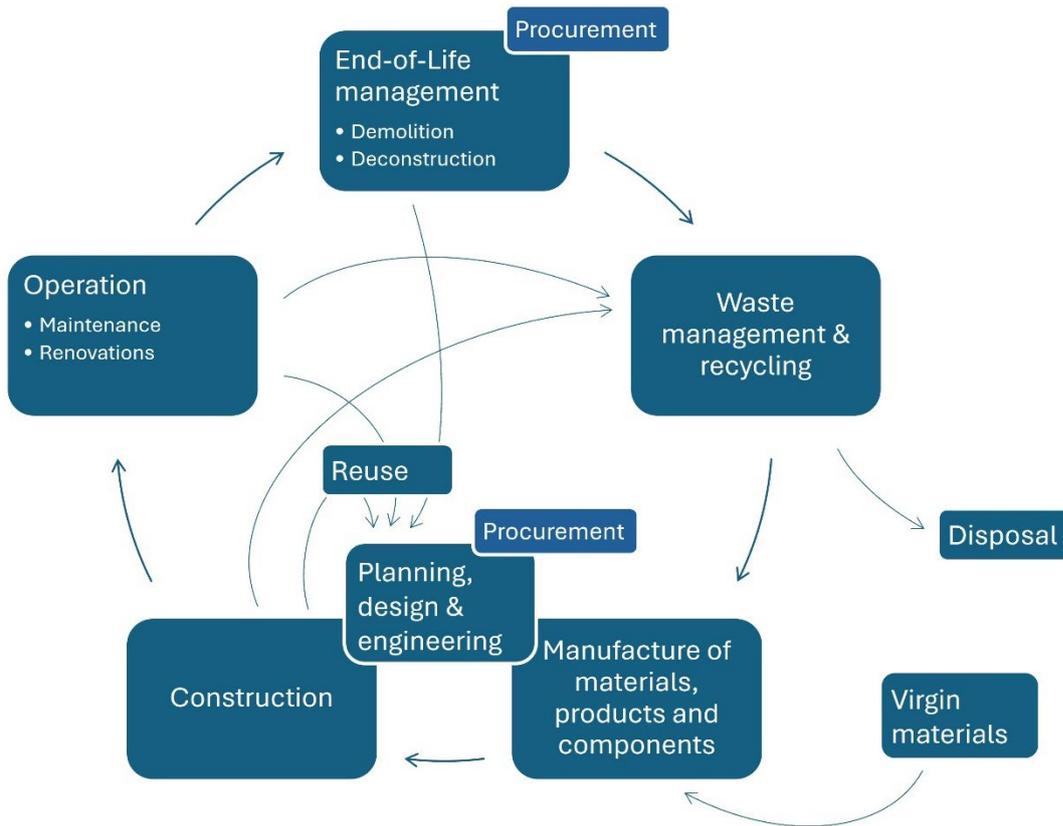
<sup>2</sup> Eurostat. 2025. Generation of waste by waste category, hazardousness and NACE Rev. 2 activity [env\_wasgen]. Including waste categories W061, W062, W063, W071, W072, W074, W075, W077, and W121, generated by the Statistical classification of economic activities in the European Community (NACE) Rev. 2 Section F (construction sector).

<b>Netherlands, The Binkhorst pilot</b>	2) Wooden beams / Cross-Laminated Timber (CLT)	Salvaged from floors/roofs and reused in modular or interior construction
	3) Doors	Removed whole from donor buildings and reinstalled directly
	4) Windows & frames	Carefully dismantled and reused if insulation values still meet standards
	5) Staircases	Modular stairs dismantled and adapted for reuse
	6) Bricks (whole, cleaned)	Used for new façades, landscape walls or paving
	7) Paving stones	Reused in new streetscapes, parks, or semi-public spaces
	<b>Norwegian pilot</b>	1) Structural timber and Glulam (Glued laminated timber)
2) Chipboard (Particle board)		Cumbersome dismantling with high degree of damages. In practice low potential of salvaging.
3) Exterior and interior wood cladding		Exterior cladding easy to dismantle, but short lengths lowers the reusability potential. Interior cladding with low circularity potential due to short lengths and damages. Reuse as chips.
4) Parquet and laminate flooring		Flooring with some potential for salvaging and reuse. Easy to dismantle without damages.
5) Mineral wool (insulation based on stone or glass)		Insulation may be reused unless damp, but the required labour cost is high compared to cost of new product. New product is light and require little energy to transport.
6) Plastic (vapor barrier)		No reusability potential as film. Recycle.
7) Gypsum boards (Drywall)		Difficult to dismantle without severe damage. Little potential for reuse, however it is a heavy product with high embodied energy.
8) Wood fiberboard (Soft and Hard/MDF)		Depending on the original use challenges to dismantle without damage. Probably downcycled and conveyed as chips.
9) Steel (Rebars, profiles and brackets)		H- and I-beams with huge potential of direct reuse. Else less potential other than recycling.
10) Concrete (slabs, screed, and columns/beams)		There are no slabs as decks or walls in the pilot, but minor slabs may be found. The potential for reuse of these are low. Crushing and reuse as fill may be an option if the toxic control is sufficient.

	11) Windows	Windows high reusability as original product in Svalbard and in the arctic. Marked price much higher than the mainland, and cost and eCO2 associated with transport is high. Challenges with increased energy use in buildings with old windows due to polluting energy mix on Svalbard.
	12) Doors	As for windows.
	13) Complete modules	Reusing the whole modules is by far the most promising type of reuse on Svalbard and the arctics due to the associated conservation of embedded eCO2 from manufacturing and transport of the module from mainland. The module may require repair (moisture barrier and deformations), but this may be a done locally in combination with increased insulation (internally or externally).
<b>Spanish Pilot</b>	1) Sorted recycled aggregates, including fractions of concrete, ceramics, asphalt and others.	<p>Concrete recycling is the most established, with crushed concrete being used primarily in non-structural applications such as road sub-bases, backfilling, and drainage layers.</p> <p>Mixed CDW recycled aggregates (containing concrete, ceramics, and other materials) are typically used for lower-grade applications like temporary roads and land restoration.</p> <p>Asphalt recycling has gained traction, with reclaimed asphalt pavement (RAP) being incorporated into new asphalt mixes, though often at relatively low percentages (10-30%).</p> <p>Basque Country has been more progressive in CDW management compared to the national average. The Basque Government has implemented several initiatives to promote the use of recycled aggregates through its environmental framework programs.</p>
	2) Re-used steel beam (structural element)	Most common practice is recycling steel for remelting. Some companies are attempting steel reuse in exceptional industrial construction, temporary structures, and some specialized architectural projects with sustainability focus.

### 1.1.1. Value chain for circular buildings

In a circular economy, raw materials must remain in the economy for as long as possible in a closed loop. This requires rethinking of value chains and business models. To close the loop, it is important to focus on the whole value chain, some of these phases are keys to waste prevention and keeping the materials in use for as long as possible, while others are necessary when the constructions have met end-of-life and must be reused or recovered. Figure 1 presents a simplified material value chain for circular buildings, where the removal of materials through disposal and the addition of virgin materials must be minimized.



**Figure 1. The value chain for circular buildings**

- **Manufacturing materials, products, and components** using secondary raw materials presents significant potential for reducing the use of virgin materials. Durability and absence of hazardous substances enhance longevity and potential for reuse.
- **Planning, design, and engineering** are crucial in promoting sustainable material usage, easy maintenance, adaptable intended uses, and extended life spans. Material selections should prioritize secondary raw materials, alongside renewable and recyclable options. Planning should aim for flexible, upgradeable, repairable, and adaptable structures, ensuring optimal performance throughout various stages of use. The ability to accommodate changes in demand is fundamental to extending construction life spans, thereby retaining materials within the cycle longer.
- **The construction phase** is critical when addressing material efficiency. Construction sites should minimize waste generation, implementing take-back solutions for surplus materials and collecting leftover materials can facilitate reuse of building materials. Employing tools such as Building Information Management (BIM) and digital product passports (DPP) can streamline the subsequent life stages of the building.
- **The operational phase** should be optimized and extended where feasible. Maximizing the use intensity of buildings can prevent the need for building additional buildings for these activities. Increased use intensity involves flexible functionality for various users at different times of the day. Extending a building's lifespan also prolongs materials utilisation. Rehabilitation, repairs, as well as strengthening and retrofitting structures, contribute to achieving longer life spans. BIM and DPPs should be updated during maintenance to enhance the building's lifespan.
- **The end-of-life phase** determines the fate of building components and materials, buildings can be deconstructed for product and component reuse or demolished for salvaging recyclable materials. Deconstruction and selective demolition with efficient site sorting prepare materials for reuse and recycling and enhances recovery and

recycling of waste, while tracing systems further contribute to quality assessment and certification of CDW streams, increasing the material value of the waste.

- **The waste management and recycling phase** prepares materials for use in the production of new products and components. Recycling efficiency is very much depending on the quality of the feedstock, where barriers for recycling include contaminants of both foreign and hazardous materials. Buildings and constructions being demolished today often contain problematic substances used in previous periods, such as PCB, asbestos, and lead, and lack circular design principles and methods. Therefore, demolition practices, including pre-demolition audits, resource inventories, and hazardous material removal prior to selective demolition, are key to maximizing material value and recyclability of waste generated from demolition. The EU Construction and Demolition Waste Management Protocol offers good practices for demolition works.

## 1.2. Background

### 1.2.1. Current status

The Joint Research Centre have conducted numerous studies<sup>34</sup> on the techno-economic potential for increasing the recycling rate of construction and demolition waste. These studies can provide the background for setting recovery targets in EU legislation. Currently a JRC study is ongoing (2024-25) on the possibilities to set End-of-Waste criteria for mineral fraction from construction and demolition waste.

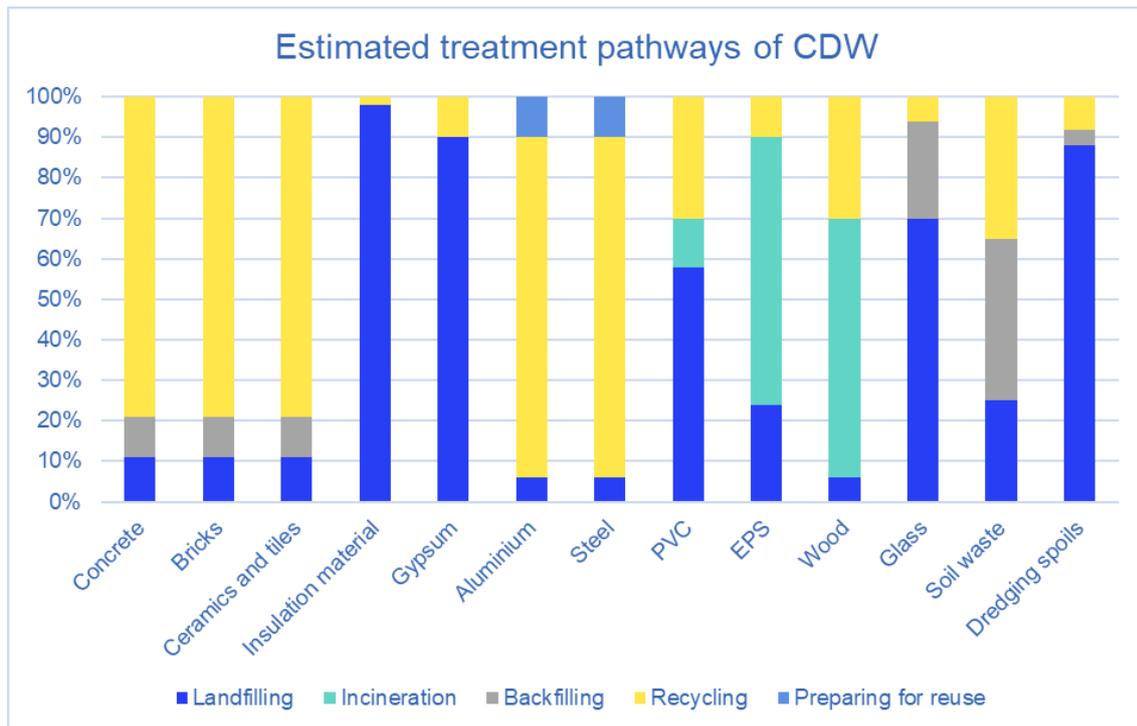
There is a lack of statistical data on reuse of different products as Eurostat does not publish data on reuse, only recycled or recovered amounts. In literature (Garcia, 2024<sup>5</sup>) has estimated the reuse rate as low (see Figure 2).

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<sup>3</sup> Damgaard, A., Lodato, C., Butera, S., Fruergaard, A. T., Kamps, M., Corbin, L., Tonini, D., & Astrup, T. F. (2022). Background data collection and life cycle assessment for construction and demolition waste (CDW) management. <https://doi.org/10.2760/772724>

<sup>4</sup> Caro, D., Lodato, C., Damgaard, A., Cristóbal, C., Foster, G., Flachenecker, F., Tonini, D. 2024. Environmental and socio-economic effects of construction and demolition waste recycling in the European Union, Science of the Total Environment 908 (2024) 168295 <https://doi.org/10.1016/j.scitotenv.2023.168295>

<sup>5</sup> Techno-economic and environmental assessment of construction and demolition waste management in the European Union, <https://publications.jrc.ec.europa.eu/repository/handle/JRC135470>



**Figure 2. Estimated treatment pathways of CDW (source: Garcia et al., 20246)**

1.2.2. What do we know from previous studies?

There has been several studies on the topic of the policy framework, local strategies, tools and guidelines related to circular construction. For additional information, the following projects (Table 2) are identified as being relevant to SUM4Re. The list is not exhaustive.

**Table 2. Relevant EU projects and studies for SUM4Re**

Project short name	Full name	Link to webpage	Link to SUM4Re
<b>CIRCuiT (2019-2023)</b>	Circular Construction in Regenerative Cities	<a href="https://www.circuit-project.eu/">https://www.circuit-project.eu/</a>	Contains policies/instruments
<b>CITYLOOPS (2019-2023)</b>	Closing the loop for urban material flows	<a href="https://cityloops.eu/">https://cityloops.eu/</a>	Handbooks, procurement tools Material banks, digital market places Updated version of EU waste audit protocol
<b>FCRBE (2018-2023)</b>	Facilitating the circulation of reclaimed building elements in Northwestern Europe	<a href="https://vb.nweurope.eu/projects/project-search/fcrbe-facilitating-the-circulation-of-reclaimed-building-elements-in-northwestern-europe/">https://vb.nweurope.eu/projects/project-search/fcrbe-facilitating-the-circulation-of-reclaimed-building-elements-in-northwestern-europe/</a>	Reuse aspects, interpretation of product status
<b>ReCreate (2021-2025)</b>	A concrete transition towards circular construction	<a href="https://recreate-project.eu/">https://recreate-project.eu/</a>	Deconstruction guidance document, product status
<b>Reincarnate (2022-2026)</b>	Repurposing construction	<a href="https://www.reincarnate-project.eu/project/">https://www.reincarnate-project.eu/project/</a>	Tools for understanding the potential to extend the lifetime of a building,

<sup>6</sup> Cristóbal García, J., Caro, D., Foster, G., Pristerà, G., Gallo, F., Tonini, D. Techno-economic and environmental assessment of construction and demolition waste management in the European Union, Publications Office of the European Union, Luxembourg, 2024, doi:10.2760/721895, JRC135470

	materials towards a circular industry		its building components, and materials, and to find optimal reuse possibilities for each of its elements.
<b>EU PROGRESS</b>	Provisions for greater reuse of steel structures	<a href="https://projectsites.vtt.fi/sites/progress/">https://projectsites.vtt.fi/sites/progress/</a>	Focus on steel, tools for supporting reuse
<b>RE4 (2016-2020)</b>	REuse and REcycling of CDW materials and structures in energy efficient pREfabricated elements for building	<a href="http://www.re4.eu/">http://www.re4.eu/</a>	Focus on reusable structures and prefabricated elements.
<b>EU ICEBERG (2020-2024)</b>	Innovative Circular Economy Based solutions demonstrating the Efficient recovery of valuable material Resources from the Generation of representative End-of-Life building materials	<a href="https://iceberg-project.eu/">https://iceberg-project.eu/</a>	Regulations, tools fostering recycling of construction products with recycled content, policy recommendations for uptake of construction products with recycled content
<b>RECONSTRUCT</b>	Reconstruct	<a href="https://reconstruct-project.eu/">https://reconstruct-project.eu/</a>	Sorting, recycled content in concrete, cases
<b>CIRC-BOOST</b>	Boosting the uptake of circular integrated solutions in construction value chains	<a href="https://circboostproject.eu/">https://circboostproject.eu/</a>	Scaling circular solutions in buildings and the construction sector through five pilot projects – handbooks, protocols
<b>4RinEU</b>	Robust and Reliable technology concepts and business models for triggering deep Renovation of Residential buildings in EU	<a href="http://www.4rineu.eu/index.html">http://www.4rineu.eu/index.html</a>	Guidelines and technology concepts for managing building end of life
<b>Demo-Blog</b>	Digital building logbooks for transparent and accessible data	<a href="https://demo-blog.eu/">https://demo-blog.eu/</a>	Developing Digital Buildings Logbooks for capturing, integrating and storing building data.

### 1.3. Methodology

Data collection was implemented through literature studies, expert interviews and a survey.

- Mapping of key policies and regulations of relevance for the construction sector was done by literature survey.
- The local best practices for overcoming legislative barriers and promoting circularity was divided in three parts; first a literature review on the local policies was conducted, followed by the generation of an outline for the stakeholder engagement which was then further refined into an interview outline and on-line survey.
- Supported by literature, the outcomes of the studies on EU regulation and the local best practises were used to find the solutions to overcome identified barriers and identify potential policy gaps that need to be addressed.

## 2. Review of the European policy framework relevant for SUM4Re cases

The key EU legislative documents include regulations and directives. Regulations have binding legal force throughout every Member State and enter into force on a set date in all the Member States. Directives lay down certain minimum requirements, but each Member State is free to decide how to transpose directives into national laws. The directives allow for adaptation to the regulatory requirements of the Member States. Thus, the implementation may differ slightly around Europe. The EU policies and strategies are non-binding but indicate the ambitions and goals that may later be implemented in legislation. Knowledge and follow-up on the policies are important for understanding the upcoming legislation and future priorities in the sector (e.g. overall environmental targets and ambitions will influence future priorities in the building sector such as targets for recycling).

The European Green Deal is the key policy which involves a package of measures and policies for achieving different environmental goals. The basis for the European Green Deal is the Paris Agreement under the United Nations Framework Convention on Climate Change and the UN sustainable development goals for a more sustainable and fairer society.

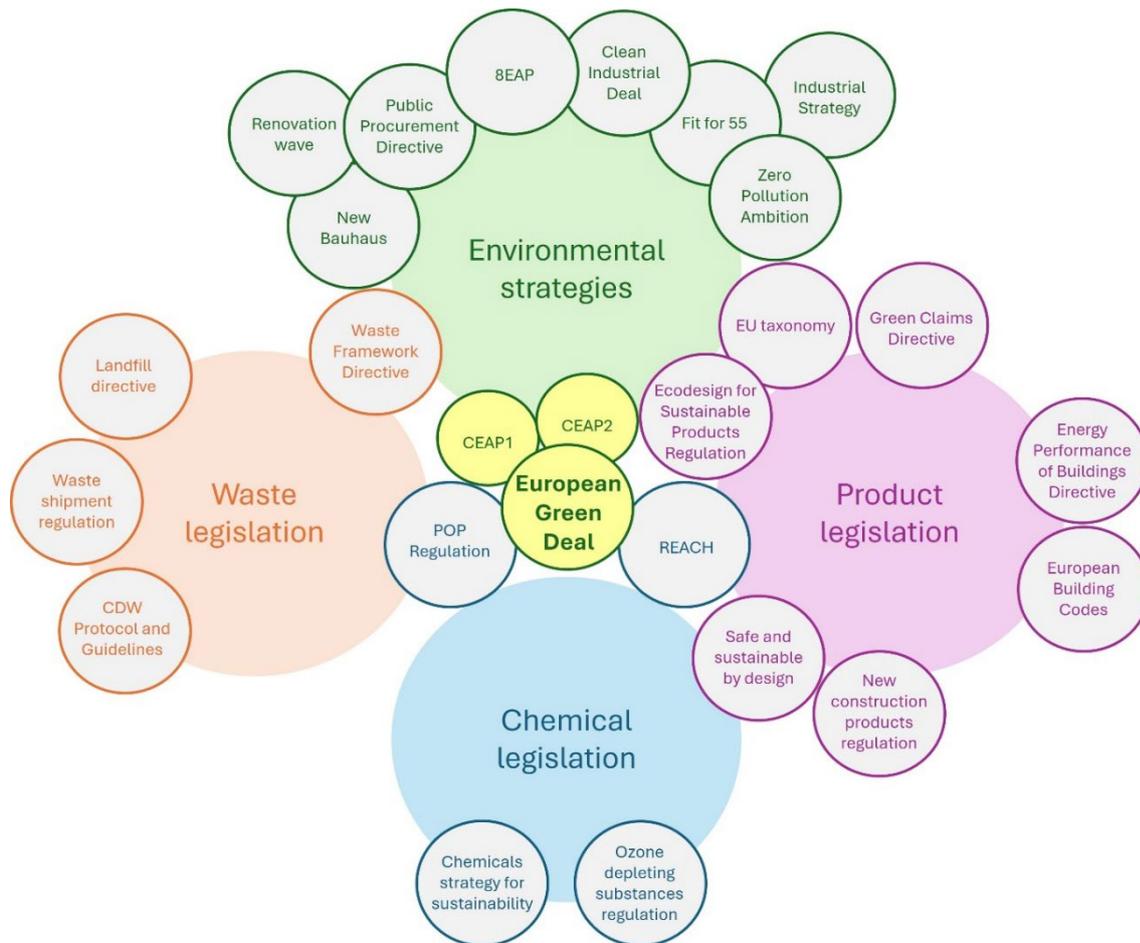
The Clean Industrial Deal aims to turn decarbonisation into a driver of growth for European industries with a focus on circularity to reduce waste and extend the life of materials by promoting recycling, reuse, and sustainable production. This is to maximise self-sufficiency in resources and reduce overdependence on raw materials imports; to support a competitive and resilient market. The Clean Industrial Deal has six focus areas: affordable energy, boosting demand for clean products, financing the clean transition, circularity and access to materials, acting on a global scale, as well as skills and quality jobs. SUM4Re's focus is mainly related to boosting demand for clean products through procurement initiatives, and the aim is to secure access to critical raw materials through recycling

There are numerous policies and pieces of legislation related to the construction sector along the lifecycle of buildings. Figure 3 illustrates the connections between some key EU policies and regulations relevant to SUM4Re. Several legislations can apply in parallel (e.g. CPR and REACH). Part of the legislation covers only one of the topics: environment, waste, products and chemicals, whereas others cover more than one topic. Further, several legislative documents can apply in parallel, when the internal ranking needs to be followed (e.g. CPR and REACH). There are numerous studies<sup>7</sup> on barriers related to reuse and recycling of construction products, also focusing on legislative barriers.

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<sup>7</sup> The following reports have been used as inspiration:

- EU Iceberg project
- EU Nontox project
- Nordic CircCDW project
- <https://www.eea.europa.eu/en/analysis/publications/investigating-europes-secondary-raw-material>
- <https://pub.norden.org/nord2023-031/nord2023-031.pdf>
- <https://pub.norden.org/us2023-441/us2023-441.pdf>



**Figure 3. Links between SUM4Re-relevant policy documents**

### 2.1. EU environmental policies/strategies related to the construction sector (VTT)

Many of the key policies evaluated in this section have a high focus on achieving climate neutrality, but also on resource efficiency (mainly circularity) and safety for the human health and the environment. Key legislative documents focusing on sustainability and circularity in general or specifically for the construction sector, which are relevant for this study and specifically for the uptake of recovered materials and reusable construction products in buildings analysed in this section, are presented in Table 3, which summarizes the ambitions, relevance and challenges of different policies for the SUM4Re demos. The key legislative documents on sustainability and circularity in general are as follows:

- 8th environmental action plan
- EU Green Deal
- Clean Industrial Deal
- EU Industrial Strategy
- Circular economy action plan CEAP 1
- CEAP 2
- Low carbon initiatives
- Zero Pollution Ambition
- Waste Framework Directive (see Section 2.3)
- Sustainable Products Initiative (See Section 2.2)
- Fit for 55
- Renovation wave
- New Bauhaus
- Taxonomy (See Section 2.2)
- Green Public Procurement and EU Public Procurement Directive (See also Section 2.5)

**Table 3. EU policies and strategies relevant for SUM4Re (not exhaustive list)**

Policy strategy	Focus	Relevance for SUM4Re	Challenges for SUM4Re solutions
<b>8<sup>th</sup> environmental action plan (EU/2022/591)</b>	<p>The EU's legally agreed common agenda for environment policy until 2030. The action programme reiterates the EU's long-term vision to 2050 of living well and within planetary boundaries. It sets out priority objectives for 2030 and the conditions needed to achieve these.</p> <p>Six priority objectives related to climate neutrality, climate adaptation, circular economy, zero pollution, protecting and restoring biodiversity, and reducing environmental and climate pressures related to production and consumption. In addition, the programme sets out an enabling framework and a monitoring framework to measure progress towards the required systemic change.</p>	<p>The construction sector is mentioned as a priority sector for promoting sustainability and reducing environmental and climate pressures related to production and consumption. The digitalization of the built environment creates benefits.</p>	<p>Transitioning to sustainable practices and technologies often involves higher upfront costs (such as the digitalization of the built environment). Conflicts can arise between different goals, e.g. resource efficiency and greenhouse gas emissions.</p>
<b>The European Green Deal (COM/2019/640)</b>	<p>Action plan with a comprehensive list of policy initiatives that aim to set out the EU on the path to a green transition, with the ultimate goal of reaching climate neutrality by 2050.</p>	<p>Policies place a strong focus on the reduction of CO<sub>2</sub> emissions in the construction sector, promoting construction products with low embodied carbon.</p> <p>The EGD includes measures to reduce waste and promote the reuse and recycling of materials.</p>	<p>Lack of indicators for reuse.</p>
<b>Clean Industrial Deal (COM/2025/85)</b>	<p>Aims to turn decarbonisation into a driver of growth for European industries. Specific focus on manufacturing and industry.</p>	<p>Boosting demand for recyclates (e.g. use of Public Procurement Framework).</p> <p>Using circularity to reduce waste and extend the life of materials by promoting recycling, reuse, and sustainable production.</p> <p>Promotes sustainable industrial processes, including the production of low-carbon construction materials such as green steel, low-emission cement, and energy-efficient glass.</p>	<p>Clean industrial production (e.g., green steel, low-carbon cement) is often more expensive than traditional methods, making sustainable renovations more costly.</p> <p>Challenges related to the availability of skilled workers.</p>

Policy strategy	Focus	Relevance for SUM4Re	Challenges for SUM4Re solutions
<b>EU Industrial Strategy (COM/2020/102)</b>	Considers digital technologies as a “critical enabler for attaining the sustainability goals of the Green deal in many different sectors”. In parallel, the European Data Strategy acknowledges the need for digital technologies to contribute to sustainable development.	Supporting BIM, digital product passport. Digital Building Logbooks to track information on construction, renovations, material use and safety aspects.	Current low use of digitalisation in the construction sector.
<b>Circular economy action plan CEAP 1 (COM/2015/0614)</b>	Mentions the construction and demolition sector as a priority area and lists three actions related to CDW required for the achievement of a circular economy.	EU Waste Management Protocol EU Level(s) – (used for monitoring – similar information as in predemolition audit on amounts) Waste audit guidance	Waste management protocol provides very general recommendations. Current low implementation of waste auditing.
<b>CEAP 2 (COM/2020/98)</b>	The ambition to make sustainable products, with a focus on the safety of consumers and the environment.	Addresses measures for sustainable performance of products Introduces digital product passports	Lack of circularity indicators for assessment of environmental sustainability of construction products containing recyclables. Need for environmental sustainability criteria for comparison on environmental performance of construction products. Lack of a standardized framework, regarding e.g., data content, format, storage and interoperability and need for simplified sustainability indicator for digital product passport.
<b>Low carbon initiatives</b>	Aims to minimise emissions of GHG to the atmosphere. Focus areas include shifting from fossil fuels to renewable sources of energy and promotion of energy efficient products and processes.	For construction products: high focus on low embodied energy.	Limited availability of materials with low carbon footprint, lack of awareness/skills of sustainable construction practices, clients often prioritize cost and timelines over sustainability.
<b>Chemicals strategy for sustainability (COM/2020/667) and Zero Pollution</b>	Aims to avoid harm from pollution to people and the environment. The chemical strategy highlights the need to prevent further pollution by substances of concern, particularly for those that accumulate or cause effects that accumulate in people or the environment.	Especially relevant for hazardous substances in reusable products.	List of hazardous substances not complete “list is expanded as more knowledge gained”. May cause restrictions in future reuse activities.

Policy strategy	Focus	Relevance for SUM4Re	Challenges for SUM4Re solutions
<b>Ambition</b> <b>(COM/2021/400)</b>	<p>Persistent chemicals such as PFAS are highlighted examples.</p> <p>The Zero Pollution Ambition calls for the risks posed by very persistent chemicals to be addressed rapidly.</p>		Uncertainty on how to assess construction products with hazardous substances, e.g. in paints.
<b>Fit for 55</b> <b>(COM/2021/550)</b>	Includes policies fit for reducing net greenhouse gas emissions by at least 55 % by 2030, compared to 1990 levels.	Use of reusable construction products results in low embodied carbon.	Stable supply of reusable construction products with sufficient quality performance from renovation or demolition work.
<b>Renovation wave</b> <b>(COM/2020/662)</b>	Aims to improve the energy performance of buildings. The Commission aims to at least double renovation rates in the next ten years and make sure renovations lead to higher energy and resource efficiency.	In renovation, reusable products improve resource efficiency (encouraging the reuse and recycling of materials and the reduction of waste).	Upgrading existing buildings for energy efficiency requires significant investment.
<b>New European Bauhaus</b> <b>(COM/2021/573)</b>	Aims at promoting lifestyle changes bringing a cultural and creative dimension to the European Green Deal, with community involvement, multi-disciplinarity, and co-design as key priorities.	<p>Promotes circular practises</p> <p>Principles in the construction industry by encouraging the reuse and recycling of materials and the reduction of waste.</p>	Related to circularity: lack of standards and regulation promoting reuse, skills and awareness, handling of left over materials, need to promote innovations.
<b>EU Public Procurement Directive (OJ L 94)</b>	Covers tenders exceeding a given amount, aiming for putting public funds to good use focusing on transparency, equal treatment, open competition, and sound procedural management.	Public procurement is a strong policy strategy instrument that can support implementing circularity in the construction sector.	Lack of expertise and knowledge on what criteria to use for supporting circularity, and also contracting authorities' knowledge on how to assess different bids.

## 2.2. Product legislation

The EU product requirements include rules for EU product safety. The key legislation related to circular construction products is the new construction products regulation (EU/2024/3110). Green public procurement is a key means for promoting circular construction products, whereas several legislation focus on requirements for product safety. Key legislative documents focusing on products, which are relevant for this study and specifically for the uptake of recovered materials and reusable construction products in buildings analysed in this section are presented in Table 4, which summarizes the ambitions, relevance and challenges of different policies for the SUM4Re demos. The key legislative documents on products are as follows:

- New construction products regulation
- Green Claims
- REACH (See Section 2.4)
- POP (See Section 2.4)
- Safe and sustainable by design
- Ecodesign for Sustainable Products Regulation
- The Product Liability Directive
- EU taxonomy
- Product safety directive
- Energy Performance of Buildings Directive
- Extended Producer Responsibility
- European Building Codes EUROCODES (Joint Research Centre, n.d.) - a series of 10 European works and construction products
- Standards (EN 1990 – EN 1999) for the design of buildings, civil engineering
- Green Public Procurement (See Sections 2.1 and 2.5)

Table 4. Overview of key regulation relevant for SUM4Re

Product legislation	Focus	Relevance for SUM4Re	Challenges for SUM4Re solutions
<b>New construction products regulation (EU/2024/3110)</b> <b>and construction products regulation (EU/305/2011)</b>	The aim of the Construction Products Regulation (CPR) (305/2011) is to remove barriers to trade of construction products between member states in the European Economic Area. The current CPR (EU/2024/3110) has been revised and the new CPR was adopted in April 2024. The goal of the new CPR is to make sustainable products the norm in the EU, boost circular business models and empower consumers for the green.	New CPR will change the standardisation process. More emphasis in including environmental characteristics in standards (e.g. mandatory green gas reporting). DPP will be mandatory. Green Public Procurement will include minimum criteria. Reuse is not regulated specifically in the new CPR (this will be an issue for scope of standards).	Reuse needs further clarification for CE marking.  Indoor quality requirements may pose a barrier for reuse of historical products indoors.
<b>Green Claims Directive (EU/2024/825)</b>	To provide consumers and end-users reliable, comparable, and verifiable information about the environmental impacts, aspects or performance of a product or the trader itself.	Use of digital product passport proposed as a source of information.	Stakeholders still lack experiences with digital product passport (e.g. related to information).
<b>Safe and sustainable by design, Commission Recommendation (EU/2022/2510)</b>	High focus on hazardous substances in design, use and end-of-life stage. Call for substitution of hazardous substances.	Identification and elimination of hazardous substances (preventing reuse and recycling of construction products containing hazardous substances).	Lack of guidance and tools that are needed for the assessment steps.
<b>EU taxonomy (EU/2020/852)</b>	Lists environmentally sustainable economic activities and is used to support sustainable investment.	Green financing (e.g. in renovation/demolition works)  Fosters the uptake of technologies providing sustainable solutions e.g. in waste management.	Guidance needed on how to implement the taxonomy circular economy criteria (proofs, scope in assessment).  The CE marking is not sufficient for the EU taxonomy (CE

Product legislation	Focus	Relevance for SUM4Re	Challenges for SUM4Re solutions
			marking refers to certain performance, properties).
<b>Ecodesign for Sustainable Products Regulation (EU/2024/1781)</b>	<p>Aims to promote the development and use of sustainable products across various sectors. It includes measures for sustainability and circularity aspects (performance requirements, e.g. durability).</p> <p>A list of requirements are further specified in the ESPR Framework.</p>	Digital Product Passport concept	Lack of tools/indicators for measuring performance.
<b>The new Product Liability Directive (EU/2024/2853)</b>	<p>The Product Liability Directive ensures that victims can claim compensation from manufacturers when they suffer damage caused by a defective product.</p>	<p>When a product is repaired and upgraded outside the original manufacturer's control, the company or person that modified the product should be held liable.</p> <p>For products manufactured outside of the EU, the company importing the product is held liable for damages.</p> <p>Liability can be shown and updated by using a product passport with blockchain technology, connecting the new owner to the product passport.</p>	Problems with lack of data related to responsibilities. Long responsibilities for buildings.
<b>Revised Energy Performance of Buildings Directive (EU/2024/1275)</b>	<p>Promotes improving the energy performance of buildings.</p> <p>Sets mandatory minimum energy performance standards for buildings as a trigger for renovation of existing buildings on a large scale. Aims to gradually phase-out low-quality buildings and continuously improve the European building</p>	Focus on low carbon economy (products should have low embodied energy).	Construction products in building stocks often do not meet the energy efficiency standards of new construction, which may prevent reuse of products and components.

Product legislation	Focus	Relevance for SUM4Re	Challenges for SUM4Re solutions
	stocks. Strongly links to EU Renovation Wave ambitions.		
<b>Extended Producer Responsibility</b> <b>Waste Framework Directive (2008/98/EC)</b> <b>WEEE Directive (2012/19/EU)</b> <b>ELV Regulation (2000/53/EC)</b>	An extended producer responsibility (EPR) puts the responsibility for the financing of collection, recycling, and End-of-Life disposal on the producers.	Currently concerns only packages, electronics, and vehicleless but national legislation may also cover construction products (e.g. in France).	Data sharing responsibility for construction products with long lifetime.
<b>European Building Codes (EUROCODES)</b> <b>Standards (EN 1990 – EN 1999) for the design of buildings, civil engineering</b>	<p>A series of 10 European standards, providing a common approach for the design of buildings and other civil engineering works and construction products.</p> <p>Technical specifications in public contracts, replacing national standards.</p> <p>Covers technical specifications for structural safety, serviceability, and durability. Although Eurocodes are established European standards, they operate nationally.</p>	Eurocodes provide comprehensive guidelines for the design and construction of structures using different materials (e.g. concrete structures, steel structures, composite steel and concrete structures, timber structures, masonry structures, aluminium structures).	<p>Reuse aspects are not specifically covered.</p> <p>The potential presence of hazardous materials in reusable products and secondary materials.</p>

### 2.2.1. Relevance of the New Construction Products Regulation for SUM4Re cases - focus on reusable construction products

The new Construction Products Regulation (EU/2024/3110) is aligned with the goals of ESPR (Eco-design for Sustainable Products Regulation) (EU/2024/1781) as both regulations were prepared at the same time. One goal of the new CPR is also to enhance the sustainability of products. It sets requirements for the design and production of products to ensure they are energy-efficient, durable, and recyclable. It also makes the digital product passport mandatory.

#### 2.2.1.1. General

The Construction Products Regulation (EU/305/2011)<sup>8</sup> has been revised and the new version (EU regulation 2024/3110) was adopted in 2024. The CPR from 2011 and the successor CPR will exist in parallel for many years, and the CPR from 2011 will be repealed in 2039. The transition period to the new CPR is long in order to avoid bottlenecks. The aim of the successor CPR remains the same: to remove barriers to trade of construction products between member states in the European Economic Area. It makes CE-marking mandatory for most construction products sold in EU countries, which are covered by a harmonised product standard or a construction product that conforms to a European Technical Assessment, which has been issued for the product.

The scope of the new CPR goes beyond that of the CPR from 2011 and includes product information that is relevant for the installation, maintenance and removal, recycling or reuse of the product. The CPR introduces the life cycle perspective when assessing the performance of a construction product. The “life cycle” is defined “as the consecutive and interlinked stages of a construction product’s life, from raw material acquisition or generation from natural resources to final disposal” (thus meaning “from cradle to grave”).

For the technical performance and the use of the construction product, also aspects that change or influence the characteristics needs to be covered in future harmonised standards. This means that change of the scope is included in the future standardization work, thus also affecting the standard development for reusable construction products.

New elements in the new CPR that are also relevant for SUM4Re:

- in the future, requirements for greener and safer construction products (reporting obligations for manufacturers)
- digital information on product characteristics
- obligation for manufacturer on environmental reporting (information on climate effects changed to mandatory)
- product traceability important (use of digital product passport)

A key change in the new CPR is the mandatory declaration of the global warming potential for construction products entering the system as of 2025 (the environmental indicators to be reported will be broadened by 2031 to a full list of LCA indicators). Furthermore, the use of a digital product passport including environmental information is expected to become obligatory around 2028. Stakeholder engagement at an early stage is crucial in the standard development, especially in defining the scope, as it becomes difficult at later stages. Herein, experiences and results from SUM4Re provide a good background for influencing standardization development.

The new CPR sets EU rules for GPP of building materials, which will be established starting at the end of 2026. These new rules will introduce mandatory minimum environmental sustainability requirements for public procurement of construction products, which will facilitate the emergence of lead markets for low-carbon products. (see Section 2.5)

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<sup>8</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011R0305>

In the development of harmonised product standards, reusable construction product can be addressed (e.g. assessment procedures parameters to be tested, methods, data requirements for DPP).

**2.2.1.2. CE marking**

The CE marking procedures in the new CPR has remained unchanged to the current CPR (still also valid till year 2039). However, the scope of the harmonized product standards has changed. In the new CPR, the scope goes beyond that of the current CPR and allows for product information that is relevant for the installation, maintenance and removal, recycling or reuse of the product. Requirements for the whole life cycle need to be considered. For the technical performance and the use of the construction product, aspects that change or influence the characteristics also need to be covered in future harmonised standards.

The CPR requires that harmonised test methods are used in the performance declarations in order to remove trade barriers between member states. The CPR does not intend to harmonise existing national regulations and requirements concerning the actual construction works (e.g. national regulation for indoor air quality). Member States and public and private sector procurers are free to set their own requirements on the performance of buildings and construction works and therefore performance levels of products. However, in the development of the harmonised standards, national regulatory requirements need to be considered (e.g. the parameters and the ways of determining need to be included in the harmonised way – testing can not be done by using conflicting national methods).

**Box 1. Basic requirements**

The new CPR contains eight (current only seven) so-called basic requirements (BRs) for construction works as follows:

- BR1: Structural integrity of construction works
- BR2: Fire safety of construction works
- BR3: Protection against adverse hygiene and health impacts related to construction works (focus on indoor air quality)
- BR4: Safety and accessibility of construction works
- BR5: Resistance to the passage of sound and acoustic properties of construction works
- BR6: Energy efficiency and thermal performance of construction works
- BR7: Emissions into the outdoor environment of construction works (focus on release to water/soil)
- BR8: Sustainable use of natural resources of construction works

Three of which are related to environmental issues and sustainability and the focus of this report: BR3 “Hygiene, health and environment”, BR7 “Outdoor emissions” and on BR8 “Sustainable use of natural resources”.



### 2.2.1.3. Declaration of performance and conformity

Manufacturers must provide the Declaration of Performance and Conformity (DoPC) when placing a construction product with a CE marking on the market. A DoPC is an official document that demonstrate compliance with regulatory standards. The content/requirements of the DoPC are specified in the annex IX of the regulation. The rules for CE marking is specified in the harmonised product standards. Here it should be noted that future standards developed according to the new CPR will include new elements.

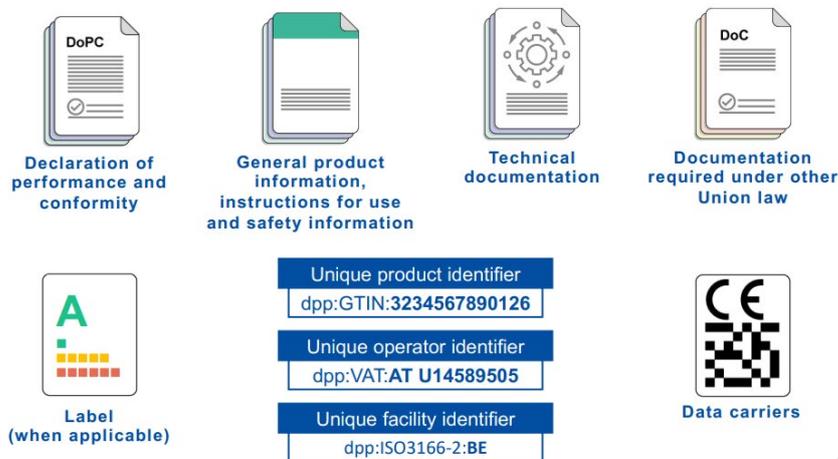
The obligations for manufacturers related to the DoPC are as follows:

1. Mandatory when there is a harmonised technical specification
2. Obligation to Undergo the respective Assessment and Verification System
3. Draw up technical documentation
4. Issue Declaration of Performance and Conformity
  - Liability for products performance
  - Liable to comply with product requirement established by delegated act

### 2.2.1.4. Digital product passport

The new CPR requires that all product information is to be made available in a single place via the Digital Product Passport (DPP). The DPP will provide access to detailed information on construction products, encompassing safety details, usage instructions, and declarations of performance and conformity as well as environmental data (e.g. greenhouse gases). The new CPR sets following timeline for introducing DPP: digital product system established (by delegated acts) by 2026 and obligation to deliver a digital product passport by 2028. Examples of data to be included in the DPP is presented in Figure 4.

## DPP content



**Figure 4. Data to be included in DPP for construction products (Source: Schulze, 20259)**

### 2.2.1.5. CPR: Relevant issues for SUM4Re

The following articles are of special interest for SUM4Re (not exhaustive):

- Article 2: regulation applies to reused products (scope)
- Article 22: obligations for manufacturer (declaration of performance and conformity)
- Articles 34-42: rules on product standards, EAD
- Article 83: Green public procurement (minimum environmental sustainability requirements will be proposed)

<sup>9</sup> Espen Schulze, Webinar 'How can CEN/TC 442 support digitalization of data in design and product standards' CEN/CLC JTC 24 [https://www.cencenelec.eu/news-and-events/events/2025/2025-03-12\\_webinar\\_cen-tc442/](https://www.cencenelec.eu/news-and-events/events/2025/2025-03-12_webinar_cen-tc442/)

- Annexes: sustainable aspects relevant for construction products

## 2.2.2. Technical standards, specifications and industry guides

To enable efficient circulation of construction products (components and materials), a set of technical rules must be developed covering all life cycle stages of the product. For some material or component groups, the European standards are already in place, in other cases there is at least a technical specification, national standard or a guidance by the industrial association under the development. The set of essential documents include:

- Design codes for structural and other critical components (e.g. the Eurocodes)
- Product standards such as harmonized execution standards
- Guides for the assessment of existing buildings
- Deconstruction and pre-deconstruction audit protocols
- Specifications for testing and quality control of reclaimed materials and components
- Technical rules for the declaration of environmental impacts of the deconstruction and reclamation process and of the recirculation potential

The standardization issue is elaborated in more detail in the deliverable D1.3 “Standardization and interoperability” of SUM4Re project<sup>10</sup>.

## 2.2.3. Enabling frameworks

### 2.2.3.1. EU Level(s)

European Commission's Level(s) provides a methodology for measuring the resource use and environmental performance during a building's lifecycle, health and comfort and cost, value, and risk. Several pieces of EU legislation (e.g. Construction Products Regulation, EU taxonomy) make references to EU Level(s).

For promoting circularity principles throughout the lifecycle of buildings, the EU Level(s) is proposed to be used to integrate life-cycle assessment (LCAs) in public procurement and the EU sustainable finance framework (EU Taxonomy). Level(s) uses core sustainability indicators to measure carbon, materials, water, health, comfort and climate change impacts throughout a building's full life cycle:

1. Greenhouse gas emissions: Minimise total lifespan carbon output, including energy consumption and embodied energy.
  - a. Use phase energy performance (kWh/m<sup>2</sup>/yr)
  - b. Life cycle Global Warming Potential (CO<sub>2</sub> eq./m<sup>2</sup>/yr)
2. Resource efficiency and circularity: Optimise the building design to support circularity.
  - a. Bill of quantities, materials and lifespans
  - b. Construction & Demolition waste and materials
  - c. Design for adaptability and renovation
  - d. Design for deconstruction, reuse and recycling
3. Efficient use of water resources (particularly in areas of water stress)
  - a. Use stage water consumption (m<sup>3</sup>/occupant/yr)
4. Healthy and comfortable spaces (focusing on four aspects of quality in the indoor environment)
  - a. Indoor air quality
  - b. Time outside of thermal comfort range
  - c. Lighting and visual comfort
  - d. Acoustics and protection against noise
5. Adaption and resilience to climate change
  - a. Protection of occupant health and thermal comfort

<sup>10</sup> Hradil P, Görsch C, Lammers B, Sebastian R, Strydom D "Standardization and interoperability", Deliverable D1.3 of SUM4Re project, May 2025, Espoo, Finland.

- b. Increased risk of extreme weather
- c. Sustainable drainage
- 6. Optimised life cycle cost and value
  - a. Life cycle costs (€/m<sup>2</sup>/yr)
  - b. Value creation and risk factors

### 2.2.3.2. Digital tools

The level of digitisation is still low in the construction sector. The new construction products regulation mentions the use of Building Information Modelling, Digital Product Passports and Digital Building Logbook (DBL). The use of a Digital Building Logbook is not regulated at the moment, but based on the EASME report<sup>11</sup>, large parts of the required data will be readily available in DPPs and possible to exchange in IFC format.

**Table 5. Digitalization tools for construction products/buildings.**

Term	Speciation	Remark
DPP – Digital Product Passport	Digital record that contains essential <b>information about a product</b> , such as its composition, environmental impact, recycling potential, and compliance with regulations. DPP tracks a product's entire lifecycle, from material sourcing and extraction to end-of-life recycling. It will be permanently attached to each product as QR code, or RFID tag.	Required by construction products regulation by 2026/2028 for construction products sold - Note! Role of Harmonised Product Standards about mandatory content of DPP. DPP need to be connected to other data files and linked to a building passport. Ongoing CIRPASS2 project about access to DPPs, data storage (construction products included as one example).
BIM – building information model ("library")	<b>Digital representation of the physical and functional characteristics of a building.</b> It includes 3D models, data about materials, systems, energy use, and lifecycle information.	
BMP – Building Material Passport (similar to e.g. German Building Resource Passport, BAMB, Circularity Passport)	A BMP is a structured digital document that contains <b>comprehensive information about the materials used in a building</b> , including their composition, origin, environmental impact, durability, and recycling potential. It enables tracking the performance and sustainability of materials over the building's lifecycle.	BMPs support circular economy strategies by providing detailed information that facilitates recycling, reuse, and recovery of materials after a building's life, ensuring materials can be properly managed for future use. For example, German DGNB provides a CO <sub>2</sub> calculator for assessment of carbon footprint of building and a concept for assessment of environmental performance. Country specific carbon footprint targets e.g. for new buildings in accordance with EPBD, EU Taxonomy
DBL – Digital building logbook <sup>12</sup>	A DBL is a comprehensive digital record that logs the <b>operational history</b> of a building. It includes information about construction, maintenance, energy use, renovations, and performance monitoring.	DBL or BMP can be considered a type of product passport.

<sup>11</sup> Volt, J., Toth, Z. 2020. *Definition of the Digital Building Logbook: Report 1 of the Study on the Development of a European Union Framework for Buildings' Digital Logbook*, Brussels

<sup>12</sup> The EU study "[Technical guidelines for digital building logbooks](#)" (2023) defines the digital building logbook as follows:

- A digital building logbook is a common repository for all relevant building data. It facilitates transparency, trust, informed decision making and information sharing within the construction sector, among building owners and occupants, financial institutions and public authorities.
- A digital building logbook is a dynamic tool that allows a variety of data, information and documents to be recorded, accessed, enriched and organised under specific categories. It represents a record of major events and changes over a building's lifecycle, such as change of ownership, tenure or use, maintenance, refurbishment and
- Other interventions. As such, it can include administrative documents, plans, description of the land, the building and its surroundings, technical systems, traceability and characteristics of construction materials, performance data such as operational energy use, indoor environmental quality, smart building potential and lifecycle emissions, as well as links to building ratings and certificates. As a result, it also enables circularity in the built environment

Figure 1: Context of digital building logbooks

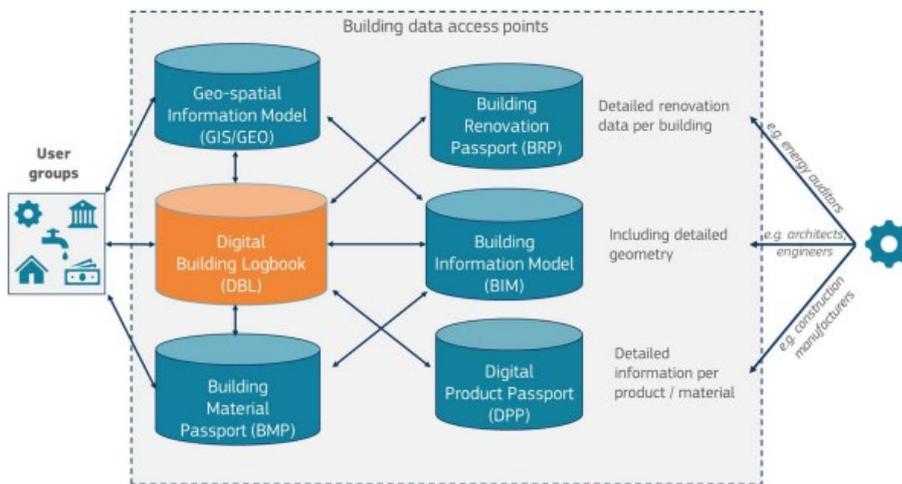


Figure 5. Links between digital building logbook, BIM, different passports and Geo-spatial information models. (Source: DBL, 2023)<sup>13</sup>

Figure 3: Overview of the building life cycle and use of a DBL

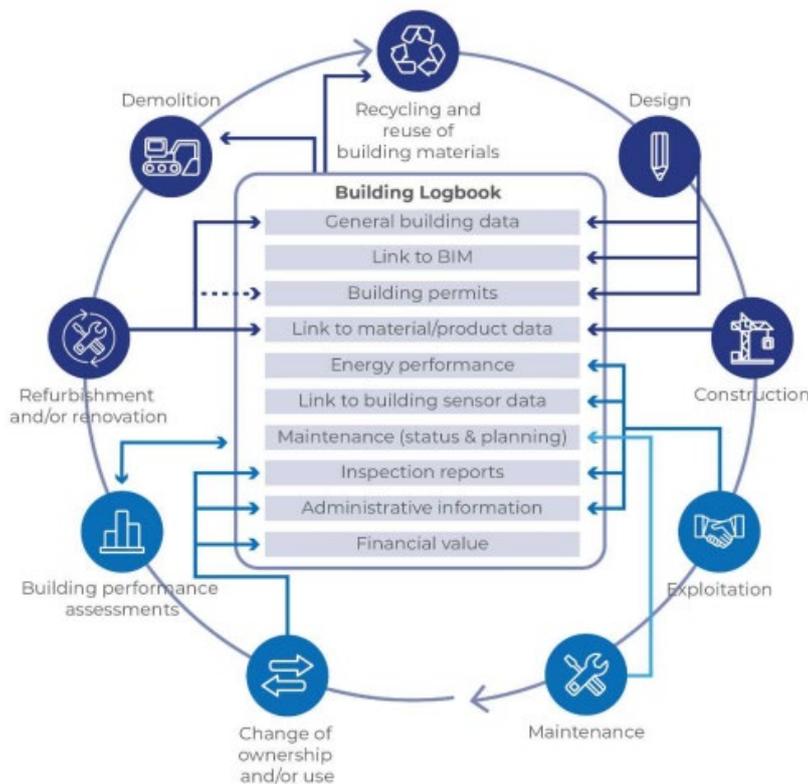


Figure 6. Examples of activities potentially to be covered by DBL. Source: DBL, 2023)<sup>14</sup>

<sup>13</sup> [Microsoft Word - DBL - Technical Guidelines for DBLs](#)

<sup>14</sup> [Microsoft Word - DBL - Technical Guidelines for DBLs](#)

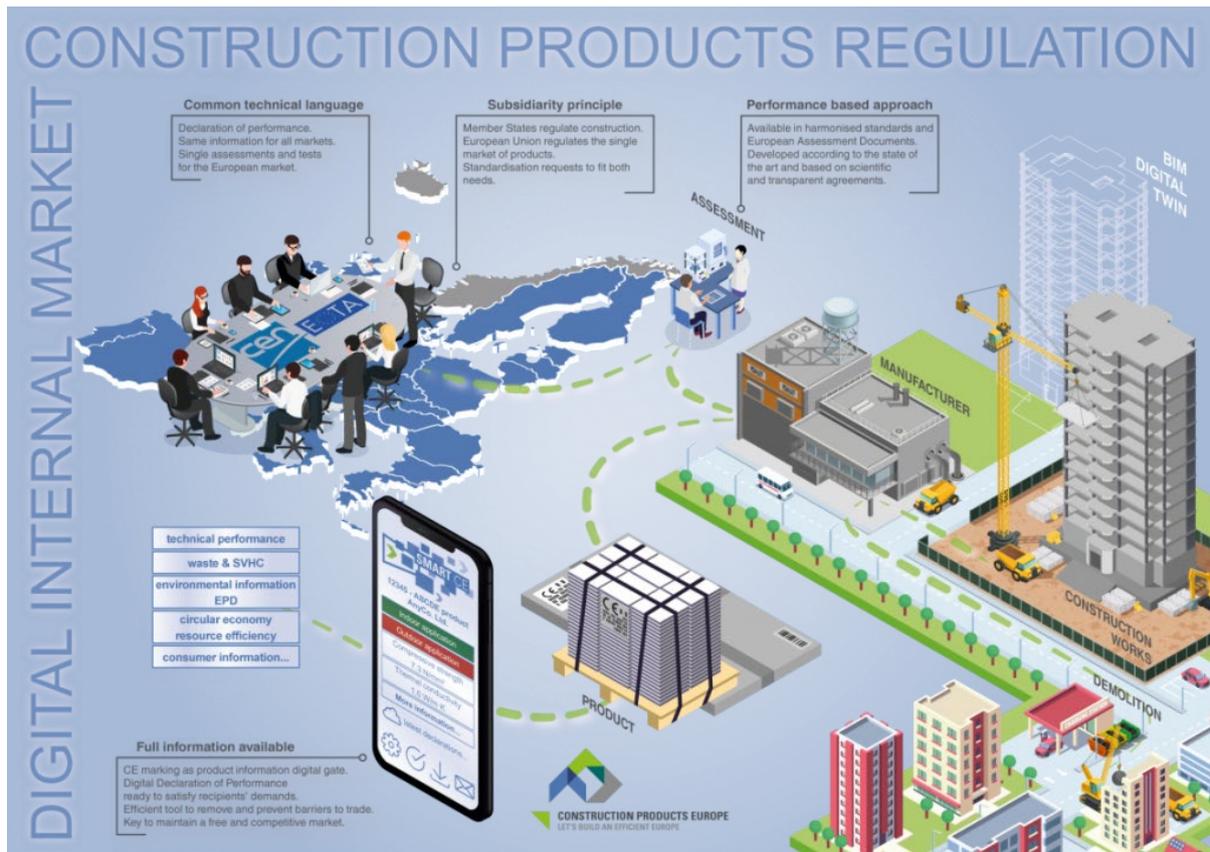


Figure 7. Digitalization one stop store approach. Source: Construction Products Europe<sup>15</sup>

### 2.2.3.3. Blockchain solutions

Blockchain technology provides a tool that enhances the use of a Digital Materials Database. It is only effective if it can be used in combination with a Product Passport. Each product has its own Product Passport, which gives this material its identity. The identity can be verified by registering the ownership of the passport in the blockchain, which also gives the possibility to see that registration as a property right at the time of registration. The blockchain registration serves as a property right that is also included in the product passport by means of its hash, i.e. the blockchain identity of the product passport.

This follows the technological characteristics of the ledger or block structure of blockchain technology in which every block or ledger stands for a unique piece of unchangeable information. Information that can only be changed by creating a new block or ledger on top of the old ledger with the help of encryption technology that is behind the block chain technology. In this way every piece of the information about the product and the products itself is unique and can be verified. For example, who is the owner of the product that is liable for future delivery of this products in a circular economy. In this way the registration of, ownership information of a product in a building, creates clear property rights for these products.

The blockchain registration establishes ownership rights on the products. Ownership rights give us the possibility to link these to other rights, such as CO<sub>2</sub> rights, or to sell these rights to

<sup>15</sup> <https://www.construction-products.eu/publications/cpr-principles-to-be-kept/>

other stakeholders. The combination of products with an identity, the verified blockchain registration and the features of ownership rights, give us the possibility to link products to marketplaces and future contracts, because the immutable nature of information in the blockchain can also handle issues such as liability and duration. Liabilities relating to future delivery can be added to the liabilities mentioned earlier. In particular if the identity of products is recorded, the property rights relating to the products and related liability for future delivery can be organized. We always know who owns the products.

A blockchain registry makes it possible and affordable to ensure the ownership rights of products. This solves quality problems caused by asymmetric information, as described by Akerlof in the Theory of the Lemons. The ability to track and trace product usage by using the combination of the digital product database and a blockchain registration also helps with this quality and ownership issue. It also reduces various (transaction) costs related to the enforcement or compliance with various laws and regulations that relate to products. And it contains the possibilities to strengthen the current weaknesses of present and future regulation concerning the quality and duration of products, because it supports the information needed to comply with the ideas behind every rule or regulation. Not only providing a fundamental layer to the information infrastructure of the built environment, if every building or object is provided a digital twin, but also a way to organise future transactions with the product without significant transaction costs. As is the case now.

### **2.3. Waste legislation**

The EU legislation related on waste aims to protect the environment and human health. The legislative framework includes general topics on waste categorisation, shipments and treatment as well as sector specific requirements on waste treatment and recycling. Key legislative documents focusing on waste, which are relevant for this study and specifically for the uptake of recovered materials and reusable construction products in buildings analysed in this section are presented in Table 6, which summarizes the ambitions, relevance and challenges of different policies for the SUM4Re demos. The key legislative documents on waste are as follows:

- Waste Framework Directive
- Waste shipment regulation
- REACH (See Section 2.4)
- POP (See Section 2.4)
- Landfill directive
- EU Construction and Demolition Waste Protocol and Guidelines

**Table 6. Overview of key waste legislation relevant for SUM4Re**

Waste legislation	Focus	Relevance for SUM4Re	Challenges
<b>Waste Framework Directive (PE/11/2018/REV/2)</b>	<p>Defines the waste hierarchy in waste management, setting waste prevention as the highest priority. It sets clear targets for the reduction of waste and requirements for waste management and recycling, including quantitative recovery targets for CDW, to be achieved by 2020. The Directive also introduces the end-of-waste concept (EoW) and New targets under considerations for recovery of certain CDW (e.g. concrete, wood, plastics) under consideration by the Commission.</p> <p>a) Waste sorting at construction site if possible                      b) Hazardous waste classification rules given                      c) Introduction of the End-of-waste concept defining criteria when a waste ceases to be a one and becomes a secondary product or material.                      d) Bans (e.g. restrictions in landfilling of gypsum waste)</p>	<p>Emphasizes reuse and high-quality recycling                      Importance for waste traceability and pre-demolition protocols</p>	<p>Uncertainty on how to understand product status (remaining the product status) and the preparing for the reuse.                      EoW does not give guidance for reusable products.                      Waste classification rules (hazardous/non-hazardous waste) are complex; limits for e.g. flame retardants low and unclarities in how to interpret recovered products with painted surfaces (e.g. containing flame retardants).</p>
<b>Waste shipment regulation (OJ L 190)</b>	<p>Aims to establish a more efficient system for the circulation of waste for recycling or re-use in the EU (crossing the borders), and determined action against illegal waste shipments</p>	<p>Rules for shipment of waste crossing borders</p>	<p>Restrictions on shipment of waste classified as hazardous (permit needed for cross country shipment – potentially a barrier for recycling)</p>
<b>Landfill directive (OJ L 182)</b>	<p>The Landfill Directive defines 3 types of landfill categories with different types of protection levels (e.g. use of bottom liners). Waste acceptance criteria have been set at the EU level for certain landfill categories. It sets a clear ban on landfilling of certain waste types.</p>	<p>Ban for landfilling of recyclable waste</p>	
<b>EU Construction and Demolition Waste Protocol and Guidelines</b>	<p>Aims to support national authorities in achieving the EU 2020 target for CDW recycling by involving all stakeholders of the value chain</p>	<p>Emphasizes reuse and high-quality recycling</p>	<p>Focus on waste and recycling, not on waste prevention and reuse.</p>

### 2.3.1. Waste Framework Directive

The Waste Framework Directive, WFD (2008/98/EC) is a policy document – it sets out several European principles and objectives for managing waste (waste management hierarchy and recommendations for waste sorting/collection of specific waste streams). The policy obligations (such as future reuse recycling targets for CDW and material specific fraction) can support and help steering the recycling value chain to better CDW management.

The WFD sets the basic concepts and definitions related to waste management, such as definitions of waste, recycling, recovery, End-of-Waste (EoW) criteria, and how to distinguish between waste and by-products. Relevant for circular construction, the WFD promotes selective demolition and site sorting to enable removal and safe handling of hazardous substances and facilitate re-use and high-quality recycling. The WFD further sets a target of recycling 70 % (by weight) of non-hazardous construction and demolition waste. In future, it is likely that the Commission will set preparing-for-reuse and recycling targets for material specific fractions of CDW (actually already required to be set by 2024, but the Commission failed to come up with these targets in time).

The classification of waste as non-hazardous or hazardous is regulated by the Waste Framework Directive (WFD) and the classification is primarily based on the European List of Waste (2014/955/EU<sup>16</sup>).

### 2.3.2. SUM4Re relevance: categorisation as product or waste

There are two options for secondary materials and products to retain or to obtain product status:

- products retain the product status after recovery from buildings
- products classified as waste can achieve a product status through an End-of-waste assessment procedure

#### 2.3.2.1. For products retain the product status

According to the EU Waste Framework Directive:

- (Art 3.13), “*re-use* means any operation whereby products or components that are not waste are used again for the same purpose for which they were intended”. This means that the product or component has been recovered as a product and at no stage been classified as a waste. The final use of the product or component is certain.
- (Art. 3.16), “*preparing for re-use* means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be reused without any other pre-processing”. Preparing for reuse means that the end-of-life management of a product is controlled by the waste legislation if not re-classified as a product through EoW procedure.

Very limited information was found about national decision or guidance on how to categorize recovered streams as waste or product. Often examples were from other areas than the building sector (e.g. Dutch guidance document<sup>17</sup>).

In the following sections mainly information or views presented in projects are presented and should not be seen as the official opinion of the authorities. In the Interreg project FCRBE<sup>18</sup>, a list of criteria (indicators) established by the courts (especially the Court of Justice of the European Union) by which the material/product may be classified as product or waste is

<sup>16</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02000D0532-20150601>

<sup>17</sup> <https://www.afvalcirculair.nl/afvalstof-of-niet-afvalstof/handreiking-afvalstof/>

<sup>18</sup> <https://vb.nweurope.eu/projects/project-search/fcrbe-facilitating-the-circulation-of-reclaimed-building-elements-in-northwestern-europe/>

collated (see Table 7). It is highlighted that none of these indicators individually define the product/waste classification, but the list of indicators can be used as a tool in planning actions to support a product definition. Critical points are also at which stages are the material declared as product or waste and who is competent for making decisions (site operator/material holder or authority).

**Table 7. Indicators suggested by the FCRBE project for product/waste classification decisions**

	Set of indicators presented in FCRBE project
Product status	<ul style="list-style-type: none"> <li>• Formulation of objectives: Formulation of the subject-matter and the requirements by integrating the objectives of reuse (or circularity, optimisation of resources, sustainable management, etc.)</li> <li>• Predemolition audit: Inventory conducted by qualified persons, with recommendations on the reclamation process of identified materials</li> <li>• Targeted removal from a construction site: Targeted disposal of materials in a separate area from the mixed waste area, taking the necessary preservation precautions</li> <li>• Sorting of damage elements: Within a batch, sorting out of materials that are clearly too damaged to be reused</li> <li>• Verifiable existence of a new holder: Identification of a buyer as soon as possible, formalised by a sale or donation agreement (even if there is a long delay before the effective transfer of property)</li> <li>• Economic interest: Existence of a market for this material, testifying to its value: professional dealers, construction companies, antique dealers, etc.</li> </ul>
Waste status	<ul style="list-style-type: none"> <li>• Suspicion that the material is hazardous: The hazardousness must be assessed by a qualified person who is familiar with the relevant European and national regulations</li> <li>• Apparent obsolescence of the material: The Court of Justice of the European Union has retained the criterion of “society’s perception of the material as waste”. In other words, if it is obvious to everyone that it is waste, so it is!</li> <li>• Abandoned or neglected stock: Abandonment is easy to characterise: e.g. deposit in an inappropriate place, unsorted materials left in disuse, no certain prospect of a buyer. Be careful when materials are kept for a long period of time to avoid the impression of abandonment.</li> <li>• Financial burden to treat the material as waste: Meaning that the transfer of these materials requires the use of a specialised operator, or incurs an additional tax</li> <li>• Heavy operation on the material. Judging of scale of actions for next use phase can be demanding. It is thus possible to carry out some transformation of the materials to adapt them to their new purpose (e.g. sawing planks or cutting stone), but not to the point of radically changing their main characteristics (e.g. crushing the planks into chips or the stone into aggregates).</li> <li>• Disposal in waste treatment site: In some states or regions, this index is a decisive criterion: it is sufficient on its own to qualify a material as waste</li> </ul>

In 2005, the network for Reuse and Recycling European Union Social Enterprises (RREUSE)<sup>19</sup> presented views on how to distinguish between the product and the waste status (with focus on the non-profit sector). The interpretation of a product maintaining its product

<sup>19</sup> <https://rreuse.org/>

status is suggested to be based on activities related to cleaning and maintenance contra activities related to improvement of performance of the product in use. It is suggested that reuse relates to an action or operation by which components or whole products are used for the same purpose for which they were conceived. For example, activities like cleaning, shortening of length of a cloth do not change the product status of a cloth, whereas changing the purpose of the product by sewing new products from the cloth relates to preparation of reuse or recycling. Table 8 presents examples for product contra waste status.

**Table 8. Cases for product contra waste status (Sources: FCRBE project<sup>20</sup> and UK guidance (2021)<sup>21</sup>)**

	Cases
<p>Reuse (= product status)</p> <p><b>“Reuse means a material is used again for the same purpose as was originally intended”</b></p>	<p>FCRBE project:</p> <ul style="list-style-type: none"> <li>• Same-site reuse – the term used in the UK and Ireland for when the product is reused on site. (Note: reclamation includes extracting, processing, transport and storage prior to reuse. Reuse includes installing a reclaimed product in a new location. Thus, ‘same-site reuse’ would actually be ‘same-site reclamation and reuse’).</li> <li>• The product is reused on another site owned by the same owner.</li> <li>• Paving stones are salvaged and sorted on site by a company, according to the instructions laid down in the pre-demolition assessment. Paving stones that are deemed to be in good condition are set aside and sent to another site for reuse. They never cease to be products.</li> <li>• During road works, another operator collects paving stones (participating on-site, ensuring quality control and reusability). The recovered batch is transported to this operator’s site for storage until sold as products.</li> </ul> <p>UK guidance:</p> <ul style="list-style-type: none"> <li>• Wooden pallets being reused as pallets as long as they are fit for use.</li> <li>• Roof tiles carefully removed from one building, stored to retain their integrity and then certain to be fitted onto another building’s roof.</li> <li>• When a charity or second-hand shop receives items, checks them and carries out a very minor repair to ensure its reuse as originally intended, for example if a button is sewn onto a coat or a handle is screwed back onto a drawer.</li> <li>• Items that are leased (and used several times by a number of people) as long as they are fit for use</li> <li>• Donating goods in re-usable condition to a charity or second-hand shop (e.g. clothes, books, toys, and CDs).</li> <li>• Networks where people can give away items for free that are fit for re-use, for example a television or computer, such as the Freecycle Network and Freegle</li> </ul>
<p>Preparation for reuse (Waste status)</p>	<p>FRCBE project:</p> <ul style="list-style-type: none"> <li>• The product is transferred to another party (by donation or sale) for future reuse. If this transfer of material involves several sorting phases, the product undergoes preparation for reuse.</li> <li>• The product is first deposited in a waste treatment facility, then a new holder desires to reuse it. The product undergoes preparation for reuse.</li> </ul>

<sup>20</sup> <https://vb.nweurope.eu/projects/project-search/fcrbe-facilitating-the-circulation-of-reclaimed-building-elements-in-northwestern-europe/>

<sup>21</sup> <https://www.gov.uk/government/publications/legal-definition-of-waste-guidance/decide-if-a-material-is-waste-or-not>

- During road works, paving stones are salvaged and stored separately on site. The appropriate sorting process is left to the future buyer. The new owner sorts them at their own facilities, rejecting contaminants and damaged items. At the end of the operation, the paving stones are classified as products
- A demolition company stores batches of paving stones recovered from road demolition sites at their facility. When a construction company wants to use them in another project, the demolition company supplies a quantity in excess, since some of the paving stones will not be usable. At the new project site, the paving stones are cleaned and sorted as they are used. Those that are retained then become products.

UK guidance:

- When a consumer brings 'items' to a recycling centre, they will be considered waste although some would be suitable for reuse. By discarding the items, the consumer's intention was for the items not to be reused.
- When a business receives waste for process for reuse, it is considered waste although it may possess a positive economic value. E.g. scrap metals has a quite high value.
- When a construction company excavates land for development, and some of the extracted soil may be suitable for reuse at a site other than where it was produced, that soil is likely to be waste. It is waste unless it can meet the by-product test<sup>22</sup>. It may also be used as a non-waste if it is used on the same site or at another site with or without further processing.

### 2.3.2.2. End-of-waste concept

The End-of-Waste (EoW) concept means that a specific waste fraction can cease to be a waste under certain criteria given in the Waste Framework directive (see Box 2). If the criteria are fulfilled, the material will no longer be classified as a waste and it will instead become a product to subject to free trade and use (although for specific purposes). If no EoW legislation has been given at the EU level, member states can develop national EoW legislation for a certain waste material or make a case decision as part of the environmental permit. In the latter case, the material and conditions are limited to the case described in the environmental permit. It should also be noted that in case of a national EoW decision, the waste ceases to be waste only within that country. This means that the product status is not applicable when EoW construction products are shipped to another country.

#### Box 2. End-of-waste criteria

The End-of-Waste (EoW) concept means that a specific waste fraction can cease to be a waste under certain criteria given in the Waste Framework directive:

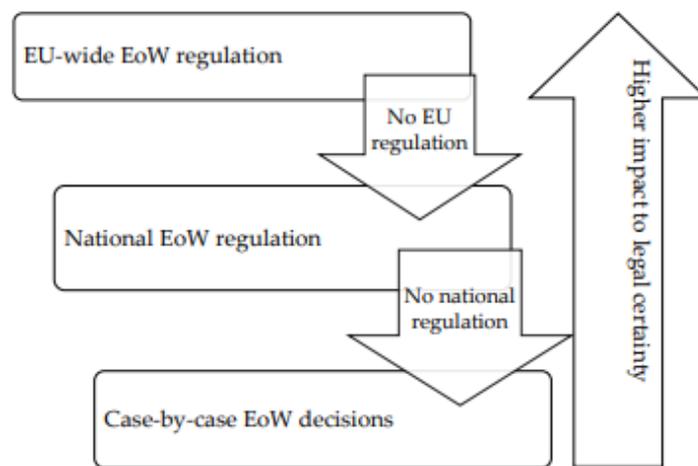
- a) the substance or object is commonly used for specific purposes;
- b) a market or demand exists for such a substance or object;
- c) the substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and
- d) the use of the substance or object will not lead to overall adverse environmental or human health impacts.

If a waste material obtains EoW status and ceases to be waste it becomes a product. In that case the use of the material will be regulated entirely by legislation on products.

<sup>22</sup> <https://claire.co.uk/projects-and-initiatives/dow-cop>

The EoW concept is built on the same elements as certification, the main difference being the reporting requirements of certified material according to waste legislation. Another difference might be need for quality control by a third party. Using the EoW concept is expected to reduce regulatory burdens with reporting obligations, and also improve the quality of the recyclable, and especially to change the image of waste materials. In member states with EoW criteria, professionalism in the whole recycling chain setting clear responsibilities for each stakeholder involved is required. Furthermore, documentation or records of the EoW material processing and quality testing are required. This means that the EoW concept is demanding for small-scale operations with input materials coming from several providers.

As stated earlier, for products receiving EoW status need to comply with product legislation (e.g. REACH). REACH sets obligation for registration that require efforts and, in some cases, also high costs.



*Different routes for achieving End-of-Waste status.<sup>23</sup>*

A procedure for End-of-Waste concepts for concrete waste is currently under development in EU. EoW concepts creates confidence in the EoW waste. In national EoW systems, national conditions for waste characteristics and use can be taken into account.

For the few waste types that have been given product status the effects are uncertain, both in relation to circulation and trade, so that EoW criteria seem mainly effective in reducing the administrative burden associated with the waste legislation (Johansson and Forsgren, 2020<sup>24</sup>).

In the national legislations in EU, the EoW concept has not been broadly applied for CDW. Only a few European countries (e.g., Austria, Belgium (Flanders), Finland, the Netherlands and UK) have introduced national legislation or protocols for stony CDW to cease to be a waste and to be used as aggregate both for unbound and bound construction. Additionally, a

<sup>23</sup> Turunen, T. 2018. *The concepts of waste and non-waste in the circular economy. PhD dissertation.* [http://epublications.uef.fi/pub/urn\\_isbn\\_978-952-61-2920-4/](http://epublications.uef.fi/pub/urn_isbn_978-952-61-2920-4/)\*

<sup>24</sup> Johansson, N. and Forsgren, C., 2020, Is this the end of end-of-waste? Uncovering the space between waste and products, *Resources, Conservation & Recycling*, Vol. 155, April 2020, 104656.

case-by-case decision on EoW status is applied to some extent in some member states (e.g., Ireland<sup>25</sup>).

In the definition of suitable EoW candidate stream, a special challenge is waste streams where the purity may vary and the characteristics for the waste stream depends on conditions from the use phase. Special challenges are also linked to the use of waste derived materials in indoor applications, due to risk for harmful indoor exposure. The construction products may also be contaminated during the use phase (e.g. spills) that means that the purity of EoW candidates must be controlled. For example, the Finnish EoW legislation given for certain plastic streams recovered by mechanical processes excludes plastic waste from demolition/renovation due to the risk for potential contamination of products/material streams during the use phase. For plastic waste from demolition/renovation activities, only a case-specific EoW decision is possible in Finland.

The EU study (financed by DG GROW and conducted by TAUW) published in June 2024 a prioritisation list for CDW as EoW candidates<sup>26</sup>. The results showed the highest potential for possible future EU-wide EoW criteria for the waste and by-product streams of aggregates, concrete, fired clay bricks and gypsum, followed by average potential for asphalt, inert insulation, plastic foam insulation, rigid plastics and wood, and a clear outlier for the stream of building products for reuse. The Commission decided in 2024 to develop EoW criteria for the mineral fractions concrete waste and gave the Joint Research Centre the task to collect background information and come up with a proposal (work will be reported later in 2025).

The Condereff report (2022)<sup>27</sup> highlights the main barriers for setting EoW criteria:

- Lack of coherence among member states' approaches to established criteria and the classification as waste or non-waste, mentioned by many as a major barrier to the trans-frontier shipment of EoW. Different regulations among the member states, posing also competitive disadvantages for companies located in countries applying higher environmental standards, if materials with lower quality requirements are introduced in the market;
- Inhomogeneities in the case-by-case EoW implementation within the same country, in particular when regional authorities are in charge of defining the EoW status;
- Lack of monitoring and of information on case-by-case decisions;
- Lack of traceability systems supporting the EoW status certification and lack of traceability of the materials once they reach the EoW;
- Characterization problems/costs for small batches of inert CDW;
- Variability of the composition inert CDW, unless selective demolition is implemented, and therefore potential presence of critical substances (such as gypsum), in specific batches."

### 2.3.2.3. Consequences of waste status

The classification of recovered stream as waste or product has several implication. It may influence the following:

- need for waste permit for treatment
- transport under supervised conditions
- difficulties for reclassification
- responsibility of waste holder in case of accidents etc

<sup>25</sup> <https://www.epa.ie/publications/compliance--enforcement/waste/FINAL-EoW-Criteria-for-Recycled-Aggregates---IMS.pdf>

<sup>26</sup> European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Reetsch, A., Tessien, J., Schröder, N., Zelfde, J. v. et al., *Background data collection for future EU end-of-waste criteria of construction and demolition waste – Final report*, Publications Office of the European Union, 2024, <https://data.europa.eu/doi/10.2873/213625>

<sup>27</sup> Luciano, A. et al 2022. Critical issues hindering a widespread construction and demolition waste (CDW) recycling practice in EU countries and actions to undertake: The stakeholder's perspective. *Sustainable Chemistry and Pharmacy* 29 (2022) 100745

- acceptance of end-users for uptake of recovered stream

APPENDIX A presents some Court decisions on product or waste classification

### 2.3.3. Hazardous waste classification

The classification of waste as non-hazardous or hazardous is regulated by the Waste Framework Directive (WFD) and the classification is primarily based on the European List of Waste (LoW) (2014/955/EU). In some cases, a particular type of waste on the list can be either hazardous or non-hazardous depending on the specific properties of the waste, and in these cases the correct classification has to be assessed based on their hazardous properties. If the waste is to be assessed based on its properties, all 15 hazardous properties (HP) must be evaluated, and additionally some specific substance limit values must be analysed.

Hazardous waste classification influences significantly the entire management and recycling chain of waste. Numerous EU regulations are setting special requirements for waste defined as hazardous waste. Examples of influence are legal procedures in waste handling (permit, taxation, inspections), requirements on waste storage, transportation, reuse/recycling and disposal of waste (e.g. landfilling), traceability from production to the final destination, and ban on the mixing of hazardous waste. Classification of waste as hazardous may in the future create conflicts with targets for resource efficiency (including Circular Economy) as the handling with hazardous waste is more restricted and complex than non-hazardous waste.

The recovery targets are specified based on the LoW codes. Furthermore, the LoW codes are also in digital product passports and in wastes audits of buildings to be renovated or demolished.

### 2.3.4. Enabling frameworks

The EU CDW management protocol was updated in 2024 (replaces the version from 2017). The scope of the updated document (entitled: EU construction & demolition waste management protocol including guidelines for pre-demolition and pre-renovation of construction works)<sup>28</sup> also gives guidelines for pre-demolition and pre-renovation audits of construction works,

The revised protocol presents a number of rules and includes best practices technologies across EU in the following topics:

- Identification of CDW and construction products through pre-demolition and pre-renovation audits
- Selective demolition
- Source separation and collection
- Preparing for re-use and recycling
- Waste logistics
- Waste processing
- Quality management
- Policy and framework conditions

Box 3 lists examples of guidelines prepared in some recent EU projects. The guidelines for waste auditing describe the waste auditing process, steps, content and defines the stakeholders to be involved in the process along the value chain. The auditing process aims to deliver such documents that the owner can submit a building permit application and open a

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<sup>28</sup>

call for demolition tenders. Furthermore, the outcome of the auditing should also provide a reliable basis for the order of a contractor concerning demolition waste. Waste auditing is mandatory in some EU countries, with a high focus on identification of hazardous materials, especially asbestos.

### Box 3. Links to some recent EU projects with guidelines for predemolition audits

**EIT PARADE-project** (2018-2019) (PARADE - Best practices for Pre-demolition Audits ensuring high quality Raw materials<sup>29</sup>): guidance document for conducting a waste audit, information on hazardous substances potentially present in construction products, reusability and recyclability of construction products, best practice examples.

**EU CITYLOOPS-project** (2020-2023)<sup>30</sup>: guidance document for conducting a waste audit, Circular Procurement Handbook, concrete examples and tools for incorporating circular procurement practices during the pretender, tender, and post-tender activities.

**EU CIRCUIT project** (2020-2023)<sup>31</sup>: (technical) criteria relevant to circular construction that could be used within public tenders of construction and refurbishment of public buildings and open spaces.

**(De)Construct for Circular Economy** (2020-2022)<sup>32</sup>: Material passport instruction<sup>33</sup> and model<sup>34</sup>; Predemolition audit manual<sup>35</sup> and model.

## 2.4. Chemical legislation – focus on hazardous substances

The chemical legislation concerns both new products and wastes. Hazardous substances are regulated in many pieces of legislation with different focus (e.g. out phasing of certain hazardous substances, safe use, safe waste management). The legislation sets restrictions or even bans for the presence of hazardous substances. Furthermore, specific requirements for permits, management (e.g. labelling, transport, storage, end-of-life options, skills, documentation etc) need to be fulfilled. Key legislative documents focusing on chemicals, which are relevant for this study and specifically for the uptake of recovered materials and reusable construction products in buildings analysed in this section are presented in Table 9, which summarizes the ambitions, relevance and challenges of different policies for the SUM4Re demos. The key legislative documents on chemicals are as follows:

- REACH
- POP
- Ozone depleting substances

<sup>29</sup> <https://op.europa.eu/en/publication-detail/-/publication/d63d5a8f-64e8-11ef-a8ba-01aa75ed71a1>

<sup>30</sup> Circular construction in Europe: handbook for local and regional governments, 2023. [https://cityloops.eu/fileadmin/user\\_upload/Resources/City-Loops-Circular-Construction-handbook.pdf](https://cityloops.eu/fileadmin/user_upload/Resources/City-Loops-Circular-Construction-handbook.pdf)

<sup>31</sup> <https://www.circuit-project.eu/>

<sup>32</sup> [\(De\)Construct for Circular Economy | LNEG Laboratório Nacional de Energia e Geologia](#)

<sup>33</sup> [Microsoft Word - Material Passport Instruction manual Final 2](#)

<sup>34</sup> [Material-passport\\_Model\\_EN.xlsm](#)

<sup>35</sup> [Pre-demolition-Audits-Guide\\_EN\\_FINAL.xlsx](#)

**Table 9. Overview of key chemical legislation relevant for SUM4Re**

Chemical legislation	Focus	Relevance for SUM4Re	Challenges
<b>REACH</b> <b>(EC/1907/2006)</b>	<p>The aim of the chemical regulation REACH is to ensure that all substances are manufactured and used safely. REACH concerns use of substances in products manufactured in EU or imported to EU. In REACH certain substances are listed as Substances of very high concern (SVHC) and published on the webpage of the European Chemical Agency ECHA.</p>	<p>REACH is relevant for products (e.g. recovered construction products retaining product status, End-of-waste streams).</p> <p>The Construction Products Regulation makes references to the Chemical Regulation related to reporting obligations.</p> <p>Recyclers may need to provide information on chemical content and comply with downstream user obligations. (Recyclers need to be aware of the chemical composition of materials they handle, as REACH mandates the registration and evaluation of substances, which includes those found in recycled products).</p>	<p>Information on potential hazard material content of historical products lacking.</p> <p>Lack of tools for identification of hazardous materials on-site.</p> <p>The SVHC list is constantly updated, and new hazardous substances are introduced.</p>
<b>POP Regulation</b> <b>(EU/2019/1021)</b>	<p>POP regulation requires that wastes containing substances listed in its annexes, such as certain brominated flame retardants or fluorinated substances (e.g. PFOS and PFOA), and exceeding specific concentration limits need to be destroyed and not re-circulated in new products.</p> <p>POP regulation is of concern both for waste and for secondary raw materials used in new products:</p> <ul style="list-style-type: none"> <li>- wastes containing substances listed in the annex IV to the regulation and exceeding certain concentration limits (so called POP wastes) need to be destroyed and not circulated in new products.</li> <li>- secondary raw materials and products containing substances listed in the annex I and exceeding the limits are prohibited to be put on the market (and thus cannot be recycled). It should be noted that for many POP substances the limits in the annex I are very low.</li> </ul>	<p>Identification of POP substances in predemolition audit.</p>	<p>List of banned or restricted substances will never be finalized as new information on toxicity of substances will set need for new additions in the list, which sets needs for constant follow-up, e.g. in raw material selection.</p> <p>The limits for recyclable materials are very low for some substances setting requirements for reliable sampling and analysis. The low POP limits (e.g. some flame retardants) may pose challenges for reuse and recycling of historical construction products.</p>
<b>Ozone depleting substances regulation</b> <b>(EU/2024/590)</b>	<p>Waste management obligations for insulation wastes containing ozone depleting substances (blowing agents) (ODS).</p>	<p>When old buildings are renovated, refurbished or demolished, foams containing ODS and fluorinated gases (F-gas) in laminated foam boards and foam panels must be handled in a way to ensure that emissions are avoided and the destruction of these gases therein (Joint obligation for building owners and contractors)</p>	<p>Lack of knowledge of ODS containing foams.</p>

### 2.4.1. Key chemical legislation for SUM4Re

The aim of the chemical regulation REACH (EC/907/2006)<sup>36</sup> is to ensure that all substances are manufactured and used safely. REACH concerns the use of substances in products manufactured in EU or imported to EU. All manufacturers and importers of substances must identify risks linked to the substances they manufacture and market in the EU. REACH provides a framework in which information can be passed from manufacturers and importers to the downstream users of chemicals. The main carrier of information is the Safety Data Sheet (SDS).

The POP regulation is the EU tool of limiting substances listed in the Stockholm Convention which is an international agreement with the aim of reducing and eliminating production, use and release of persistent organic pollutants (POPs). The convention comprises production (both intentional and unintentional), use, waste management and environmental supervision of POPs. The POP regulation (EU/2019/1021) is of concern both for waste and for secondary raw materials used in new products. The legislation sets also high requirements on acceptable techniques for destroying POP wastes.

Ozone depleting substances (ODS) and hydrofluorocarbons (HFCs) or other substances with high global warming potential (GWP) fall under the Montreal Protocol (UNEP, 1987)<sup>37 38</sup> unless otherwise noted in the Montreal Protocol or REACH (EC/907/2006). The Montreal Protocol includes a phase-out plan for both the production and consumption of ozone-depleting substances. From 2025, building owners and contractors shall ensure that, during renovation, refurbishing or demolition activities implying the removal of foam panels that contain foams with ozone-depleting substances (specified in Ozone depleting substances regulation (EU/2024/590)), emissions are avoided to the extent possible by handling the foams or the substances contained therein in a way that ensures the destruction of those substances. In the case of recovery of those substances, the recovery shall be carried out only by appropriately qualified personnel.

### 2.4.2. Examples of substances of concern

Example of restrictions and limit values given for certain substances of concern are collated in Table 10.

<sup>36</sup> The EU regulation REACH (EC/907/2006) stands for Registration, Evaluation, Authorisation and Restriction of Chemicals

<sup>37</sup> UNEP (1987) 'The Montreal Protocol on Substances that Deplete the Ozone Layer. Available at: <https://ozone.unep.org/treaties/montreal-protocol/montreal-protocol-substances-deplete-ozone-layer>

<sup>38</sup> United Nations (2016) Chapter XXVII Sub Chapter 2.f. Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer. Kigali: United Nations. Available at: [https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg\\_no=XXVII-2-f&chapter=27&clang=en](https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-2-f&chapter=27&clang=en)

**Table 10. Substances of concern mentioned in legislation.**

	Focus	Products	Wastes	Relevance for SUM4Re
<b>REACH (EU/1907/2006)</b>	<p>Safe use of substances in products manufactured in EU or imported to EU</p> <p>Safety data sheets are the main tool for communicating information on hazardous substances throughout the supply chain (e.g. manufacturers, importers, distributors).</p>	<p>A. Substances<sup>39</sup> on the Authorisation List (REACH Art. 57, Annex XIV) - Strict regulation requiring authorisation to use, phasing out obligations Currently</p> <p>B. Substances classified as substances of high concern (SVHC-candidate list) by same criteria as above, notification obligation<sup>40</sup> (substitution encouraged) – Currently)</p> <p>C. Other restricted (to be) restricted substances (e.g. PFAS, microplastics) (REACH Annex VII)</p> <p>D. Most harmful substance for essential use (Annex VI to the CLP Regulation<sup>41</sup>)</p>	<p>Substances of concern hampering reuse/recycling (Annex VI to CLP regulation) – this information is used as input for classification of waste as hazardous or non-hazardous according to Waste Framework Directive (see further below).</p>	<p>Reuse and recycling of historical materials and products requires reliable information on composition and potential exposure during use phase (e.g. spills, fires).</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• DEPH (Substance group A) used in flexible PVC flooring</li> <li>• Flame retardant HBCD (substance B) used in insulation materials</li> <li>• PFAS (substance C) used in adhesives, paintings, surface treatment application (repellent for dirt and water)</li> </ul>
<b>POP Regulation (EU/2019/1021)</b>	<p>Phasing out POP substances in products and destroying POP substances in waste.</p>	<p>Maximum content of POP substances in raw materials (Annex I).</p>	<p>Wastes containing POP substances exceeding limits need to be destroyed in high temperatures (with some exemptions) (Annex IV).</p>	<p>It should be noted that for many POP substances the limits in the annex I are very low (e.g. flame retardant HBCD).</p>
<b>Waste Framework Directive (2008/98/EC)</b>	<p>Safe management of waste (restrictions/reporting requirements for reuse and recycling of hazardous waste, e.g. permits, waste shipment).</p>		<p>Classification of waste as hazardous and non-hazardous primarily based on the European List of Waste (LoW) (2014/955/EU) or for case base decision based on a waste's hazardous properties (CLP, Annex VI).</p>	<p>Need for permits, restrictions in waste management (e.g. disposal of waste at landfill).</p>
<b>Montreal Protocol &amp; 2016 amendment</b>	<p>Phasing out both the production and consumption of ozone-depleting substances.</p>	<p>Insulation materials with blowing agents.</p>	<p>Substances (ODS) or hydrofluorocarbons (HFCs) are “super greenhouse gases” and must be phased out (agreement signed in 1987 and entered into force in 1989).</p>	<p>From 2025, when old buildings are renovated, refurbished or demolished, ODS and fluorinated gases (F-gas) containing foams in laminated foam boards and foam panels, must be handled in a way to</p>

<sup>39</sup> Substances meet at least one of the following criteria in CLP:

- Carcinogenic, Mutagenic, or Reproductive toxicants (CMRs): Categories 1A or 1B.
- Persistent, Bioaccumulative, and Toxic (PBT) or very Persistent and very Bioaccumulative (vPvB).
- Substances of equivalent concern, such as those with endocrine-disrupting properties.

<sup>40</sup> SVHC substances over threshold 0.1 % (1000 pm) by weight

<sup>41</sup> [EUR-Lex - 02008R1272-20231201 - EN - EUR-Lex](https://eur-lex.europa.eu/eli/reg/2023/1201/oj/1)

	Focus	Products	Wastes	Relevance for SUM4Re
				ensure that emissions are avoided and the gases therein are destroyed (Joint obligation on building owners and contractors).
<b>Construction Products Regulation (EU/2024/3110) (EU/305/2011)</b>	Protecting both the environment and human health by setting reporting obligations about the presence and release of hazardous substances in construction products and promoting sustainable resource use  (Note! National regulations may contain application specific limit values)	Classification of indoor air emissions for CE marking (e.g. based on Lowest concentration of interest (LCI list) <sup>42</sup> )  Limit values given in some national legislations for indoor emission  Limit values given some national legislations for release to water from construction products in contact with soil and water	Same rules applies for waste-derived products as for products	For indoor emission, high focus on Volatile Organic Carbon (VOC). Concerns e.g. paints, glues, surface treatment agents  For release to water: high focus on release of metals and sulphate (concerns e.g. recycling of concrete products)
<b>Asbestos</b>	Especially on worker safety	Not relevant	Many houses built between 1920s and the beginning of 1990s contain asbestos products	The timeline for bans varied in EU, the use banned in 1994 in Finland
<b>Quarts emission</b>	Worker safety related to respirable crystalline silica (RCS) – EU Directive (EU) 2017/239843			Risk assessments for RCS exposure, occupational exposure limit given
<b>Others (links to tools)</b>	The Substitute It Now (SIN) list <sup>44</sup> by ChemSec  The Endocrine Disruption eXchange (TEDX) list <sup>45</sup> of potential endocrine disruptors.  LOUS database <sup>46</sup> <sup>47</sup> (The Danish Environmental Protection Agency's ('the Danish EPA') List of Undesirable Substances (LOUS)	Examples (factsheets) of restricted, harmful substances in certain products provided in differences listed.		

<sup>42</sup> [https://single-market-economy.ec.europa.eu/sectors/construction/eu-lci-subgroup/eu-lci-values\\_en](https://single-market-economy.ec.europa.eu/sectors/construction/eu-lci-subgroup/eu-lci-values_en)

<sup>43</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017L2398>

<sup>44</sup> <https://sinlist.chemsec.org>

<sup>45</sup> [Search the TEDX List — The Endocrine Disruption Exchange](#)

<sup>46</sup> <https://www2.mst.dk/udgiv/publications/2011/05/978-87-92708-95-3.pdf>

<sup>47</sup> <https://chemycal.com/news/9d5e9f88-7195-4e21-8736-8de514c47f00/2012-2015-Danish-EPA-Surveys-on-Undesirable-Substances>

### 2.4.3. Enabling frameworks

Commission published in 2022 the Framework “Safe and sustainable by design”<sup>48</sup> which is linked to Chemicals Strategy for Sustainability – Towards a Toxic-Free Environment. It is a volunteer design approach recommended by the Commission where objectives such as minimizing hazardous chemicals use, reducing greenhouse gas emissions, and fostering materials reuse and recycling in a circular economy are built into product design, all this requires also economic sustainability for product to enter the market. In the framework, a high focus on hazardous substances in design, use and end-of-life stage.

The aim of the framework is to substitute hazardous substances with more environmental solutions (comparison of hazard properties of alternative solutions). It also addresses environmental sustainability data (LCA data).

The safety and sustainability assessment includes four steps:

- Step 1 - Hazard assessment of the chemical/material
- Step 2 - Human health and safety aspects in the chemical/material production and processing phase
- Step 3 - Human health and environmental aspects in the final application phase
- Step 4 - Environmental sustainability (LCA)
- Step 5 – Socio-economic sustainability (no guidance yet)

The Joint Research Centre (JRC) has published guidance documents<sup>4950</sup> for conducting the assessment. For chemicals where there is a lack of toxicological data, several modelling tools are proposed for step 1. For steps 2 and 3, references are made to REACH documents for assessments and exposure/emission models are listed. Both the modelling and assessment procedure are still rather complex and require deep knowledge on chemical hazard properties and risk assessment.

## 2.5. Green Public Procurement and EU Public Procurement Directive

Green Public Procurement (GPP) is a voluntary instrument used by European public authorities that allows them to choose environmentally friendly goods, services and works. The public sector organizations can apply environmental criteria in the public procurement processes in construction, renovation and demolition work. The GPP is a potential tool for enhancing sustainability or circularity goals by setting different requirements such as the demand of products with recycled content, or directing waste recovered in demolition works for recycling or set requirements for mandatory implementation of pre-demolition audits in demolition activities or obligations to implement selective demolition process or take into account disassembly/deconstruction in choice of construction products. GPP criteria have an important role to play in creating demand, enlarge markets by setting requirements on energy consumptions and GHG, material circularity, efficient use of water resources etc. Implementation will only be effective if criteria are based on existing policy instruments such as the CPR and any other regulatory instrument applicable to construction products.

In the second CEAP (2020)<sup>51</sup>, the Commission set a goal to propose sectoral legislation for minimum mandatory GPP criteria and targets related to product reuse, recycling, remanufacturing and end-of-life in order to enhance circularity. For promoting circularity

<sup>48</sup> COMMISSION RECOMMENDATION (EU/2022/2510) establishing a European assessment framework for ‘safe and sustainable by design’ chemicals and materials

<sup>49</sup> Caldeira et al., 2022, Safe and sustainable by design chemicals and materials - Framework for the definition of criteria and evaluation procedure for chemicals and materials, <https://publications.jrc.ec.europa.eu/repository/handle/JRC128591>

<sup>50</sup> Caldeira et al., 2022, Safe and Sustainable by Design chemicals and materials Review of safety and sustainability dimensions, aspects, methods, indicators, and tools, <https://publications.jrc.ec.europa.eu/repository/handle/JRC127109>

<sup>51</sup> [https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC\\_1&format=PDF](https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF)

principles throughout the lifecycle of buildings, the EU Level(s) is proposed to be used to integrate life-cycle assessment (LCAs) in public procurement and the EU sustainable finance framework.

The new CPR supports initiatives for setting EU GPP rules for construction products (from the end of 2026). These new rules will introduce mandatory minimum environmental sustainability requirements for public procurement of construction products, which will facilitate the emergence of lead markets for low-carbon products. This emphasizes the growing emergence of more mandatory GPP requirements at Member State level.

The national strategies for circular economy presented by many EU countries define construction sector as a prioritized sector. The goal, for example, in the Nordic countries is to support increasing innovation through more circular projects by setting requirements on climate and environmental savings in public procurements.<sup>52</sup>

The general framework/procedures (e.g. exemptions) to be used for applying GPP criteria are presented in the EU Public Procurement Directive.

According to results from the Condereff project<sup>53</sup>, 23 countries in EU have adopted a national GPP plan. However, for buildings and roads, the GPP is still only implemented to a limit extent in the EU as the mandatory criteria are seldom set in the tendering documents. The price is often still used as awarding criteria in case not policy measures influence the decision for reuse and recycling. Also, the lack of knowledge among the authorities for formulation of tenders as well as in decision making was mentioned as barrier for the use of GPP to support the recycling. Also the EU CIRCuIT<sup>54</sup> project and the EU CITYLOOPS<sup>55</sup> project presented criteria and toolkits for circular public procurement tenders in the construction sector

## 2.6. Summary of focus in environmental legislation related to construction products and identified key bottlenecks for SUM4Re cases

As general in the construction sector, the EU legislation focuses on the following sustainability goals that are covered by several EU regulations:

- Resource efficiency
- Climate aspects
- Hazardous substances:
  - related to toxicity
  - related to biodiversity (usually limited for construction products, focusing on buildings – e.g. site planning)

For achieving the goals for reuse and recycling of construction products, enabling frameworks (e.g. digitalisation, standards) have been or are developed and under implementation. Also administrative (e.g. EoW wide concepts for selected streams) and economic actions (e.g. EU Taxonomy, GPP, taxation) support the reuse of construction products in new buildings and the uptake of secondary raw materials in construction products.

Although the recovery rate of mineral CDW is rather high in Europe, the recovery is largely based on backfilling operations and low-quality recovery, mainly of concrete waste which forms a majority of generated CDW. There are significant variations in the recovery of CDW between EU Member States. The Commission is planning to set material specific recovery

<sup>52</sup> Simon Kaarsberg and Lea Kress. 2023. Policies Enabling the Reuse of Construction Products in the Nordics. Nordic Innovation. 2023. <https://pub.norden.org/us2023-441/us2023-441.pdf>

<sup>53</sup> Luciano, A. et al 2022. Critical issues hindering a widespread construction and demolition waste (CDW) recycling practice in EU countries and actions to undertake: The stakeholder's perspective. Sustainable Chemistry and Pharmacy 29 (2022) 100745

<sup>54</sup> <https://www.circuit-project.eu/> Deliverable D7.4 Recommendations: Criteria for public tenders on construction

<sup>55</sup> <https://cityloops.eu/cities-and-the-circular-economy/circular-procurement> Circular Procurement Toolkit

target for construction and demolition waste (should have been set in year 2024). See Box 4 for identified hotspots related to end-of-life stage of buildings.

**Box 4. Examples of hotspots in EoL stage for achieving a sustainable building (as addressed in EEA report 09/2024<sup>56</sup>)**

- Despite high recycling rates for inert mineral waste, CDW is currently downcycled, mainly benefiting savings of natural resources and only to limited extent CO<sub>2</sub> savings
- A truly circular construction requires increasing the reuse of end-of-life products and directing recovered materials from downcycling to high-grade recycling
- Circularity aspects are currently not sufficiently addressed in the management of construction and demolition waste. Especially selective demolition and waste sorting practices influence the waste quality and subsequent processing needs for high-grade recycling.
- Challenges at the end-of-life stage are often related to decisions at the design stage and lack of traceability of origin and composition.

### 2.6.1. Key bottlenecks identified in the European policy framework

In the previous sections, the relevance and challenges of relevant regulations for SUM4Re cases have been analysed. The key bottlenecks identified for an efficient uptake of reusable construction products or construction products with recycled content can be summarised as follows (of which some are interlinked):

1. Lack of measures or guidance for conflicting environmental targets (e.g. reuse of construction products is hindered by strict climate ambitions, high grade recycling processes requires energy causing increased CO<sub>2</sub> footprint)
2. For securing a sufficient quality of reusable and recyclable construction products/materials: lack of mandatory requirements for pre-demolition auditing, selective demolition and waste sorting and tools for quality testing
3. Costs related to new innovative solutions and uncertainty in uptake of new solutions (e.g. lack of support for implementation, taxation, bans for disposal of recyclable material, promotion of GPP)
4. Lack of guidance on acceptability procedures for reuse and use of recycled materials in certain applications (e.g. quality requirements for different applications (including suitable tools for assessment), environmental and technical criteria, standards, unclarities how to understand product status (remaining the product status) and the preparing for the reuse.)
5. Clarification for CE marking of reusable construction products and of construction products with recycled content
6. Lack of knowledge (skills of workers, lack of experience for use of digitalisation tools in construction sector, lack of data (quality, origin) on historical construction products)
7. Complexity in the EU rules to be followed (e.g. need for permits for waste management and shipment, special knowledge needs for assessment of hazardous substances in materials and waste)

<sup>56</sup> EEA Report 09/2024 Addressing the environmental and climate footprint of buildings.  
<https://www.eea.europa.eu/en/analysis/publications/addressing-the-environmental-and-climate-footprint-of-buildings>

### 3. Local and national policies

This section provides an in-depth analysis of the regulatory landscape concerning smart data acquisition, urban mining, product reuse, and circular construction. The study examines the challenges and opportunities presented by existing laws and policies for local governments and stakeholders. It also presents best practices from municipalities in Norway, Netherlands and Spain, showcasing municipal-level initiatives for circular construction.

The following quote highlights the relevance of a comprehensive approach to information systems and circular construction governance:

*“Circular construction starts with a design that takes into account all of the phases in the lifecycle of a structure and continues in the following cycle. The following lifecycles of construction elements, products and materials form part of that design process. The architect must know how the demolition contractor works, the recycler must know what technical requirements the circular constructor places on the materials that he uses, so that the recycling technology can be adapted to suit. The contractor must ensure that important information concerning the materials that he uses is available to the owner / manager of the structure and the manager must ensure that the demolition contractor - sometimes more than a hundred years later - can also have access to the information. As a result, while circular construction is at first a design- and technological challenge, it quickly progresses to cooperation, knowledge sharing and transparency. New business models undoubtedly - already - arise from the intensive practical cooperation (Rijkswaterstaat, Circular economy in the Dutch construction sector, p. 9, 2015)*

This section aims to explore the local policy landscapes in the demo regions, as well as finding best practices for overcoming (EU and regional) legislative bottlenecks and for promoting circularity of buildings. The study focused on stakeholder engagement in the form of interviews and an on-line survey. Some case examples of good practises on how local policies can support circular construction are presented in Annex B.

#### 3.1. Methods

The research methodology for this report is based on a mixed-methods approach, combining qualitative and desk-based analysis to assess the regulatory landscape and practical implementation of circular construction across selected pilot countries. The following components were employed:

- **Desk Research:** A comprehensive review was conducted of national and EU-level regulations, policy documents, reports, and peer-reviewed academic literature related to circular construction, urban mining, smart data acquisition, and material reuse. This included legal frameworks, public procurement policies, digital tools, and benchmarking systems relevant to the Netherlands and comparable practices in Spain and Norway.
- **Stakeholder Engagement through Events:** Qualitative data were gathered during interactive sessions and discussions at two key events. The first was the *METREX Symposium: Rules and Space to Speed up Circular Construction*, held on 14–15 November 2024 in The Hague. The second was the *Circular Construction Enabled by Photonics Technologies* event on 5 December 2024 at The Hague University of Applied Sciences (THUAS), which brought together circular construction experts from over 10 European countries. These events offered firsthand insights into the challenges, innovations, and legal interpretations shared by stakeholders across municipal, academic, and private sectors.
- **Online Survey:** A structured questionnaire was developed using Microsoft Forms and disseminated through the SUM4RE consortium network. The survey targeted circular construction professionals and public sector representatives in the Netherlands, Spain,

and Norway, aiming to capture comparative perspectives on barriers, opportunities, and enabling frameworks. Data collection is ongoing and will inform follow-up analysis in subsequent phases.

- Semi-Structured Interviews:** In-depth interviews were conducted via Microsoft Teams or in person with practitioners and policymakers actively involved in circular construction. The interviews followed a semi-structured guide developed by the research team, allowing for consistent thematic exploration while remaining flexible to capture case-specific knowledge. These interviews provided rich qualitative data on implementation dynamics, legal bottlenecks, procurement practices, and data-sharing challenges in the pilot countries.

This triangulated approach enables both breadth and depth in the analysis, aligning with the aims of Task 1.2 of the SUM4RE project and supporting actionable insights for EU-level and national policy development.

### 3.2. Policy-landscapes in three demo regions

#### 3.2.1. The Norwegian policy framework related to the pilot case

Norway promotes circular construction through a mix of legal, economic, technical, and informational measures. Legally, and in line with the EU Waste Framework Directive, Norway requires recycling or reuse of at least 70 % of non-hazardous CDW. The Building Regulation (TEK17) mandates waste management plans for projects with over 10 tons of waste, though enforcement is inconsistent. The Regulation on Documentation of Building Products (DOK) was updated in 2023 to simplify the reuse of materials, allowing self-documentation and easing requirements for non-CE-marked products.

Economic instruments also play a role, particularly through Green Public Procurement (GPP), which incentivizes reuse by prioritizing circularity in public tenders supported by online platforms. However, unlike other Nordic countries, Norway does not impose a landfill tax, which could further encourage reuse and recycling.

Technical support to circular construction is provided by guidelines for material mapping before demolition and for promoting the design of buildings for disassembly and the digital tracking of materials. Different platforms operate marketplaces for reused/recycled materials. Meanwhile, sustainability certification systems have been adapted to award reuse and recycling in design or rehabilitation of construction. However, standardized procedures for assessing and reintroducing reclaimed components in new constructions are not available yet, with only a few exceptions.

Initiatives like the Norwegian Coordination Council for Digitalization in the Construction Industry have piloted digital tools for material traceability, digital material banks, and waste management on construction sites. Climate partnerships between the government and the industry aim at accelerating uptake of sustainable construction solutions in practice, with circular economy efforts at the core of the process. The government continues to support digitalization efforts, as outlined its Circular Economy Plan (2024/25).

Specific Norwegian policy instruments and initiatives are listed in Table 11 below.

**Table 11. Existing circular construction policy instruments in Norway**

Policies supporting circular construction	Explanation: Name of policy/strategy; what is the focus (building phase + what materials), tools, guidelines, indicators in use; is the implementation successful, etc.
Political and legal instruments	
Building laws and regulations	The Norwegian Planning and Building Act, enacted in 2008, serves as the primary legislative framework

	<p>governing land use planning and building processes in Norway. Its main objectives include promoting sustainable development, ensuring coordinated planning across governmental levels, and facilitating public participation in decision-making. The Act delineates responsibilities among municipalities, counties, and national authorities, emphasizing transparency and predictability in planning procedures.<sup>57</sup></p> <p>On Svalbard, where the Norwegian SUM4RE pilot is located, the Planning and Building Act does not apply. Those undertaking construction projects must adhere to the Building Regulations for Longyearbyen, established in 2016.<sup>58</sup> Currently, these regulations are being revised by the Longyearbyen Community Council, with assistance from the Norwegian Building Authority (DIBK).<sup>59</sup></p> <p>The primary goal of the revision is to update the regulations to align with the standards of the Technical Building Regulations (TEK17)<sup>60</sup>, incorporating local adaptations to address challenges like permafrost melting, stormwater management and greenhouse gas accounting for larger construction projects. The revised regulations are scheduled for public consultation in the spring 2025, with adoption anticipated within the same year.<sup>61</sup> For the time being TEK 10, predecessor of TEK17, is still in use on Svalbard.<sup>58</sup></p> <p>Since 2022, TEK17 requires buildings to be designed to minimize waste over their lifespan. Products suitable for reuse and material recycling should be chosen and design should facilitate future deconstruction within practical and economic limits.<sup>60</sup></p>
<p><b>Non-waste categorization (e.g. national/regional end-of-waste concept, retained product status) of dismantled components/materials</b></p>	<p>Norway follows the EU Waste Framework Directive, which mandates at least 70 % (by weight) of non-hazardous CDW be prepared for reuse, recycling, or other material recovery.</p> <p>Waste management in the construction sector in Norway is regulated in TEK17, which requires the preparation of waste plans before new construction, renovation or demolition procedures generating more than 10 t of waste TEK17<sup>60</sup> requires at least 70 % (by weight) of the CDW to be sorted, mostly on-site. Hazardous waste is registered and sorted separately with specific requirements and limit values established in the Norwegian waste regulation<sup>62</sup>. Non-hazardous waste is sorted by material for reuse, recycling, incineration, or landfill. Some waste remains unsorted and is incinerated or landfilled.</p> <p>However, while regulations for sorting exist, they are not consistently adhered to, potentially due to a lack of adverse consequences for companies. Moreover, the sorting requirements are not reflected in publicly</p>

<sup>57</sup> [Planning and Building Act \(2008\) - regjeringen.no](https://www.regjeringen.no)

<sup>58</sup> [Byggeforskrift for Longyearbyen - - Lovdata](#)

<sup>59</sup> [Direktoratet for byggkvalitet](#)

<sup>60</sup> [Byggeteknisk forskrift \(TEK17\) med veiledning - Direktoratet for byggkvalitet](#)

<sup>61</sup> [Byggeindustrien.no](https://www.byggeindustrien.no)

<sup>62</sup> [Avfallsforskriften - miljodirektoratet.no](#)

	<p>available waste data from the sector, as the data is aggregated in reporting. This applies to other Nordic countries as well.<sup>63</sup></p> <p>On Svalbard, C&amp;D waste management adheres to TEK10 and local waste management regulations requiring construction, demolition, or rehabilitation projects to submit a waste management plan detailing expected waste types and disposal methods. Before demolition, hazardous materials must be identified and safely removed, with a report documenting their handling. After completion, a final report must be submitted showing how waste was recycled or disposed of. Product reuse is not explicitly mentioned in these provisions.<sup>64</sup></p>
<b>Predemolition audit guidelines</b>	<p>The construction guideline “Ombrukskartlegging av bygninger” addresses procedures and requirements for the reuse mapping of building components in connection with the demolition or rehabilitation of buildings<sup>65</sup>, what is a requirement in TEK17.</p>
<b>Acceptance procedures for reuse and recycling of products/materials in applications</b>	<p>For reclaimed components and materials to be reused in new buildings, they must meet requirements outlined in TEK17.<sup>60</sup> However, there are currently no specifically designed acceptance procedures and criteria for component reuse<sup>66</sup>, with the exceptions of the standards provided under “Technical Instruments”.</p> <p>The Regulation on Documentation of Building Products (DOK)<sup>67</sup>, which governs the documentation, marketing, and use of construction products in Norway, aligns with the EU Construction Product Regulation (CPR) to facilitate the trade of CE-marked products across the EEA/EU. The DOK was revised in 2023 to promote circular use and recycling of building materials. As a result, developers and resellers can now self-document reused materials, fostering a stronger market for reclaimed construction products. In addition, non-CE-marked reused materials disassembled without substantial alteration are now exempt from full documentation requirements. However, these materials must still meet TEK17 requirements for their intended reuse.</p> <p>To close the gap between the relaxed requirement of the DOK and the compulsory documentation of compliance in TEK17, the national initiative Norwegian knowledge arena<sup>68</sup> established a use-specific and limited Declaration of Performance (DoP)<sup>69</sup> to standardize documentation for circular materials, using digital templates and classification systems.</p>
<b>Economic instruments</b>	

<sup>63</sup> [Reuse, recycling and recovery of construction and demolition waste in the Nordic countries](#)

<sup>64</sup> [Forskrift om avfallshåndtering og avfalls- og avløpsgebyrer i Longyearbyen planområde - Kapittel 3. Byggavfall - Lovdata](#)

<sup>65</sup> [700.803 Ombrukskartlegging av bygninger - Byggforskserien](#)

<sup>66</sup> [Forsvarlig ombruk av byggevarer. Resirkel 2019](#)

<sup>67</sup> [Forskrift om dokumentasjon av byggevarer \(DOK\) - Direktoratet for byggkvalitet](#)

<sup>68</sup> [SRAS](#)

<sup>69</sup> [DoP – Declaration of Performance](#)

<p><b>Green Public Procurement (GPP) incentives, such as demolition, renovation, or real estate tendering prioritizing circularity</b></p>	<p>The Norwegian government agency DFØ (Direktoratet for forvaltning og økonomistyring) promotes circular public procurement practices in construction and real estate. As outlined in the 2021 Action Plan for climate-friendly procurement<sup>70</sup>, DFØ enhances the usability of the platform for public procurement information, Anskaffelser.no.<sup>71</sup></p>
<p><b>Tax/economic incentives for achieving circularity targets, including innovation funds.</b></p>	<p>As opposed to most other Nordic countries, Norway does not have an additional landfill tax.<sup>63</sup></p> <p>ENOVA is a Norwegian government agency supporting the transition to a low-emission society by funding energy-efficient projects. They provide financial support for innovative solutions in building construction, and renovation to improve energy performance and support Norway's climate goals.<sup>72</sup></p> <p>On Svalbard, the Svalbard Environmental Protection Fund supports projects aimed at preserving the unique Arctic environment of the archipelago. It provides funding for initiatives that focus on sustainable development, environmental protection, and minimizing human impact on the region's ecosystems. While the fund's primary focus is on environmental conservation, it also encourages projects that promote circularity, such as reducing waste, recycling, and reusing materials and products for construction and infrastructure.<sup>73</sup></p>
<p><b>Technical instruments</b></p>	
<p><b>National standards for reuse and recycling of products/materials</b></p>	<p>Available national standards promoting reuse of structural building components are:</p> <p>NS 3682: Covers the process from dismantling to the assessment of existing hollow core slabs, specifying requirements for their performance verification and enabling their documentation in a similar way as newly produced slabs.<sup>74</sup></p> <p>NS 3691: Provides a standardized method for assessing used timber by means of visual grading, enabling its reuse in new constructions and products.<sup>75</sup></p>
<p><b>Availability and use of handbooks, guidelines for reusable construction products and construction products with recyclable content.</b></p>	<p><i>The guideline Byggenæringens klimafotavtrykk</i> published by the Direktoratet for Byggkvalitet (DIBK)<sup>59</sup> emphasizes designing buildings for disassembly by selecting reusable materials and adaptable construction methods. It also advocates for reporting requirements and digital databases to document and track materials for future reuse.<sup>76</sup></p> <p>The SINTEF report <i>Ombruk av byggevarer – innspill til statlige føringer</i> examined procurement models, regulations, market dynamics, and financial incentives for</p>

<sup>70</sup> [DFO Handlingsplan 2021 Digital-v2 0.pdf](#)

<sup>71</sup> [Anskaffelser.no | Fagsider om offentlige anskaffelser](#)

<sup>72</sup> [Enova](#)

<sup>73</sup> [Grants | Svalbards miljøvernfond](#)

<sup>74</sup> [Norwegian Standard for hollow core slabs for reuse – NS 3682](#)

<sup>75</sup> [Norsk Standard for evaluering av returtre – NS 3691](#)

<sup>76</sup> [240604 Byggenæringens Klimafotavtrykk - et kunnskapsgrunnlag.pdf](#)

	<p>reusing building components. Industry interviews highlighted the need for mandatory reuse, public reuse mapping, faster permits, and better financial support. Proposed measures include a digital reuse portal and resale in building supply stores. Participants stressed prioritizing practical implementation over bureaucracy while acknowledging the need for regulatory support.<sup>77</sup></p>
<p><b>Supply &amp; Demand logistics (Digital marketplaces for reused/recycled products and materials &amp; Storage spaces for re-used or recycled materials.)</b></p>	<p>For CDW there are facilities and sites with databases operated by companies like Loopfront, Resirquel, Rehub, Sirken, which receive materials from building sites. The buyer has the responsibility for quality control of the reused products.<sup>63</sup></p> <p>The Circular Resource Centre is a pilot innovation project under FutureBuilt, aiming to serve as a structured marketplace that facilitate the buying and selling of used construction materials for circular building projects.<sup>78</sup></p> <p>Porfyr, a marketplace designed to facilitate the exchange of surplus materials, serves as a tool for builders, contractors, and processing facilities to promote the reuse of mass materials (earth, stone, concrete) from their construction projects.<sup>79</sup></p> <p>On Svalbard, the store Bruktikken offers used products for sale. While it provides a broader range of products, it does offer a variety of construction products.<sup>80</sup></p>
<p><b>Sustainability certification systems incorporating circularity principles</b></p>	<p>According to the Norwegian building law, products suitable for reuse should be eco-labeled (Svanemarket/EU-Blomsten, Green Building Alliance's ECOproduct categorization).<sup>60</sup></p> <p>BREEAM-NOR is a sustainability certification system tailored for Norway, published by the Norwegian Green Building Alliance. Its purpose is to assess and recognize the environmental performance of buildings throughout their lifecycle. Circularity principles are promoted and integrated into the certification by awarding specific credits for incorporating reclaimed materials and reducing waste in construction and demolition processes.<sup>81</sup></p>
<p><b>Information instruments</b></p>	
<p><b>Digital tools for circularity (BIM, databases for traceability, product passports, etc.)</b></p>	<p>The use of BIM and digital databases in connection with circular construction practices is still an exception in Norway. Norwegian startups, such as Madaster, provide online registry for materials and products, and enable the creation of material passports based on user-provided BIM models.<sup>82</sup></p>
<p><b>Available protocols and/or partnerships for data sharing and capacity building</b></p>	<p>Norway is participating in the Digital Europe Programme (DIGITAL) 2021–2027, which is the EU's new major investment and capacity-building program for digital</p>

<sup>77</sup> [SINTEF Open: Ombruk av byggevarer – innspill til statlige føringer](#)

<sup>78</sup> [FutureBuilt](#)

<sup>79</sup> [Porfyr](#)

<sup>80</sup> [Renovasjon - Longyearbyen lokalstyre](#)

<sup>81</sup> <https://byggalliansen.no/sertifisering/>

<sup>82</sup> [Madaster plattform | Registrer materialer og produkter](#)

	<p>transformation and the use of innovative digital technologies in society and business.<sup>83</sup></p> <p>The Norwegian Coordination Council for Digitalization in the Construction Industry (2021-2023) ran pilot projects to improve digital information flow, focusing on materials with high reuse potential and supporting digital material banks. A digital waste management pilot and tools for digital transactions on construction sites were also launched. The Norwegian government continues to support digitalization in the industry.<sup>84</sup></p> <p>The Norwegian government has launched climate partnerships to facilitate structured dialogue between the state and industry, aiming to accelerate emission reductions, promote sustainable value creation, and boost competitiveness in Norwegian business, with circular economy efforts at the core of the process.<sup>84</sup></p> <p>Bærum Municipality, the Norwegian Environment Agency (via Klimasats funding), Regional Research Fund Viken, and Enova are funding the Bærum Resource Bank, which aims to maximize the recycling and reuse of surplus materials (stone, soil, concrete, asphalt) from regional construction and infrastructure projects. The goal is to turn these materials into resources for reuse, as a first choice for contractors and other actors.<sup>85</sup></p>
<p><b>Communication about good practices and success stories</b></p>	<p>FutureBuilt is a Norwegian program promoting climate-friendly urban development through innovative architecture and planning. Established in 2010, it collaborates with multiple municipalities to showcase climate-neutral urban areas. A key focus is circular construction, emphasizing material reuse and recycling to reduce waste and environmental impact, demonstrated through success stories.<sup>86</sup> (see also Annex B).</p>

### 3.2.2. The Dutch policy framework related to the pilot case

The Netherlands has established a comprehensive policy framework to promote circular construction, positioning itself as a European frontrunner in sustainability. Key instruments include the National Circular Economy Programme and the sector-specific Transition Agenda for Construction, which emphasize lifecycle thinking, urban mining, and circular procurement. Regulatory frameworks such as the Building Decree 2012 and the Environmental Performance of Buildings (MPG) provide technical guidance, while procurement legislation and Green Deal initiatives foster public-private collaboration. Non-legislative tools like Madaster and Het Nieuwe Normaal enhance traceability and standardization. Despite this progress, challenges persist in regulatory enforcement and harmonization with EU-level directives, pointing to the need for continued policy innovation and integration across governance levels.

<sup>83</sup> [Investing in the future Digital Transformation 2021-2027 | Shaping Europe's digital future](#)

<sup>84</sup> [Handlingsplan for en sirkulær økonomi 2024-2025](#)

<sup>85</sup> [Bakgrunn og aktiviteter | Bærum ressursbank | Bærum kommune](#)

<sup>86</sup> [FutureBuilt](#)

Table 12. Existing circular construction policy instruments in the Netherlands

Policies supporting circular construction	Explanation: Name of policy/strategy; what is the focus (building phase + what materials), tools, guidelines, indicators in use; is the implementation successful etc...
<b>Political and legal instruments</b>	
<b>Building laws and regulations</b>	<p><b>National Circular Economy Programme (2016):</b> Sets the ambition of a fully circular economy by 2050. <b>Transition Agenda for the Construction Sector (2018)</b> focuses on market development, regulatory improvement, and cultural change. <b>Environmental Management Act (Wet Milieubeheer)</b> provides the legal basis for environmental regulation, including waste management.</p> <p><b>Dutch Building Decree 2012 (Bouwbesluit):</b> Establishes technical requirements for construction, including environmental performance (MPG). Integrates sustainability standards incrementally.</p>
Non-waste categorization (e.g. national/regional end-of-waste concept, retained product status) of dismantled components/materials	Although no specific Dutch regulation enforces a national end-of-waste status for construction materials, platforms like <a href="#">Madaster</a> promote digital passports for reused materials, helping track product status and value retention for future reuse.
Predemolition audit guidelines	The <b>Environmental Management Act</b> includes rules on waste separation and demolition permits, but no mandatory national predemolition audit protocol yet. However, municipalities like Amsterdam and Leiden promote audits in circular tenders.
Acceptance procedures for reuse and recycling of products/materials in applications	Acceptance is guided by existing technical standards in <b>Bouwbesluit</b> and <b>Environmental Performance of Buildings (MPG)</b> . <a href="#">Het Nieuwe Normaal</a> provides benchmarks and guidelines for accepted performance levels of reused/recycled materials.
<b>Economic instruments</b>	
Green Public Procurement (GPP) incentives, such as demolition, renovation, or real estate tendering prioritizing circularity	<p><b>Milieu-investeringsaftrek (MIA) / Vamil</b> schemes: Dutch tax deduction incentives for environmentally friendly investments, including sustainable construction. <b>Green Deal Circular Procurement</b> also promotes innovative funding paths.</p> <p><b>The Socially Responsible Procurement (SRP)</b> framework is a key national policy instrument in the Netherlands that encourages public authorities to include sustainability, social impact, and circularity as criteria in public tenders. Managed by <a href="#">PIANOo—the Dutch expertise centre for procurement—SRP</a> offers municipalities and public entities tools, templates, and sector-specific guidelines to implement circularity goals through procurement. The framework supports the integration of lifecycle thinking, material reuse, and energy performance in construction projects. Under SRP, local governments are encouraged to prioritize environmental and social value in award criteria, going beyond lowest price. Cities such as Amsterdam, Leiden, and The Hague have embedded SRP practices in their procurement strategies by applying weighted scoring systems for sustainability, requiring pre-demolition audits, and requesting materials passports. Although</p>

	<p>SRP is not mandatory, it aligns with national ambitions for a circular economy and is widely promoted as a best practice in public commissioning.</p>
<p><b>Tax/economic incentives for achieving circularity targets, including innovation funds.</b></p>	<p><b>MIA/Vamil Schemes</b> (<i>National – Ministry of Infrastructure and Water Management &amp; Tax Authority</i>): The Environmental Investment Allowance (MIA) and Arbitrary Depreciation of Environmental Investments (Vamil) are tax schemes that offer financial advantages for environmentally conscious investments, including in circular construction. These incentives allow companies to deduct a significant portion of the investment costs for sustainable technologies from taxable profits or to write them off flexibly. These schemes help lower the barrier to entry for circular innovation in the private sector. Some municipalities, such as Amsterdam and The Hague, are exploring local pilot subsidy programs or complementary investment credits for projects that integrate circular materials, design for disassembly, or urban mining principles.</p>
<p><b>Technical instruments</b></p>	
<p><b>National standards for reuse and recycling of products/materials</b></p>	<p>While no mandatory national reuse standards exist, <b>Het Nieuwe Normaal</b> acts as a de facto national benchmark. It provides shared definitions and measurable criteria for assessing circularity in construction projects.</p>
<p><b>Availability and use of handbooks, guidelines for reusable construction products and construction products with recyclable content.</b></p>	<p><b>Het Nieuwe Normaal</b> offers a practical benchmark developed by a coalition of frontrunner municipalities, developers, and knowledge institutes under <b>Platform CB'23</b>. It provides a shared language and quantifiable performance levels for circular construction, making it easier to assess tenders and projects based on uniform criteria. It includes metrics for circular material use, adaptability, and environmental impact, and is increasingly used in public procurement and pilot projects.</p> <p><b>Madaster</b> serves as a materials passport platform that registers building components and their material value, enabling lifecycle tracking, reuse planning, and circular design. It allows architects, developers, and asset managers to assess the environmental and financial impact of material choices and disassembly potential over time.</p> <p><b>Platform CB'23</b> (Circular Building 2023) is a national collaborative initiative involving Rijkswaterstaat, NEN (Dutch Standardization Institute), and many public-private actors. It creates consensus-based guidelines, handbooks, and definitions for circular construction—such as uniform indicators for circularity, product categorization, and standard contract clauses—which are critical for mainstreaming circular practices across the Netherlands.</p>
<p><b>Supply &amp; Demand logistics (Digital marketplaces for reused/recycled products and materials &amp; Storage spaces for re-used or recycled materials.)</b></p>	<p>One of the critical enablers of circular construction is the efficient coordination between the supply and demand of secondary materials. In the Netherlands, digital marketplaces and physical storage hubs are emerging as essential infrastructure components for facilitating material reuse.</p>

	<p><b>Digital Marketplaces for Reused/Recycled Products:</b></p> <p>Platforms such as <a href="#">Insert</a>, <a href="#">excessmaterialsexchange.com</a>, and <b>Madaster</b> help match suppliers of salvaged or recycled materials with buyers in the construction industry. These tools promote transparency, traceability, and valuation of materials, allowing project developers, contractors, and architects to source pre-used building elements—such as structural beams, façades, or flooring—with full insight into their quality and lifecycle impact.</p> <p><b>Storage and Material Hubs:</b> To overcome timing mismatches between demolition and new construction phases, several Dutch municipalities and private actors are piloting <b>material depots</b> or <b>urban mining hubs</b>. These hubs act as interim storage spaces where reusable components are catalogued and held for future use. Cities like Amsterdam and Rotterdam have experimented with “material banks” linked to demolition projects, ensuring recovered resources remain accessible to public and private sector clients pursuing circular goals.</p> <p>These supply chain innovations are increasingly supported by municipal circular procurement strategies, which encourage contractors to either use marketplace-listed materials or demonstrate logistics planning for reclaimed components. However, scaling up these practices will require inter-municipal and national coordination, harmonized quality standards for reused products, and financial models that incentivize flexible storage and logistics solutions.</p>
<p><b>Sustainability certification systems incorporating circularity principles</b></p>	<p>In the Netherlands, several sustainability assessment and certification systems have begun integrating circular economy principles into their frameworks. <a href="#">BREEAM-NL</a> (Building Research Establishment Environmental Assessment Method) includes credits related to material reuse, adaptability, waste minimization, and circular design strategies. Projects can earn higher BREEAM ratings by demonstrating how they reduce raw material consumption and enable future disassembly or material recovery. Similarly, <a href="#">GPR Gebouw</a>, a Dutch tool developed by the municipality of Tilburg and W/E Adviseurs, assesses buildings across environmental performance indicators, including circularity aspects such as material lifespan and reuse potential</p>
<p><b>Information instruments</b></p>	
<p><b>Digital tools for circularity (BIM, databases for traceability, product passports, etc.)</b></p>	<ul style="list-style-type: none"> <li>- <b>Madaster:</b> A materials passport platform that documents the circular potential and residual value of building materials.</li> <li>- <b>Insert &amp; Excess Materials Exchange:</b> Marketplaces connecting suppliers and buyers of reused construction materials.</li> <li>- <b>BIM (Building Information Modeling):</b> Increasingly used with embedded circularity parameters (e.g., design for disassembly, LCA data).</li> </ul>
<p><b>Available protocols and/or partnerships for data sharing and capacity building</b></p>	<ul style="list-style-type: none"> <li>- <a href="#">City Deal 'Circulair en Conceptueel Bouwen'</a>: A network of municipalities, ministries, and private actors collaborating on shared data standards and innovation.</li> </ul>

	<ul style="list-style-type: none"> <li>- <b>Digital Deconstruction (Digitaal Slopen)</b>: National initiative piloting protocols for deconstruction data and smart demolition workflows.</li> <li>- <b>Cirkelstad Network</b>: A Dutch learning and innovation network promoting regional capacity building and shared project data.</li> </ul>
<p><b>Communication about good practices and success stories</b></p>	<ul style="list-style-type: none"> <li>- <b>Pioneering cities</b> (e.g., Amsterdam, Leiden, The Hague) regularly publish public case studies through local platforms and partnership with universities such as The Hague University of Applied Sciences (THUAS). See annex for a list of best practices from The Hague and neighbouring municipalities.</li> <li>- <b>Het Nieuwe Normaal</b>: Includes best practice cases as reference projects for circular benchmarks.</li> <li>- <b>PIANOO</b>: National procurement expertise center shares municipal case studies and tender templates.</li> </ul>

### 3.2.3. The Spanish policy framework related to the pilot case

Spain's circular economy policies in the construction sector are primarily governed by Law 7/2022 on waste and contaminated soils, which aims to reduce environmental impact and promote resource efficiency. This law introduces the concept of end-of-waste (EoW) status, allowing certain materials to cease being classified as waste when they meet specific criteria: intended use, existing market demand, compliance with technical standards, and no adverse environmental or health impacts. However, the practical application of EoW status remains limited, with only a few materials having received official EoW recognition. The national strategy, España Circular 2030, further supports these initiatives by setting targets to reduce resource consumption and waste generation, thereby fostering a more sustainable construction industry. Circularity is mainly promoted through mandatory CDW recovery targets. GPP also encourages the use of recycled products. At regional level, several Spanish autonomous communities, like Basque Country and Catalonia, have developed specific instruments to facilitate the valorisation of materials like recycled aggregates and steel slags, and to promote circularity in buildings. These include selective deconstruction guidelines, dedicated funding calls, collaboration platforms and digital tools to track material flows.

**Table 13. Existing circular construction policy instruments in Spain**

<p><b>Policies supporting circular construction</b></p>	<p><b>Explanation: Name of policy/strategy; what is the focus (building phase + what materials), tools, guidelines, indicators in use; is the implementation successful etc...</b></p>
<p><b>Political and legal instruments</b></p>	
<p><b>Building laws and regulations</b></p>	<p><b>Waste and Contaminated Land for a Circular Economy Act (Law 7/2022)</b></p> <p>This law establishes a framework for waste management and contaminated land remediation, emphasizing the principles of the circular economy. It sets specific targets for the reuse, recycling, and recovery of construction and demolition waste, aiming for a 70% recovery rate by weight. The law mandates on-site separation of non-hazardous CDW into specific fractions—such as wood, minerals, metals, glass, plastic, and plaster—to facilitate recycling and reuse.</p> <p><a href="https://www.boe.es/eli/es/l/2022/04/08/7/con">https://www.boe.es/eli/es/l/2022/04/08/7/con</a></p> <p><b>Structural Code</b></p>

	<p>Updated in 2021, it provides regulations for structural safety and incorporates sustainability considerations into construction practices. It emphasizes the use of materials with a lower environmental impact and promotes the adoption of circular economy principles in building design and execution.</p> <p><a href="https://www.boe.es/boe/dias/2021/08/10/pdfs/BOE-A-2021-13681.pdf">https://www.boe.es/boe/dias/2021/08/10/pdfs/BOE-A-2021-13681.pdf</a></p> <p><b>Technical Building Code</b></p> <p>Among others, it sets minimum energy performance requirements for new and refurbished buildings.</p> <p><a href="https://www.codigotecnico.org/">https://www.codigotecnico.org/</a></p>
<p><b>Non-waste categorization (e.g. national/regional end-of-waste concept, retained product status) of dismantled components/materials</b></p>	<p><b>Royal Decree 105/2008</b> outlines conditions under which construction and demolition waste can be processed and reused.</p> <p>However, regional policies complement national regulations in the end-of-waste criteria and accepted uses (recycled aggregates, steel slags)</p>
<p><b>Predemolition audit guidelines</b></p>	<p>Law 7/2022 emphasizes selective demolition and waste separation, but it does not explicitly mandate pre-demolition audits. However, conducting a pre-demolition audit is considered a best practice within the industry.</p> <p>The Waste Management Study is the mandatory document (by Royal Decree 105/2008), to be prepared by the owner of the building or the owner of the demolition project), which contains, among others, an estimation of the quantity of each type of waste to be generated, measures for waste prevention during the work and plans for the reuse, recovery, or disposal of the generated waste, prioritizing reuse and recycling.</p>
<p><b>Acceptance procedures for reuse and recycling of products/materials in applications</b></p>	<p>Royal Decree 105/2008 regulates the production and management of construction and demolition waste. It emphasizes the prevention, reuse, recycling, and other forms of waste recovery. However regions have developed specific regulations/guidelines to further facilitate the valorization and use of recycled materials.</p>
<p><b>Economic instruments</b></p>	
<p><b>Green Public Procurement (GPP) incentives, such as demolition, renovation, or real estate tendering prioritizing circularity</b></p>	<p>The Spanish government approved the General State Administration's Green Public Procurement Plan in 2019. In Basque Country, Green Procurement and Contracting Programme 2030 (available in English) aims to integrate environmental criteria into public procurement processes, thereby promoting sustainability across various sectors. This one applies to both public and private sectors.</p> <p><a href="https://www.ihobe.eus/publications/green-procurement-and-contracting-program-of-basque-country-2030">https://www.ihobe.eus/publications/green-procurement-and-contracting-program-of-basque-country-2030</a></p>
<p><b>Tax/economic incentives for achieving circularity targets, including innovation funds.</b></p>	<p>There are grants and funding programs that enhance sustainability and circularity in business processes, as the Circular Economy PERTE (Strategic Projects for Economic Recovery and Transformation).</p> <p>Regional administrations and waste managers have implemented landfill taxes, increasing the cost of waste disposal and making recycling and reuse more economically attractive.</p>

Technical instruments	
National standards for reuse and recycling of products/materials	<p>The Spanish Building Technical Code (CTE) includes some instructions to promote the use of recycled materials in construction.</p> <p>There are several technical guides that provide strategies and validated practices for material recycling and waste reduction (as GEAR for recycled aggregates).</p>
Availability and use of handbooks, guidelines for reusable construction products and construction products with recyclable content.	<p>There are several guidelines, prepared by public bodies and associations.</p> <p>"Guía Española de Áridos Reciclados" (Spanish Guide for Recycled Aggregates)</p> <p>"Manual de Deconstrucción" by ITeC</p> <p>"Catálogo de Residuos Utilizables en Construcción" by CEDEX</p>
Supply & Demand logistics (Digital marketplaces for reused/recycled products and materials & Storage spaces for re-used or recycled materials.)	<p>There are some initiatives, mainly around research and innovation projects.</p> <p>MARKETcons, Ciclo Verde, Mercado Circular, Conectando Construcción, etc... have &gt;150 active users each.</p>
Sustainability certification systems incorporating circularity principles	<p>VERDE is the primary Spanish green building certification system developed by the Green Building Council España (GBCe)</p> <p>LEED, BREAM, EDGE are used too.</p>
Information instruments	
Digital tools for circularity (BIM, databases for traceability, product passports, etc.)	<p>BIM is widely used for design and new construction. It is not as usual in renovation and demolition projects.</p> <p>Construction companies are interested in DPP and traceability but they use is still very limited.</p>
Available protocols and/or partnerships for data sharing and capacity building	<p>Data Sharing initiatives are mostly limited to BIM platforms for collaborators in large projects, industry associations or research projects.</p>
Communication about good practices and success stories	<p>Technological platforms, research groups, associations, specialized magazines and websites (RETEMA, Construible, Interempresas, ...), and even the general media are increasingly covering the topic of circular construction and presenting success stories.</p>

### 3.3. Survey & interview outcomes

In addition to extensive desk research, our team designed a survey that was answered by 29 experts in the construction field ranging from research and academia, public institutions, construction companies and nonprofit organizations. To get deeper qualitative understanding of some topics, semi-structured interviews were conducted in Norway, The Netherlands and Spain. This section highlights the most important results from the survey and the interviews.

#### 3.3.1. Survey outcomes

The survey was answered by 29 respondents (Norway n=16, Finland n=3, Spain n=4, the Netherlands n=4, Belgium n=1, India n=1). The majority of respondents represented academic and research (59 %), while other SMEs (17 %), construction companies (10 %), policy and government bodies (7 %), NGO/non-profits (3 %) and property owners and developers (3 %).

The survey responses show that the three major legislative and policy barriers to circular construction at the local level include the lack of standardized procedures, financial barriers and policy gaps such as unclear regulations and a lack of enforcement. There was a strong agreement that the inconsistencies between waste and product regulations create obstacles for circular construction. Moreover, it was widely agreed that circular construction projects are not receiving sufficient financial support or investments. Herein, tax incentives and government grant and subsidies were deemed most helpful. Current tax policies were not deemed to support circular use, rather having no tangible impact. The current most supportive policies for circular construction involve communication about good practices and success stories, GPP, deconstruction guidelines and practices, marketplaces for reused/recycled materials, as well as storage spaces for reused or recycled materials.

Survey respondents considered that legislative packages at the EU-level facilitate innovation in circularity more than national policies and regional and municipal policies.

There were varying responses regarding whether all dismantled building components and materials are automatically classified as waste or not. In cases where the dismantled materials were classified as waste, it was widely agreed that classifying dismantled materials as waste creates barriers for reuse at another construction site and that if dismantled materials retained product status, they would be subject to less regulation and control, raising safety concerns. In cases where not all dismantled materials were classified as waste, it was widely agreed that even when materials retain product status, administrative barriers still exist for their reuse at another construction site. Moreover, it was also agreed that classifying dismantled materials as non-waste support circular construction practices and that if dismantled materials retain product status, they are subject to less regulation, which often raises safety concerns.

Respondents widely agreed that lack of a common definition for waste and non-waste materials create significant barriers to reusing secondary materials in construction.

Survey results show that tax incentives for circular materials, regional coordination in material supply chains, inter-municipal cooperation in waste management, real estate tendering prioritizing circularity, stronger alignment between EU, national, and local policies, digital tools for circularity (BIM, databases for traceability, material passports, etc.), innovation funds for local and regional circularity would help improve circular construction implementation.

Detailed survey results are found in Annex D.

### 3.3.2. Interview outcomes

The interview aims to explore the barriers, opportunities, and existing policies that influence circular construction **at local levels**. Interviews were carried out in Norway, Spain and The Netherlands. Appendix C presents the detailed results from the semi-structured interviews. It is acknowledged that the number of interviews was limited, and that the selection does not cover the full range of stakeholders across the circular construction value chain. As such, the findings should be understood as indicative rather than representative.

#### 3.3.2.1. Circular Construction in Svalbard, Norway

In Norway, three semi-structured interviews were carried out with experts from the local governments and the construction sector with relevant experience in Svalbard (see Table 3.4 in annex C):

**A: Project manager** from Longeyarbyen's local governance entity with functions similarly to a municipal council and responsible for key services such as infrastructure, education, and community planning.

**B: Project manager** from a government-owned company involved in numerous businesses on Svalbard, such as property and logistics.

**C: Architect** from an Architecture office located on Svalbard with a team of 120 architects and consultants.

### Synthesis of the three Interviews

Circular construction in Svalbard, Norway, presents a unique case shaped by geographic isolation, a small-scale built environment, and partial applicability of national regulations. Based on interviews with three technical experts in construction and development, it is clear that while a strong cultural tradition of reuse exists, systemic adoption of circular construction remains limited due to policy ambiguity, economic barriers, and a lack of enabling infrastructure.

### Policy Landscape

Unlike mainland Norway, Svalbard operates under a distinct legal framework, with the Svalbard Act and local building regulations taking precedence. The region still adheres to TEK10, an older version of national building codes, rather than TEK17, which includes provisions for reuse mapping. Experts note that no formal circular construction strategy currently exists for Svalbard. While recent local plans, such as the Local Community Plan 2022–2033, include circularity-related goals (e.g., reducing residual waste by 80% by 2030), these remain largely aspirational. There is no clear alignment between EU, national, and local policies, and communication between stakeholders remains weak or non-existent.

### Barriers to Circularity

**Regulatory and Certification Challenges:** Reuse of building materials faces high barriers due to the cost and complexity of obtaining certification. Regulations require reused components (e.g., windows, doors) to meet modern performance standards, creating a burdensome documentation process.

**Economic Disincentives:** The high cost of labor in Norway significantly affects the viability of reuse. Reuse often entails greater labor time and risk, making new materials more cost-effective despite their environmental footprint. Tax policy currently does not favor reuse or material circularity.

**Limited Digital Infrastructure:** There is minimal adoption of BIM, material passports, or traceability databases. While interest exists, the technical capacity to implement and maintain these tools is lacking, particularly for maintenance and operational phases.

**Market Fragmentation:** There is no centralized marketplace or storage for reclaimed materials, which creates uncertainty and limits reuse planning. Contractors have no guarantee that *suitable reused materials will be available when needed*.

**Cultural Complexity:** Svalbard has a strong reuse culture, especially in domestic settings and informal exchange platforms. However, this culture has not yet extended to institutional construction practices. This tradition, while positive, has sometimes led to waste accumulation rather than efficient reuse systems.

**Lack of Incentives:** Existing funding mechanisms, such as the Svalbard Environmental Protection Fund and Enova, support reuse efforts, but these funds are small in scale and do not compensate for the potential risks and effort involved.

### Best Practices and Innovations

Despite limitations, some noteworthy initiatives have been carried out:

**Svea Mine Reuse Project:** This political initiative relocated materials and buildings from the decommissioned Svea mining town to Longyearbyen. While not economically viable in the traditional sense, it serves as a symbolic success for large-scale reuse.

**Bruktikken ("Reuse Store"):** A local reuse store where construction materials can be traded.

**Repurposed Infrastructure:** Smaller-scale projects, such as the reuse of a coal stacker from the Svea Nord mine used for a new pedestrian bridge over the Longyearelva river or the Svalbad Sauna project, demonstrate creative approaches to reuse. These initiatives, despite high logistical costs, serve as visible and public examples of circularity.

**Cultural Infrastructure Reuse:** The reuse of houses, a control tower, and community buildings exemplifies the potential for architectural reuse with cultural value. These projects emphasize the importance of integrating cultural heritage into circular construction efforts.

### Opportunities and Recommendations

**Develop Circular Supply Chains and Marketplaces:** Establish material banks and reuse inventories, possibly linked to BIM databases, to improve foresight and enable project planning. Centralized marketplaces for reclaimed materials could reduce uncertainty in reuse planning.

**Introduce Clear Regulatory Frameworks:** Implement enforceable reuse criteria in building codes and tenders, with standardized procedures for certification and quality control. Establish clear regulatory pathways for pilot projects and testing of new circular solutions.

**Improve Economic Incentives:** Adjust tax policies and introduce preferential loans or subsidies for reuse-based projects to make reuse economically competitive. Financial support mechanisms should better reflect the costs of circular construction.

**Leverage Technology:** Pilot the use of AI, IoT sensors, and blockchain to track material conditions and facilitate reuse certification. Such technologies can enhance transparency in reuse supply chains and make reuse more manageable.

**Promote Capacity Building and Knowledge Sharing:** Invest in training for contractors, suppliers, and policymakers to better understand reuse potential and digital tools. Knowledge sharing between stakeholders can create a stronger foundation for future circular construction projects.

**Build on Existing Cultural Foundations:** Utilize Svalbard's history of reuse and adaptability to normalize circularity in the built environment. By evolving from informal reuse to structured, policy-supported systems, Svalbard could lead the way in circular construction for Arctic and remote regions.

This synthesis underscores the fact that while Svalbard's unique challenges—such as its small scale and remoteness—pose logistical hurdles, they also foster a culture of resilience and creativity that is well-suited to circular construction. With better coordination, regulation, and incentives, Svalbard has the potential to serve as a living lab for circularity in Arctic and remote settlements.

### 3.3.2.2. Circular Construction in the Netherlands

In the Netherlands, interviews were conducted via two methods. First, **Stakeholder Engagement through Events** where qualitative data were gathered during interactive sessions and discussions at two key events. The first was the *METREX Symposium: Rules and Space to Speed up Circular Construction*, held on 14–15 November 2024 in The Hague. The second was the *Circular Construction Enabled by Photonics Technologies* event on 5 December 2024 at The Hague University of Applied Sciences (THUAS), which brought together circular construction experts from over 10 European countries. These events offered firsthand insights into the challenges, innovations, and legal interpretations shared by stakeholders across municipal, academic, and private sectors.

Second, two depth interviews were conducted in person, the researcher took notes, and the answers were included in the overall analysis in section 3.2.2 and what follows below:

#### Overview of Circularity in the Construction Sector in The Netherlands

The Netherlands has made substantial progress in recycling and reusing construction and demolition waste, with the majority of recycled demolition material currently repurposed as foundation material for infrastructure projects. Despite this commendable recycling rate, only around 3 to 4% of new construction materials used in residential and non-residential buildings consist of secondary materials (Rijkswaterstaat, 2015). This highlights a critical gap between recycling efforts and the broader goals of a circular construction economy.

Unlike some countries where material scarcity is the primary motivation for circularity, the Dutch construction sector is driven more by environmental concerns, such as reducing CO<sub>2</sub> emissions from concrete and steel. As a result, circular construction in the Netherlands emphasizes a holistic approach—beginning with design and encompassing all phases of a building's lifecycle. This approach prioritizes reusability, value retention, and environmental performance, while fostering cooperation, transparency, and information sharing among architects, contractors, recyclers, and demolition experts.

One of the interviewees from a leading Dutch construction company highlighted that the most impactful way to advance circular construction in the Netherlands is by prioritizing policies, standards, and incentives that support the design of buildings for disassembly and adaptability. According to the interviewee, the focus should not lie primarily on which materials/product are reused or recycled, but rather on ensuring that buildings are conceived from the outset to be easily deconstructed, and their components repurposed. Embedding this principle in the design phase enables long-term material recovery, reduces waste, and fosters a truly circular built environment.

However, multiple challenges remain. These include fragmented regulations, limited financial incentives, and the absence of harmonized data standards for urban mining and reuse. Stakeholders stress the need for government leadership through pilot projects, public procurement, targeted subsidies, and innovation in environmental assessment tools. With the right policies and stakeholder collaboration, the Netherlands is well-positioned to become a global frontrunner in circular construction.

## Challenges in Circular Construction

Circular construction faces several barriers that hinder its widespread adoption and implementation at various levels:

**Regulatory Complexity:** Fragmented and sometimes contradictory regulations slow down the adoption of circular principles.

**Financial Disincentives:** Circular construction can be costlier upfront, while subsidies and taxation structures often favor traditional construction methods.

**Material Certification:** Ensuring reused materials meet safety and quality standards is challenging and costly.

**Lack of Standardized Data:** The absence of uniform tools for material traceability hinders the scalability of urban mining and reuse initiatives.

**Balancing Best Practices with Scalability:** Many solutions work well on a small scale but are difficult to replicate in larger developments.

**Local Data Governance:** Municipalities often lack efficient systems to manage and share construction and demolition data.

**Inter-Departmental Coordination:** Cross-departmental cooperation within municipalities is complex due to siloed operations and competing priorities.

**Public Awareness and Participation:** Engaging local communities in circular initiatives remains a challenge.

**Integration Across Processes:** Effective circularity requires coordinated actions across design, demolition, and reuse, but traditional delivery models hinder this integration.

Addressing these challenges is critical to enabling systemic change in construction practices.

## Opportunities in Circular Construction

Despite these barriers, numerous opportunities exist to scale up circular practices:

**Policy Integration:** Strengthening alignment between EU, national, and local circular strategies.

**Public Procurement as a Tool:** Embedding circularity criteria in public tenders to drive market transformation.

**Standardization of Certification:** Developing frameworks for certifying reused and recycled materials.

**Technology Integration:** Employing digital twins, BIM, and material passports for smarter design and reuse.

**EU Taxonomy:** Leveraging sustainability regulations to define and incentivize circular construction.

**Local Data Hubs:** Municipalities can host centralized databases that track material availability and reuse potential.

**Regulatory Innovation Zones:** Creating experimental spaces to test circular solutions with relaxed regulatory constraints.

**Capacity Building:** Training stakeholders and facilitating peer learning to build sector-wide expertise.

**Design for Circularity:** Emphasizing adaptable and modular design to support long-term material value.

**Integration Across Processes:** Encouraging seamless collaboration among actors throughout the building lifecycle.

These opportunities, when supported by strong governance and investment, can fast-track the transition to circularity.

## Challenges and Best Practices in Dutch Municipalities

### The Hague

The Hague is a leader in circular construction, integrating sustainability into its urban development strategy. As demonstrated in a comprehensive appendix of case examples, the city fosters innovation through pilot projects, urban material banks, and sustainable procurement.

An interviewee from The Hague municipality highlighted that the policies for circular innovation are already available in The Netherlands. However, the financial incentives and the governance mechanisms for scaling the successful pilots need to be strengthened for wider impact. Some municipalities are already playing an important role as frontrunners in circularity processes, but inter-municipal cooperation, regional and national support and public-private partnerships are needed for long-term impact.

#### Key Achievements:

- Reuse of materials in municipal projects.
- Circular procurement requirements for tenders.
- Strong public-private partnerships with NGOs and academia.

### Leiden

Leiden employs procurement to drive circularity, integrating sustainability metrics into tendering and financial assessments. Materials are treated as future assets, reinforcing long-term thinking.

#### Key Achievements:

- Tender assessment systems incorporating circular KPIs.
- Lifecycle costing that includes residual material value.
- Alignment with “Paris Proof” and “Future Proof” ambitions.

#### Challenges:

- National regulations limit municipal innovation.
- Complexity in translating goals to practical applications.
- Scalability of best practices remains difficult.

#### Proposed Actions:

- Real cost accounting for pollution.
- Tax incentives favoring reuse and labor over virgin materials.
- Spatial planning for circular initiatives.
- Legal alignment with 2030 and 2050 climate targets.

### Amsterdam

Amsterdam is pioneering EU Taxonomy implementation and integrates the [Doughnut Economy Model](#) into urban planning. Its Circular Implementation Agenda (2023–2026) includes neighborhood-level actions and uses transparent benchmarks like *Het Nieuwe Normaal*.

#### Key Ambitions:

Expand circularity to neighborhood scale.  
 Institutionalize sustainable practices through contracting and monitoring.  
 Align local instruments with EU-level frameworks.

### Challenges:

Difficulty in labeling sustainable companies under current frameworks.  
 Dilution of EU Taxonomy thresholds.  
 Lack of clear legal mandates to support high-standard projects.  
 Legal contradictions between local and national authority.

### Conclusion:

The Netherlands stands at the forefront of circular construction, with municipalities playing a key role in driving this transition. The integration of circular design principles and full-lifecycle collaboration offers the opportunity to decouple construction growth from environmental degradation. However, unlocking this potential requires overcoming regulatory fragmentation, aligning incentives, and building capacity at all levels. By coordinating supply-demand systems, facilitating smart data governance, and investing in public-private partnerships, municipalities can foster an efficient and transparent market for circular materials. This momentum must be supported through strong governance, innovation funding, and knowledge sharing to ensure a resilient and sustainable built environment.

#### 3.3.2.3. Circular Construction in the Basque Country

In Spain, two interviews with a technical director at a regional construction company in the Basque Country was conducted in March and one in April with a leading expert in the research and development sector. The main results are highlighted below:

#### Combined Synthesis: Circular Construction in the Basque Country, Spain

Circular construction in Spain—and especially in the Basque Country—is progressing through regulatory frameworks, technical pilots, and industrial engagement. Yet, as highlighted by two technical experts from the construction and demolition sectors, the transition remains partial. Legal mandates are in place, but implementation is fragmented, and significant barriers persist around market incentives, technical integration, and local capacity.

#### Policy Landscape: Strong Legal Framework, Uneven Operationalization

National legislation such as **Royal Decree 105/2008** and the **2022 Law on Waste and Contaminated Soils** lay the legal foundation for selective demolition and a **70% recovery rate for construction and demolition waste**. The Basque Country builds on this with **Decree 112/2012** and **Law 10/2021**, which include stricter obligations—such as a **minimum 40% use of recycled content** in public works.

However, these legal instruments often **lack practical guidance or enforcement mechanisms**, and remain difficult to apply uniformly. A 350-page technical guide introduced by the regional government attempts to close this gap but is still poorly known and applied in many municipalities. The timeline mismatch between law adoption and project implementation (which can take 3–5 years) further delays visible change.

## Material-Specific Circularity Insights

**Concrete:** Clean concrete recycling is technically mature and aligned with best practices in Northern Europe. A regional plant dedicated to **high-quality recycled concrete aggregates** demonstrates this potential. However, market uptake is limited due to minimal price differences with virgin materials and reluctance to adjust specifications mid-project.

**Plaster and Ceramics:** These materials face **technical and logistical barriers**. Plaster is 100% recyclable in theory, but contamination and lack of local industry make it non-viable in practice. Ceramics have no high-value reuse market and are downcycled, often mixed with other debris.

**Wood:** Reuse is mostly limited to **noble hardwoods** salvaged from traditional buildings. The remainder is either chipped for panel board production or used for **energy recovery**. A growing interest in timber construction may boost demand for quality wood reuse.

**Metals:** While **recycled at high rates**, metal components are rarely **reused** due to deformation during demolition and the high cost of structural inspections needed for safety certification.

**Asphalt:** Reused in **road resurfacing projects**, though typically limited to 20–30% of new material volume. The percentage depends on wear and degradation of recovered material.

## Barriers to Circularity

**Economic Disincentives:** In the Basque Country, abundant and cheap virgin materials—especially limestone—make circular alternatives less competitive without regulatory or fiscal incentives.

**Regulatory Ambiguity:** Requirements such as the 40% recycled content threshold are **broadly defined**, making compliance verification difficult for both public authorities and private actors.

**Local Government Constraints:** **Small and mid-sized municipalities often lack the personnel, budget, or technical capacity** to evaluate or approve circular proposals—especially when new materials or methods are introduced.

**Lack of Data & Coordination:** There is no consistent system for **material traceability**, no centralized **marketplace for secondary materials**, and no established **material banks or storage hubs** to match supply with demand in real time.

**Cultural and Generational Resistance:** Adoption of circular practices often depends on the mindset of project stakeholders, with more senior professionals showing **greater resistance to change** than younger, sustainability-driven teams.

## Best Practices and Innovations

Despite these barriers, several **promising practices and innovations** are underway:

**Industrialized Construction and Design-Build Procurement**  
Design-and-build procurement models are gaining traction, enabling **early integration of circular principles** and favoring **prefabricated and modular solutions**. This shift aligns design, construction, and demolition stages to support reuse and resource efficiency.

**Digital Tools: BIM and Blockchain for Traceability**  
**Building Information Modelling (BIM)** is seen as critical for designing deconstruction-ready buildings and mapping material lifecycles. Though underused in demolitions, its role is expanding. **Blockchain-based traceability systems** are being piloted to document the origin, treatment, and compliance of secondary materials—enhancing trust in the market.

**Arigreen Concrete Recycling Plant**  
 A regional facility processes clean concrete waste to produce **certified recycled aggregates** that match the performance of virgin materials. While still underused, the plant represents a local benchmark for circular construction quality and reliability.

**Green Public Procurement (GPP) Support by IHOBE**  
 The **Basque Environmental Agency (IHOBE)** has created detailed guides and templates for municipalities to implement **green procurement criteria**, helping embed circularity into public tenders. It also leads educational initiatives such as **Ekoaste**, a recurring training and knowledge-sharing forum.

**Demolition Planning and Pre-Market Platforms**  
 New platforms are being developed to allow construction firms to **pre-announce demolition outputs**, enabling potential buyers to plan reuse in advance. This is seen as key for reducing waste and improving reuse efficiency at scale.

### Strategic Recommendations

**From Policy to Practice**  
 Simplify technical documentation, clarify performance criteria, and embed enforceable circularity indicators in public works tenders.

**Empower Municipalities**  
 Invest in local government capacity through **training, additional staffing, and technical support**, especially for small municipalities who must assess non-standard materials and designs.

**Accelerate Digitalization**  
 Scale up **BIM, AI-based surveying, and blockchain** tools for real-time material traceability, lifecycle documentation, and market matchmaking.

**Build Circular Infrastructure**  
 Create **material hubs, temporary storage centers**, and public-private platforms for trading and certifying secondary materials.

**Stimulate Demand with Incentives**  
 Align **tax structures, subsidies, and scoring systems** in public tenders to reward circular performance and offset price disadvantages of recycled content.

This synthesis confirms that the Basque Country is well-positioned to lead Spain’s shift toward circular construction. It combines advanced policy frameworks, technical know-how, and industrial engagement. Yet, scaling up requires sustained investment in data systems, local governance, and market incentives. The transition is underway—but still depends on a limited number of pioneers rather than a fully embedded system.

## 4. Conclusions and policy recommendations

### 4.1. Policy impact on SUM4Re solutions

This section aims to identify policy gaps preventing the recovery of construction products and materials for second life use and recycling at EU and regional level. Section 4.1.1. presents barriers and support on the EU level, while Section 4.1.2 presents barriers and support on a local level. Section 4.2 then presents policy recommendations to answer to policy gaps and to overcome barriers to circularity in the construction sector.

#### 4.1.1. EU policies: supporting and creating barriers for circular construction?

This section sets out to identify the key bottlenecks to the circularity of secondary materials and reusable products in the EU regulatory, aiming to highlight key topics for generating policy recommendations. The support and potential barriers of the SUM4Re-relevant EU-policies were presented in Section 2. It was concluded that the SUM4Re-relevant EU legislation focuses on resource efficiency, climate aspects and material safety. Table 14 presents the key support and barriers identified in Chapter 2.

**Table 14. Key support and barriers identified in the European policy framework relevant for SUM4Re**

Topic	Barrier	Support
<b>Resource efficiency</b>	<ul style="list-style-type: none"> <li>• The lack of a common understanding related to secondary materials/products to retain or to obtain the product status.</li> <li>• National or case-by-case EoW status is not valid throughout the EU.</li> <li>• CE-marking rarely address the reuse of construction products. No available guidelines for reusable products' performance and quality assessment.</li> <li>• Public procurement requirements lack circularity criteria</li> <li>• Lack of indicators for reuse</li> </ul>	<ul style="list-style-type: none"> <li>• End-of-waste definition in the WFD.</li> <li>• EoW status for secondary products.</li> <li>• CE-marking to support secondary materials content</li> <li>• The new CPR presents Mandatory Digital Product Passports to support circularity.</li> <li>• Public Procurement criteria</li> <li>• Legislative targets for recycling, promoting reuse.</li> <li>• Targets for reduction of embodied carbon supports use of non-virgin products</li> </ul>
<b>Climate aspects</b>	<ul style="list-style-type: none"> <li>• No clear focus on circularity.</li> <li>• Taxonomy lacks indicators for circularity.</li> </ul>	<ul style="list-style-type: none"> <li>• Focus on upgrading buildings for energy efficiency</li> <li>• Green financing, EU taxonomy</li> <li>• Targets for reduction of embodied carbon</li> </ul>
<b>Safety and quality</b>	<ul style="list-style-type: none"> <li>• High focus on hazardous substances in design, use and end-of-life stage favors virgin materials</li> <li>• Call for substitution of hazardous substances may prevent reuse and recycling</li> <li>• Lack of requirements on the competence of the auditor/demolition expert.</li> </ul>	<ul style="list-style-type: none"> <li>• Traceability requirements to enable safe recycling and reuse</li> <li>• Declaration of Performance and Compliance includes information on hazardous substances</li> <li>• Safe and sustainable by design framework (volunteer)</li> <li>• Predemolition audits to promote safety of circular solutions</li> <li>• Harmonized standards (both for technical and environmental performance) to support reuse</li> </ul>

	<ul style="list-style-type: none"> <li>• The SVHC list is constantly updated, and new hazardous substances are introduced. (may prevent reuse and recycling)</li> <li>• The limits values for some substances very low (may prevent reuse and recycling)</li> </ul>	and use of secondary materials. E.g. Eurocodes and ISO 14040 series.
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In addition to the legislative support and barriers as presented in Table 14, as well the lack thereof creates some similar barriers in the construction sector. Section 2.6 presents bottlenecks related to conflicting environmental targets, which serve as an internal administrative and political barrier for implementation of all targets. Further, lack of strict quality requirements and supporting acceptance procedures, combined with a general sense of complexity of EU rules, brings uncertainties related to the quality of secondary products, which disfavours the image and usability of circular products. Finally, economic hurdles related to the higher costs of circular solutions further prevent circularity in the construction sector.

#### 4.1.2. Local and national policy impact

##### Policy Pathways for Circular Construction: From Local Innovation to European Transformation

The transition to circular construction in Europe stands at a pivotal juncture—facing entrenched regulatory and market barriers yet energized by innovative local practices and emerging policy frameworks. Across **Spain, the Netherlands, and Norway**, the interplay between national ambitions and local realities reveals both the systemic gaps and the transformative potential of place-based policy action.

In **Spain**, the absence of cohesive local regulation and weak alignment with national strategies have led to fragmented implementation. Many municipalities—especially smaller ones—struggle with the technical and organizational capacity required to manage construction and demolition data, enforce reuse standards, or invest in urban mining infrastructure. Yet, **regional pilot projects in Catalonia** and the **Basque Country** demonstrate how **subnational leadership** and collaboration with regional environmental agencies can catalyze progress even in the absence of comprehensive national mandates.

In **the Netherlands**, circular construction is supported by a strong national framework and a clear goal: becoming a **100% circular economy by 2050**. Cities like **Amsterdam, The Hague, Rotterdam** and **Leiden** are leading the way with digital tools (e.g., **BIM, material passports**), regulatory experimentation, and circular procurement. In **The Hague's Binkhorst redevelopment zone**, planners are applying modular construction, heritage reuse, and digital planning tools to transform industrial land into a circular urban district. Despite this progress, challenges persist around **certifying reused materials, aligning fiscal instruments, and scaling innovation across municipalities and regions**.

**Norway** represents a hybrid case. National policy promotes sustainability and innovation, but **local implementation varies greatly**. In **Svalbard**, governance is highly localized and only loosely connected to mainland legislation. This creates both **opportunities for experimentation** and **gaps in consistency**, particularly around material traceability, circular procurement, and reuse certification. Still, local initiatives—such as e.g. the **Svea mine**

**relocation**, the **Bruktikken reuse center**, and **reuse-focused building projects**—highlight how isolated communities can build on cultural traditions of resourcefulness.

### Systemic Challenges Across Contexts

From local interviews, surveys, and field insights, several cross-cutting challenges emerge:

- **Regulatory fragmentation** and lack of coherence between national, regional, and local policies.
- **Limited inter-municipal and regional collaboration**, which weakens knowledge sharing, material exchange, and circular ecosystem development.
- **Economic disincentives**, especially where labor-intensive reuse is costlier than using virgin materials.
- **Absence of traceability systems** and material inventories to support urban mining and reuse planning.
- **Low technical capacity**, particularly in smaller municipalities and construction SMEs.
- **Public procurement practices** that often overlook circularity or lack concrete evaluation criteria for reused/recycled content.

### Supportive policies

To move from pilot success to systemic change, the following **policy directions** are recommended—building on SUM4RE’s goal to enhance urban mining and enable circular construction across Europe:

1. **Embed Circularity into Local and Regional Planning Frameworks**  
Ensure that circular construction targets—including material reuse, selective demolition, and digital material tracking—are explicitly integrated into urban plans and regional development strategies.
2. **Establish and Fund Inter-Municipal Circularity Platforms**  
Create regional consortia or platforms to enable **material exchange, shared logistics, and coordinated deconstruction planning** across municipalities. These can lower transaction costs and expand access to reused materials, especially for small and medium localities.
3. **Support Urban Mining Infrastructure and Digital Tools**  
Invest in **material banks, demolition forecasting systems, and centralized reuse marketplaces**. Tools like BIM, blockchain, and IoT should be scaled to support traceability, certification, and early reuse planning.
4. **Align Public Procurement with Circular Goals**  
Mandate circularity criteria in public tenders, including **thresholds for reused/recycled content**, lifecycle assessments, and circular design principles. Provide municipalities with implementation guides and scoring rubrics.
5. **Build Local Capacity Through Training and Technical Assistance**  
Offer targeted support to municipalities, SMEs, and construction professionals through **training, toolkits, and expert networks**. Focus on integrating circular practices into daily operations and procurement routines.
6. **Develop Standardized Certification and Risk-Sharing Mechanisms**  
Simplify and harmonize **certification procedures for reused materials** at the EU

level. Develop clear liability or warranty frameworks to de-risk reuse and facilitate trust among stakeholders.

7. **Create Economic Incentives for Circular Construction**  
Adjust tax and subsidy frameworks to reward reuse and penalize unnecessary demolition. Incentives could include **green loans**, **favorable depreciation rates**, or direct funding for reuse-intensive projects.
8. **Scale Lessons from Pilot Projects**  
Use successful **case studies as policy laboratories** to refine and export successful models. Encourage peer learning among cities and regions through EU-supported platforms.

## Conclusion

The SUM4RE project underscores that unlocking circularity in construction depends not only on technological advances but on **multi-level governance, local capacity, and regional coordination**. By embedding circular principles in local plans, empowering municipalities, and scaling insights from pilots, Europe can transform its cities into **material banks**—turning waste into value and urban development into a cornerstone of the circular economy.

For more inspiration, in the annex B we share examples of best practices in circularity that are already happening in Spain, Netherlands and Norway.

## 4.2. Policy recommendations

Based on the findings of this study<sup>87</sup>, the SUM4Re project presents six policy recommendations for enhancing circularity of construction products as follows:

### Legal instruments

1. Harmonising rules for categorisation of products and waste

### Technical instruments

2. Methods for performance assessment and quality
3. Design for disassembly and reuse

### Information instruments

4. Development of digital competences and infrastructure

### Economic instruments

5. Circular public procurement practises
6. Economic policy instruments

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<sup>87</sup> In addition to the findings of the study, also the following sources provided background for drafting the policy recommendations:

- EU Iceberg project
- EU Nontox project
- Nordic CircCDW project
- <https://pub.norden.org/nord2023-031/nord2023-031.pdf>
- <https://pub.norden.org/us2023-441/us2023-441.pdf>

## Harmonising rules for categorisation of products and waste

### Context

The product and waste definitions in the Waste Framework Directive are general and further clarification is needed for the construction products to be recovered from a building. Moreover, the standards and industry guides in the sector provide different interpretation of the waste/product status than the legislation and create confusion in the practical applications.

The lack of a common definition/interpretation of dismantled building components/materials as waste or products creates significant barriers in uptake of reusable construction products in new construction. Clear assessment approaches, criteria, protocols (e.g. for traceability and use history) and certification schemes are needed. End-of-waste status improves acceptance and trust for the construction product and clear criteria improve also the quality and trust for reusable products. Also, the administrative burden related to permits for waste management can be avoided.

Circularity in the construction sector is closely linked to bridging the gap between demolition and construction, which in turn is closely related to requirements for documentation and technical specifications of products and materials.

The process of determining the EoW status should be transparent and clear, with minimal costs to all parties concerned; the process and criteria should be aligned within the EU. However, for some specific applications or streams, a national decision considering actual national or regional conditions and parameters could be applied

### Challenges

Keeping a material, that in practice is perceived and treated as a product, under waste legislation creates some uncertainties. When practices related to the categorisation of a waste/product vary between different countries, this can create conflict in trans-boundary movement. The legislation is perceived as unclear, and would benefit from harmonisation.

Furthermore, stakeholders find inconsistencies between waste and product regulation.

Classifying dismantled materials as waste creates barriers for reuse at another construction site. However, retaining product status may imply less quality control, raising some concerns related to safety.

### Implementation

- EoW criteria (national and EU-wide)
- Harmonised rules for secondary materials/components to retain or to obtain the product status and for their quality control

## Methods for performance assessment and quality

### Context

There is a market need for a uniform system for documentation and testing. This would assure that recycled materials and reusable products are suitable for their use as resources in building or other products. This assurance needs to cover both the technical and environmental suitability, also including assessment of potentially harmful substances. The testing procedure must be relevant, clear, and replicable.

Standardized guidance on procedures for assessment of suitability of end-of-life products and materials for reuse and recycling would meet these needs. Certification of recovered materials, traceability systems, and End-of-Waste status are means of fulfilling requirements on quality and supporting the market for recovered and reused materials and products.

According to the Construction Products Regulation, the CE marking of construction products is mandatory, if the construction product is covered by a harmonised product standard or the construction product conforms to a European Technical Assessment which has been issued for the product. Currently the harmonized products standards for CE-marking rarely address the reuse of construction products. In the development of the harmonized standards, it is important that key characteristics related to reuse of construction products are considered and that relevant methods as well as assessment methods will be included for relevant applications for reusable products in the harmonized standards.

### Challenges

For proving the performance and conformity of reusable construction products and construction products with recycled content, several new aspects (e.g. origin of products, history of use, potential repairs etc) need to be taken into account in the assessment. Also new test methods need to be developed.

The DoPC of reused products shall be applicable for the full scope of the new CPR, including putting the product on the market or its direct installation without remanufacturing. This is not reflected in the existing harmonized product standards, where the requirements such as FPC may directly narrow their applicability for the reused products.

Doubts about the performance (e.g. quality) are a key barrier to reuse and recycling. Concerns about the material degradation and potential presence of hazardous substances lead to a lack of confidence or trust in the recovered waste streams.

In planning the disassembly of reusable construction products (elements, components), special measures might be needed to prevent damage. Also for recycling, it is important that demolition contractors know the requirements for (the quality of) different materials for recycling (e.g. avoiding unwanted fractions or impurities contaminate the target material) and can identify and collect high quality materials for recycling. The required quality of

	<p>the recovered material depends on the application. Typically, high quality materials are needed for high grade recycling.</p> <p>In addition, the competence of the auditors/demolition experts needs to be ensured to guarantee a high-quality pre-demolition audit and follow-up process. Here the knowledge of construction methods, of materials (especially hazardous), and construction products used in the building, provides an important base for the assessment of valuable streams for reuse and recycling. Often there is no obligatory experience or education required prior to the drafting of a pre-demolition audit. In many countries, mainly identification and removal of asbestos is mandatory.</p>
<b>Implementation</b>	<ul style="list-style-type: none"> <li>• Predemolition audit to focus more on reuseable products.</li> <li>• EU-wide recommendations for the content and procedures for the pre-demolition audit</li> <li>• Guidelines for dismantling</li> <li>• Standardized methods for performance assessment and quality implemented in or connected to structural/construction standards (e.g. Eurocodes).</li> <li>• CE-marking</li> </ul>

### Design for disassembly and reuse

<b>Context</b>	<p>Buildings must be designed for flexibility and demountability to facilitate the reuse of materials and products. The technical solutions for the interfaces between different products or material layers must ensure their separation and possibility to exchange those products or materials during the building's life with a minimum effort. This also includes selecting durable and recyclable materials and ensuring that the production, use and maintenance of those materials are harmless over the service life of the reusable product, which may be longer than the typical design life of the building. The materials and components needs to be linked to their design documentation, certification documents and inspection reports throughout the life of the building.</p>
<b>Challenges</b>	<p>The environmental benefits of such solutions applied today will be visible after several decades, and therefore they do not directly contribute to most of the sustainability targets and policies. This is also the reason why there are not very specific requirements for design for disassembly and reuse, harmonized qualitative or quantitative assessment methods and industry guides.</p> <p>Reused materials and products will be competing on the market with the new products, and therefore their circulation may be directly against the business strategies of the material producers and product manufacturers.</p> <p>Return of investment in the improved building design is uncertain and the net present value of the end-of-life material after the decades of use is very small.</p>

## Implementation

- Include the design for deconstruction and reuse in the policy documents, strategies and regulations on EU and national level.
- Provide financial support for the implementation of circular design practises.
- Develop harmonized rules for the assessment of environmental impacts beyond the current building's life or circularity in general and integrate them in the current requirements for the environmental impact of the building design.
- Support the transition of European manufacturing industry to the circular business models.

## Development of digital competences and infrastructure

### Context

In the construction sector, digital solutions are applied as tools to boost a circular economy via reuse and high-grade recycling.

The level of digitalization is generally low in the construction and demolition sector, and many digital solutions are at early development stages. Although the type of digital system in use is important, the reliability of data still depends on several other factors. For assessment and reporting of sustainable performance of construction products, reliable product information, from manufacturing to the installation in the building and demolition, will be needed. Target groups are all stakeholders along the value chain.

Digital product passports (DPP) are new concepts under development. DPP can be linked to Building Information Modelling and to Digital Building Logbook. These new digital tools are needed to complement existing non-digital solutions. The creation of a collective infrastructure of (building) passports, would enable more efficient execution of current legislative requirements on materials overview and traceability.

A collective infrastructure of (building) passports would facilitate the reduction of various costs of dealing with regulatory requirements, as there would be a common information base. This information base would also serve as a coordination instrument for reaching other stakeholders.

For waste amount monitoring, good quality data is key for policy-making, to set and follow-up on targets. How waste data is collected or reported, information on generated or treated waste, quality of waste streams.

Documentation of CDW flows and development of national waste statistics are done differently in different countries. Digital solutions also offer possibilities for improving the reliability of waste statistics which is the basis for monitoring and regulative actions and decisions for new activities and financial investments.

	<ul style="list-style-type: none"> <li>➤ Initiatives to increase the level of digitalization, which enables documentation of waste flows and enhances treatment of CDW</li> <li>➤ Traceability of waste enables meeting the quality requirements for recycling and reuse</li> <li>➤ Digital marketplaces facilitate new business models within reuse and recycling</li> </ul>
<b>Challenges</b>	<p>The digital system highly depends on stakeholder acceptance to be effective. The digital systems must be easy to access and user-friendly and ensure protection of intellectual property rights. Absence of data governance presents concerns regarding data safety. The digital systems need to be flexible and allow adding and removing as well information as actors.</p> <p>There are risks related to data quality, overflow of data, and up-to-dateness. Data quality could be compromised due to lack of data, while poorly defined content requirements may lead to the upload of all available data. Due to the long lifespan of construction products, it should be ensured that the data is updated as needed.</p> <p>Problems with different stakeholders carrying the costs from data acquisition and those benefiting from data availability.</p> <p>The digital solutions need to be based on open standards because of shared responsibility between many private and public actors across the value chain and during the life cycle of the building. However, the open standards are only marginally supported by the large software companies because wider interoperability may affect their own business strategies.</p> <p>BIM (Building Information Modelling) is lacking in old constructions.</p>
<b>Implementation</b>	<ul style="list-style-type: none"> <li>• Digital product passports (DPPs) to increase data availability and sharing, and traceability of the construction products during their lifecycle</li> <li>• A collective infrastructure of building logbooks/passports including product passports with Blockchain technology as one of the fundamental technologies behind this infrastructure</li> <li>• CBIM – providing products information on ownership and materials characteristics so that those products can be delivered in the future.</li> <li>• Developing clear and detailed requirements/specifications on EU and national level for information needs, exchange and delivery in open formats including BIM and digital passports.</li> <li>• Open data specifications to enable collaboration and cooperation regardless of software applications.</li> <li>• Establishing tracing systems and certification schemes</li> </ul>

Circular public procurement practises	
<b>Context</b>	Local, regional, and federal authorities possess significant purchasing power for implementing various new construction and renovation projects, as well as building maintenance and demolitions. These investments can be directed to support circularity in the sector by implementing strict public procurement requirements. By promoting the use of recycled materials in construction products or reuse of construction products, not only are circularity goals addressed, but can also contribute to reducing the embodied carbon in constructions.
<b>Challenges</b>	The public sector often lacks knowledge about structures, products, materials that could be recovered and used in new constructions. Tendering documents do not often specifically address recycling, reuse and the uptake of secondary products and materials.
<b>Implementation</b>	<ul style="list-style-type: none"> <li>• Templates for the public procurement tendering documents supporting sustainability and circularity in various construction projects</li> <li>• Procurement requirements to include requirement on reuse of construction products or recovered material contents in new products used in construction</li> </ul>

Economic policy instruments	
<b>Context</b>	<p>Financial support is needed to facilitate circular construction projects. Currently circular construction projects suffer from increased overhead costs and material costs related to sourcing of circular products and the implementation of the circular solutions.</p> <p>As reuse of building materials still is its nascent period of development, there is a large potential to streamline the circular processes to make them more competitive compared to building products based on virgin materials. Reuse aspects must be considered early in the demolition or renovation process, since it requires a longer lead time as well as new ways of working which take time and effort to learn and implement</p> <p>There is also a need to develop continuous and comprehensive reuse inventories to increase the supply of reusable building products, developing more efficient reverse logistic solutions, and providing storage solutions.</p> <p>Collaboration between parties in a circular system is currently characterized by a lack of coordinating institutions, which would ensure that parties can collaborate more easily with regard to supply and demand.</p>
<b>Challenges</b>	Markets for recycled materials depend on the quality, clear property rights, the price and the material availability. The main obstacle for reuse and recycling is often the low price of competing virgin materials. Furthermore, the sorting and processing needs of

	<p>demolition waste to secure high-quality material for recycling or dismantling cost for reusable products increase the demolition costs.</p> <p>An identified challenge for the implementation of CE concepts is related to the market's readiness, it can be difficult to find the right materials that could meet the requirements and expectations if essential elements of a functioning marketplace are not organised. Without a clear information base about (quality of) products in building and the liability of the owners to deliver those products to the future, new (virgin) products will always be considered by many stakeholders as cheaper and better than recovered products. Organising market for secondary materials means that property rights for those products should be established, for example by combining building and products passports with blockchain technology, as a foundation layer in the information infrastructure on buildings.</p> <p>For reusable products, there are also difficulties to match the supply and demand. Constructors may have difficulties to find acceptable products and materials, and there is often a lack of timely information about generated materials and components that can be reused or recycled.</p>
<b>Implementation</b>	<ul style="list-style-type: none"> <li>• Providing a collective infrastructure of building- and products passport</li> <li>• Market places for reusable materials to connect supply with demand</li> <li>• Government grants and subsidies, tax incentives, sanctions or fees, as well as subsidies to promote reuse and recycling</li> <li>• Taxation of virgin material</li> <li>• Landfill taxes and landfill bans on recyclable materials.</li> <li>• Green public procurement</li> <li>• EU taxonomy (clarification of guidelines for circular economy in buildings)</li> </ul>

## **ACKNOWLEDGEMENTS**

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Creating materials banks  
from digital urban mining

## APPENDICES

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## APPENDIX A Court decisions on product or waste classification

Reference	Product/application	Decision
<b>Court decision</b>		
<b>France</b>	Construction products recovered from demolition work	In France, the 'Anti-Waste for a Circular Economy' Law of 10 February 2020 specifies that 'all products sorted on site by a competent reclaimer will not be classified as waste'. This law also defines the framework for the "Product-Material-Waste" diagnosis which will be mandatory for significant demolition or restoration operations and which includes a section on identifying the reuse potential of materials
<b>Belgium</b>  <b>Judgement of the Court of Appeal of Liège, 7 January 2009, Amen-Env, [2009]. Book.3 p.216, note: B. JADO</b>	The Pavillion case:  The land in front of a pavilion was covered with various objects (old rotten wood, old building materials, old cars, etc.). After a certain period of time, the municipal authority ordered, by decree, the disposal of this supposed waste. The holder refused, arguing that it was not waste but that these were objects that could be used in the future. In whose favour did the court rule	In this case in Belgium, the Court condemned the holder for 'Abandoning waste', citing the dilapidated state and the disparate nature of the objects left on the land, 'which precluded them from being regarded as a set of reusable materials for the renovation of a building
<b>Finland</b>  <b>(Judgement of the C.J.E.U of 7 March 2013, Lapin, C-358/11. §§17; §§22-26; § 60; §§ 63-64.)</b>	Treated wood case:  A municipality in northern Finland had wooden bridges built to allow vehicles to pass over a path leading to a village. The wood used to support these bridges came from old telephone poles, which had been treated with a CCA (copper-chrome-arsenic) solution in their previous usage. The poles were therefore classified as hazardous waste. However, REACH regulations allow wood treated with CCA to be used in certain forms and under certain conditions:  - The wood is only used in a professional or industrial context.  - Its treatment with CCA is justified to preserve the structural integrity of the wood, and thus the safety of humans and animals.  - It is unlikely that the public will come into skin contact with the wood during its lifetime.  This is particularly true of its application as "structural timber for public, agricultural, administrative and industrial buildings, bridges and engineering structures".	In this particular case, the wood from the old poles thus avoided being classified as waste and could be reused.  This case illustrates the fact that health and environmental risks are the fixed boundaries separating products from waste. It is always with these risks in mind that judges will apply and interpret the law.

## APPENDIX B Good practises

Success stories of circular use of construction materials enabled by local and regional policy initiatives in Norway and the Netherlands are summarized in Table B.1 and B.2.

*Table B.1: Norwegian success stories of circular construction projects*

Photo	Name and location	Description
	<p><b>Mjøstårnet in Brumunddal</b>  <a href="https://circularmaterialsystems.com/en/case/mjostarnet/">circularmaterialsystems.com/en/case/mjostarnet/</a></p>	<p>Mjøstårnet is an 18-story timber tower standing at 85.4 meters, recognized as the world's tallest timber building upon its completion in March 2019. The structure utilizes glulam (glued laminated timber) for its columns, beams, and diagonals. The joints involves steel plates slotted into timber elements, connected with screws or dowels, facilitating potential disassembly and reuse in the future.</p>
	<p><b>Kristian Augusts gate 13 (KA13) in Oslo</b>  <a href="#">Kristian Augusts gate 13 - KA13 – Norges første fullskala ombruksbygg - Entra</a>  <a href="#">EUMiesAward</a></p>	<p>KA13 exemplifies pioneering material reuse in Norwegian construction, achieving approximately 80% material reuse by sourcing components from various demolition sites, including concrete slabs from government facilities, steel structures from warehouses, railings from a swimming hall, and facade cladding panels from multiple Oslo projects. A significant challenge was the absence of standardized systems for qualifying reused materials; thus, each component underwent rigorous evaluation by an interdisciplinary team, considering factors such as cost, service life, functionality, and aesthetics. Once approved, materials were meticulously prepared for transportation, storage, and on-site installation.</p>

	<p><b>Kristian Augusts gate 23 (KA23) in Oslo</b>  <a href="#">FutureBuilt</a></p>	<p>KA23, originally built in 1950, underwent renovation with a focus on circular principles. Approximately 50% of the materials and building components were either reused or designed to be reusable. The renovation also preserved interior details, integrating new building parts conditioned on their reusability. This project serves as an example on the integration of circular economy principles in building renovations.</p>
	<p><b>Nedre Sem låve in Asker</b>  <a href="#">FutureBuilt</a>  <a href="#">Veidekke: Bygger sirkulært og bærekraftig i Asker</a></p>	<p>The new barn at Nedre Sem is a pioneering project, testing a recently developed circularity index (<a href="#">FutureBuilt</a>). Structural elements of the barn are made of solid wood, while the basement uses low-carbon concrete with recycled aggregates. The project achieved 50% circularity through the reuse and redesign of materials from the existing barn and other buildings, with plans for future reuse of components and 100% reused materials in outdoor areas. It is also part of the EU's Circular Cities and Regions Initiative.</p>

	<p><b>Cissi Klein videregående skole in Trondheim</b></p> <p><a href="#">Teglstein fra nedlagt margarinfabrikk pryder Cissi Klein - Byggfakta Nyheter</a></p>	<p>Cissi Klein Secondary School, opening in autumn 2025, highlights material reuse with an 800-square-meter wall made of nearly 60,000 reclaimed bricks from a demolished margarine factory. The project also incorporates tiles from Nidarvoll School, slate from Byåsen School, surplus panels from Steinkjer Cultural House, oak panels from a health center in Levanger, and marble tiles from the Britannia Hotel. A challenge was coordinating the sourcing, timing, and storage of these materials, requiring careful planning and added costs. Despite this, the project demonstrates the potential of material reuse in overcoming logistical challenges.</p>
	<p><b>Føniks project in Bergen</b></p> <p><a href="#">FutureBuilt</a></p>	<p>Føniks is a reuse <i>project</i> in Bergen that aims to explore large-scale material reuse. The project involves an existing office building at Damsgård, which will become a FutureBuilt pilot. Frydenbø Eiendom AS has been collecting residual materials from tenant turnover and remodeling, cataloging them in the Loopfront database for reuse (<a href="#">Loopfront - Ombruk gjort enkelt</a>). The project focuses on overcoming challenges in material handling, dismantling, and storage. The goal is to make reuse more feasible and create an industry marketplace that supports it.</p>

	<p><b>Nøstebukten Brygge project in Bergen</b></p>	<p>The Nøstebukten Brygge <i>project</i> in Bergen aims to reuse 70% of materials from the former TV2 headquarters to create apartments, a maritime kindergarten, and an urban garden. With a goal of 90% sorting during dismantling, the project will repurpose wood, bricks, façade panels, and sprinkler pipes. The former building’s floor will be used for exterior cladding, and reusable fixtures like ventilation ducts have been redistributed. Bricks and wood will be available for future buyers to incorporate into their apartments, and sprinkler pipes will be reused as balusters. The project highlights the need for policy frameworks to support large-scale material reuse and systematic recycling.</p>
	<p><b>Midtbygda Behandlingscenter in Bergen</b></p>	<p>The new Midtbygda Behandlingscenter in Bergen will replace the existing hospital. The construction, which is expected to finish in 2027 focuses on material reuse from the demolished Midtbygda Hospital. About 850 m<sup>2</sup> of hollow core slabs, along with 950 m<sup>2</sup> of ceiling systems, 15 tons of steel reinforcement, and other structural components like staircases and doors, will be repurposed in the new construction. The project's efforts to minimize waste and reuse materials are supported by the BREEAM-NOR certification (<a href="#">Sertifisering – Grønn byggallianse</a>) for sustainability and guidelines for emissions-free construction sites.</p>

[FutureBuilt](#)

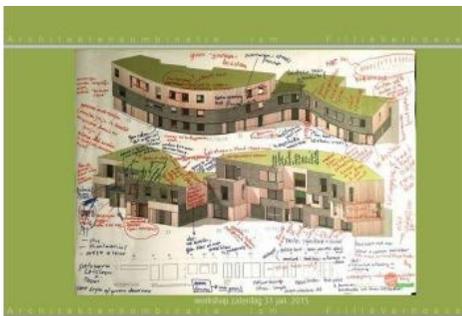
[Bergen kommune - Byggeprosjekt Midtbygda behandlingscenter](#)

	<p><b>New accident and emergency centre in Oslo</b></p> <p><a href="#">Taking a pioneering approach to re-using concrete decks   Skanska - Global corporate website</a></p>	<p>The reuse of hollow-core concrete decks from a demolished government building is envisaged in a new accident and emergency center in Oslo. The project involves a collaboration between public building units, contractors (Skanska and Veidekke), consultants, NTNU, and suppliers (Resirqel and Contiga), with funding from Enova. After thorough inspections, a selection of the concrete decks underwent full-scale testing, confirming they maintain their strength and suitability for reuse in the new construction. The project aims for near-zero emissions on-site and seeks BREEAM Excellent certification, setting a new precedent for large-scale reuse of structural components.</p>
	<p><b>Elvegrenda project in Longyearbyen (Svalbard)</b></p> <p><a href="#">LPO Arkitekter   Elvedansen – ombruk steg for steg</a></p>	<p>Elvegrenda in Longyearbyen is a project that integrates circular principles through local planning policy. In response to building removals linked to the Svea mine closures (<a href="#">LPO Arkitekter   Avslutningsplan for Svea gruver</a>) and avalanche protection (<a href="#">LPO Arkitekter   Sanering av rasutsatte bygg i Lia</a>), the municipality adopted a new area plan in 2021, enabling phased redevelopment and allowing reuse of existing housing modules by relocating them onto new foundations. The project, which began construction in 2023, and which is part of the national research initiative SirkTRE, reuses 46 modules and upgrades them with improved insulation, new façades, and technical systems. These measures reduce energy demand and extend building lifespan while minimizing demolition and transport emissions—key concerns in a remote Arctic setting.</p>

*Table B.2: Dutch success stories of circular construction projects*

**Circular Economy: The Hague Best Practices in Construction (January 2021 Edition) (provided by Ger Kwakkel, The Hague Municipality)**

Photo	Name and location	Description
	<p><b>Verbouwing Haagse Poort (Nationale Nederlanden)</b></p> <p><a href="#">NATIONALE NEDERLANDEN Kiest voor Circulaire Producten TRIBOO</a></p> <p>Centrum</p> <p><a href="#">Circulair project: TRIBOO &amp; Nationale Nederlanden</a></p>	<p>The renovation of Haagse Poort follows circular construction principles, prioritizing material reuse. Existing materials are reused as much as possible, sometimes with modifications. Additional materials come from Oogstkaart, a marketplace for circular and recyclable building materials. The Zero Waste principle ensures that materials that are no longer needed are repurposed—an old bookshelf is transformed into a phone booth, and leftover materials are shared as raw materials between properties. The project aims for a <b>Well V2 Platinum certificate</b>.</p>
	<p><b>Sloop Stadhouderslaan 9</b></p> <p>Stadhouderslaan 9</p> <p>PLAN</p> <p>GEMEENTE</p>	<p>In 2020, an inventory was conducted to identify reusable building materials. The circular demolition assessment revealed that many extracted materials could be reused or recycled at a high level, including <b>floor finishes, doors, and partition walls</b>.</p>

	<p>Sloop Schenkweg  <a href="#">(12) Facebook</a>           GEMEENTE</p>	<p>The building at Schenkweg was <b>stripped to its bare structure</b> in a circular manner. Circular materials such as <b>cable trays, doors, window frames, and suspended ceilings</b> were dismantled and reused in new construction projects.</p>
	<p><b>Sociaal-ecologisch woonproject Groene Mient</b>  <a href="http://www.groenemient.nl/">http://www.groenemient.nl/</a>           Vruchtenbuurt, Segbroek</p>	<p>This project consists of <b>33 sustainable homes</b> surrounding an ecological garden, developed through a <b>Collective Private Commissioning (CPO)</b> approach. Key features include <b>self-sufficiency in energy, reuse of materials</b> (such as beams from an old school and playground tiles), <b>rainwater harvesting</b>, and <b>local food production</b>.</p>
	<p><b>Transformatie vml. CB&amp;I/SHELL-kantoor</b>  <a href="https://www.repurpose.nl/projecten/cbi/">https://www.repurpose.nl/projecten/cbi/</a>           Benoordenhout, Haagse Hout</p>	<p>A former office building is being transformed into <b>luxury apartments</b>, maintaining a circular approach. The office has been stripped to its core structure, and <b>materials such as carpets, door closers, and 120 lamps from the stairwell have been repurposed</b>. The reuse of materials resulted in savings of <b>€35,000</b> for the developer.</p>

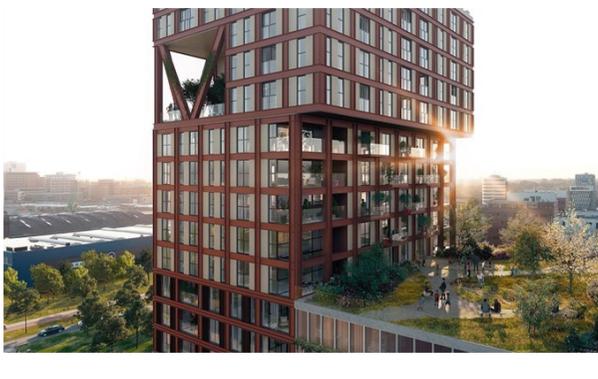
	<p><b>Herinrichting New World Campus</b>  <a href="#">Een circulaire verbouwing - New World Campus, Den Haag - Projecten - Inbo - Urban Strategy, Architectuur, Bouwkunde en Interieur</a>          Rivierenbuurt-Zuid, Centrum</p>	<p>The renovation of the former <b>Postcheque building</b> into the <b>New World Campus</b> followed circular principles, including <b>reuse of existing carpets and furniture</b>. Additional carpeting was sourced from <b>recycled fishing nets collected by local fishermen in the Philippines</b>. A circular contract ensures that materials are <b>returned to the production cycle</b> at the end of their lifespan.</p>
	<p><b>Verbouwing Hotel Courtgarden</b>  <a href="#">Onze duurzame keurmerken - Court Garden Hotel   Officiële website   Beste prijs (hotelcourtgarden.nl)</a>          Zeeheldenkwartier, Centrum</p>	<p>The <b>Court Garden Hotel</b> is the <b>first and most sustainable hotel in the Netherlands</b>, holding a <b>Green Declaration, Energy Label A+, and Green Key Gold certification</b>. The renovation prioritized <b>reuse of lighting fixtures and ceiling tiles</b>, and <b>energy-efficient systems</b> were installed.</p>
	<p><b>Nieuwbouw Afvalbrenngstation Uitenhagestraat</b>  <a href="#">Mex Groep</a>          Centrum          GEMEENTE</p>	<p>This project incorporated <b>six circular components</b>, including a <b>roof repurposed from a demolished building</b> and <b>façade panels made from metal waste sourced from the DAF truck factory</b>.</p>

	<p><b>Renovatie en nieuwbouw HagaZiekenhuis</b></p> <p><a href="https://www.hagaziekenhuis.nl/over-hagaziekenhuis/duurzaamheid/duurzaam-bouwen.aspx">https://www.hagaziekenhuis.nl/over-hagaziekenhuis/duurzaamheid/duurzaam-bouwen.aspx</a></p> <p>Leyenburg, Escamp</p>	<p>The <b>Haga Hospital</b> implemented multiple <b>circular economy innovations</b>, such as:</p> <p><b>Cradle to Cradle-certified drywall</b></p> <p><b>Heat recovery wheels</b> that extract warmth from outgoing air</p>
	<p><b>Systeemwand Haagsche Zwaan</b></p> <p><a href="http://www.planeffect.nl/portfolio-item/c2c-wandsysteem/">http://www.planeffect.nl/portfolio-item/c2c-wandsysteem/</a></p> <p>Bezuidenhout, Haagse Hout</p>	<p>In the 'Haagsche Zwaan', the characteristic office building on the Schenkkade in The Hague, C2C-certified system walls with a sleek, detailed finish are present.</p>
	<p><b>Inrichting kantoor Bouwens Groep</b></p> <p><a href="http://www.ezpress.eu/news/22654/Haags-kantoor-Bouwens-Groep-volledig-ingericht-met-afval">http://www.ezpress.eu/news/22654/Haags-kantoor-Bouwens-Groep-volledig-ingericht-met-afval</a></p> <p>Voorhout, Centrum</p>	<p>The interior of the Bouwens Group office is made entirely of waste and recycled materials, according to the Cradle to Cradle principle. And in the office they use recycled pens, stationery and envelopes.</p>

	<p><b>Bamboe parkeergarage</b>  <a href="http://www.bamboebouwnederland.nl/nl/bamboe-projecten/bamboe-parkeergarage-den-haag/">http://www.bamboebouwnederland.nl/nl/bamboe-projecten/bamboe-parkeergarage-den-haag/</a>          Laakkwartier en Spoorwijk, Laak</p>	<p>The façade of this parking garage is <b>entirely made from bamboo</b>, a fast-growing, <b>self-replenishing grass that requires no replanting</b>—a first in the Netherlands.</p>
	<p><b>Mindbuilding Staedion</b>  <a href="#">Flexibele woningen - Den Haag, Zuid-Holland - Jan Wind Architecten</a>          Moerwijk, Escamp</p>	<p>“Life-long construction” is a construction concept that prioritises sustainability and flexibility for residents and the living environment. For Staedion, 32 owner-occupied and 28 rental homes were built in The Hague according to this concept. Adjustments to the home are easy due to the flexible floor that keeps the pipes accessible. The homes are fully demountable, allowing building components to be reused when expanding your own home or when building other homes.</p>

	<p><b>Renovatie vml. Ministerie VROM-gebouw</b>  <a href="http://www.rijksvastgoedbedrijf.nl/actueel/nieuws/2015/02/03/sloopmateriaal-rijnstraat-8-hergebruikt">http://www.rijksvastgoedbedrijf.nl/actueel/nieuws/2015/02/03/sloopmateriaal-rijnstraat-8-hergebruikt</a>                  Stationsbuurt, Centrum</p>	<p>Almost all of the demolition material that remains during the renovation of the former VROM ministry building (Rijnstraat 8) in The Hague is reused. Of all waste materials, 99.7 percent is recycled. The supplier of the new facade recycles the old glass. When purchasing concrete, the demolished concrete is also offered to the supplier for recycling.</p>
	<p><b>MIAW</b>  <a href="http://miaw.nl/">http://miaw.nl/</a>                  Centrum</p>	<p>Stichting MIAW (Make It Art Worthy) started in January 2015 in the building at Noordwal 18. The building was furnished in a short time with welfare leftovers and recycled materials. Open workspaces for artists were created and rented out and a gallery (without selection) was set up.</p>
	<p><b>Stadhuis</b>  <a href="http://www.denhaag.nl/home/bewoners/gemeente/document/Green-deal-Circulair-inkopen.htm">http://www.denhaag.nl/home/bewoners/gemeente/document/Green-deal-Circulair-inkopen.htm</a>                  Centrum</p>	<p>As co-signatory of Green Deal Circular Purchasing, the municipality of The Hague has completed the tender procedure (2016) for the purchase of carpet (tiles) according to the circular principle. This concerns floor coverings for all municipal buildings of the municipality of The Hague. The emphasis was on the use of recycled raw materials, the possibilities for reusing the floor coverings to be removed and the new floor coverings. The same applies to the purchase of furniture.</p>

	<p><b>Proeftuin Erasmusveld</b>  <a href="http://www.proeftuinerasmusveld.nl/">http://www.proeftuinerasmusveld.nl/</a>          Wateringse Veld, Escamp</p>	<p>The Erasmusveld Proeftuin will be a new sustainable residential area to be developed with 350 homes. This will create space for a circular economy, in which existing materials from the area are reused. The Erasmusveld Proeftuin will also take reuse and recycling into account in the much longer term. The development of the buildings has been carried out using so-called raw material passports. This means that it will be easy to check later which materials have been used. If buildings ever have to be demolished, it will be possible to see in advance which materials will be released and how they can be reused.</p>
	<p><b>Aanleg Rotterdamse baan</b>  <a href="https://www.denhaag.nl/home/bewoners/verkeer-en-vervoer/verkeersprojecten/Rotterdamsebaan.htm">https://www.denhaag.nl/home/bewoners/verkeer-en-vervoer/verkeersprojecten/Rotterdamsebaan.htm</a>          Binckhorst, laak</p> <p>GEMEENTE</p>	<p>When constructing the Rotterdamse baan, the use of materials and raw materials was one of the important tender criteria. The amount of cement in concrete has been minimized. For some components, multiple types of concrete are used, high-quality where necessary and low-cement where possible. Recycled asphalt is used for the road surface and all the material released during the drilling of the tunnel is reused.</p>
	<p><b>Frank is een Binck</b>  <a href="http://www.demannenvanschuim.nl/project/van-klingeren-paviljoen-den-haagherbestemmen-en-nieuwbouw/">http://www.demannenvanschuim.nl/project/van-klingeren-paviljoen-den-haagherbestemmen-en-nieuwbouw/</a>          Binckhorst, Laak</p> <p>PLAN</p>	<p>The reconstruction of the Van Klingereren building on the Binckhorst is the largest relocation of a building in the Netherlands. 'Frank is a Binck' will be given a total living and working experience. The project consists of a concept hotel with a rooftop bar in the former Van Klingereren wing, a co-working space with open workspaces for start-ups and a flexible living concept that offers space for both social rental apartments and apartments for the market.</p>

	<p><b>Woningproject op Den Haag CS</b>  <a href="https://www.vastgoedactueel.nl/nieuws/primeur-350-nieuwbouwappartementen-0-parkeerplaatsen">https://www.vastgoedactueel.nl/nieuws/primeur-350-nieuwbouwappartementen-0-parkeerplaatsen</a>          Centrum           PLAN</p>	<p>The future residents can use various (partial) services in the building. For example, there will be a launderette, guest rooms for guests, a gym and an apartment that can be rented by residents. They can also use shared cars, which are deployed from the garage. No parking space has been included for this new construction. This is the first time that a large-scale housing project in the Netherlands has been carried out with a parking standard of zero.</p>
	<p><b>Voedingscentrum</b>  <a href="https://www.cradletocradlecafe.com/geen-onderdeel-van-een-categorie/12-april-2018-voedingscentrum-den-haag-projectbezoek-gezonder-werken-en-leven/">https://www.cradletocradlecafe.com/geen-onderdeel-van-een-categorie/12-april-2018-voedingscentrum-den-haag-projectbezoek-gezonder-werken-en-leven/</a>          Centrum   <a href="#">Voedingscentrum is verhuisd naar een nieuwe circulaire werkomgeving + LIAG Architecten van Geluk</a></p>	<p>The Voedingscentrum moved to a new location in the centre of The Hague at the end of 2017. The result is impressive – an inspiring working environment with maximum reuse of existing materials, lamps made from old milk cans and even mushrooms. The materials used have been reused, all elements are easy to maintain and move, and all these materials or elements can be recycled or reproduced at the end of their life cycle or are given a new function.</p>
	<p><b>BinckBlocks</b>  <a href="https://vorm.nl/index.php/nieuws/verticale-stadswijk-wordt-werkelijkheid-in-de-binckhorst">https://vorm.nl/index.php/nieuws/verticale-stadswijk-wordt-werkelijkheid-in-de-binckhorst</a>          Laak           PLAN</p>	<p>The Binck Blocks residential tower in Binckhorst is being built as circularly as possible. This means that materials from existing projects in the area are reused. By involving the facade builder at an early stage, the industrially developed element facade is completely demountable and therefore circular. In addition to the facade, the shell is also being worked out in prefabricated concrete, which increases the construction speed. The structural prefabricated floors are separated from the installations in the floors, which provides great flexibility in the future.</p>

	<p><b>Transformatie The Green Campus</b>  <a href="https://www.beelen.nl/circulair-1">https://www.beelen.nl/circulair-1</a>          Laak  <a href="#">Beelen's circulaire aanpak Maanplein te Den Haag - YouTube</a></p>	<p>The circular renovation demolition for transformation of the building at Maanplein in The Hague involves the dismantling and removal of the interior package of the building complex "The Green Campus". The former KPN building with a surface area of approximately 25,000 m2 is being redeveloped into, among other things, homes. Before dismantling the building, it was examined which materials could be reused.</p>
	<p><b>Tiny Houses</b>          Escamp  <a href="#">Den Haag - Tiny House Nederland</a></p>	<p>A mini house or tiny house is a fully-fledged home of up to 50 square meters. In The Hague there are several houses of 20 to 25 square meters. People who live in these small houses live according to a certain philosophy: less materials and less consumption. The houses are largely self-sufficient with local cycles, thanks to a rainwater tank and compost toilet, among other things.</p>
	<p><b>Sloop Boomaweg</b>  <a href="#">Circulaire sloop opstallen Vroondaal in Den Haag   Dusseldorp Infra, Sloop en Milieu</a>          Boomaweg, Loosduinen           GEMEENTE</p>	<p>At four buildings on the Boomaweg (including warehouse, greenhouse, house) the materials that are reusable were inventoried in advance. The buildings were then demolished as circularly as possible and the materials were reused as much as possible (frames, bricks, etc.).</p>

	<p><b>Verbouwing De Helena</b>  <a href="#">Circulaire transformatie De Helena Den Haag - Cirkelstad</a>                  Centrum                   PLAN                   GEMEENTE</p>	<p>Urban Climate Architects, member of Cirkelstad Den Haag, is working on a circular transformation of the Helena. This includes a repurposing of the former school building with the addition of new (social) functions. The associated renovation is carried out as circularly as possible, for example by reusing materials from the building.</p>
	<p><b>Inrichting bedrijfsrestaurant Staedion</b>  <a href="#">Circulair bedrijfsrestaurant voor Staedion - TWO-O (two-o.com)</a></p>	<p>Reuse and upcycling of existing furniture has been used and a no-waste policy has been applied by recycling wood. The space has been redesigned with tables made of recycled wood and table legs, circular furniture, pillars made of recycled wood and mobile divider cabinets made of steel and wood</p>
	<p><b>Linck</b>  <a href="#">Natuurinclusieve woontoren voor De Binckhorst in Den Haag - architectenweb.nl</a>                  Laak</p>	<p>Parts of the building that are subject to frequent changes, such as the finishing of communal areas, will be given a circular finish.</p>

	<p><b>Sloop en nieuwbouw Westhovenplein</b></p> <p><a href="#">Westhovenplein</a> <a href="#">Circulariteit verankeren in ontwerp en ontwikkeling (stebru.nl)</a></p> <p>Escamp</p>	<p>An old school building with outbuildings was dismantled at the same location as where the new building would be built. Possible demolition materials were inventoried for reuse. It was examined – with the clients in the end – how these materials could fit in as well as possible with the design of the new building.</p>
	<p><b>Zuiderstrandtheater</b></p> <p>Scheveningen</p> <p><a href="#">Marktconsultatie</a> <a href="#">circulaire ontmanteling Zuiderstrandtheater Den Haag – Aanbestedingsnieuws</a></p>	<p>The Zuiderstrandtheater in The Hague is a temporary theater, built in 2015. The construction took into account future relocation/demolition. During the circular dismantling (tender starts in 2021), an attempt will be made to preserve the building as a whole, or the individual (construction) materials, as much as possible.</p>

	<p>De Binck</p> <p><a href="#">De transformatie van De Binck in Den Haag: een mooi voorbeeld van circulair bouwen! - VORM</a></p> <p>Laak</p>	<p>The transformation of the SDU complex is an example of circular construction. The former office building was transformed into a characteristic residential building with approximately 70 homes. Circularity is a main theme in the creation of the new residential area. The 10,000 square meter printing halls were dismantled and are being reused as a museum in Barneveld. Even the former thick floor of the halls was given a useful purpose as a foundation under the parking garage. The high-quality reuse of the printing halls, the facade parts, insulation material, glass and possibly other materials from the shed, is an excellent example of circularity.</p>
	<p>Verbouwing Titaan</p> <p><a href="#">RIS310894 Voortgang De Titaan (raadsinformatie.nl)</a></p> <p>Laak</p> <p><a href="#">GEMEENTE</a></p>	<p>During the conversion of the former Harting Bank to the Titaan (place for start-ups) project, as little as possible was demolished and as much as possible was reused. This is reflected in the following measures: More than 80% of the existing floors are reused; Around the central void, the roof trusses of the roof to be demolished will be reused and remain visible as a reference to the original construction; The old wooden interior frames are reused as much as possible; A number of prefabricated concrete frames around facade frames are reused in the east and south facades;</p>

	<p>Hoofdbureau Politie</p> <p><a href="https://www.politie.nl">Nieuw hoofdbureau Eenheid Den Haag krijgt certificaat BREEAM-Excellent (politie.nl)</a></p> <p>Laak</p>	<p>On the edge of the former Binckhorst business area, the new. Unit office for the police unit of The Hague will be built. Completion is scheduled for 2024. The design meets the requirements for a BREEAM-Excellent certification (4 stars). Including: Reuse of an existing inner-city plot. The main supporting structure, facades, installation and the installation package can be completely separated and can be replaced depending on the life of the building. Integrated parking garage with the possibility of conversion into office space. BREEAM: WASTE component: waste management on the construction site, use of secondary material, storage space for reusable waste, compost, furnishing</p>
	<p>Justitueel Centrum</p> <p><a href="#">Tijdelijk Justitueel Centrum voor Somatische Zorg - Wiegerinck</a></p> <p>Scheveningen</p>	<p>An approach was chosen in which logistics, transport, construction method, use of materials and circularity formed the starting point. The building and the construction components must be light and demountable, the foundation consists of screw piles that can also be removed from the ground later. The design is completely modular. The bare facade is covered with sustainable bamboo. A versatile biobased material with an MKI value of less than 2.</p>

	<p>Woningen Monchyplein  <a href="#">Kantoortransformatie Monchyplein Den Haag - Portfolio - SENS real estate</a>          Centrum</p>	<p>By transforming less rentable office spaces into a desirable residential location, supply and demand are much better aligned. As we do at Monchyplein. This proved difficult to rent out as an office building, but the relatively young building is far from ready for demolition. Research has shown that the building does indeed have a future as a residential complex. As many materials as possible from the existing building are being used for the transformation.</p>
	<p>Uitbreiding British School  <a href="#">BSN SSL   Kraaijvanger Architects</a>          Leidschenveen-Ypenburg</p>	<p>Sustainable, cradle-to-cradle materials were used in the project. The use of C2C tile adhesive – developed in collaboration with Kraaijvanger Architects – was a world first, as was the circular roofing. Such materials make an important contribution to a clean and healthy learning environment.</p>

## APPENDIX C Detailed results from semi-structured interviews

Below we have included the detailed transcript of the interviews conducted in Norway.

**A: Project manager** from Longeyarbyen's local governance entity with functions similarly to a municipal council and responsible for key services such as infrastructure, education, and community planning.

**B: Project manager** from a government-owned company involved in numerous businesses on Svalbard, such as property and logistics.

**C: Architect** from an Architecture office located on Svalbard with a team of 120 architects and consultants.

*Table C.1. Interview results from Norway (Interviewer: I; Interviewees: A, B, C)*

General
Do the interviewees have a good understanding of the key policies and strategies shaping circular construction? (1: Very good understanding – 5: Very poor understanding)
<b>A:</b> 3
<b>B:</b> 3
<b>C:</b> 2
Policies & Strategies
General Awareness
Can you describe the most important laws and policies that influence circular construction in your region?
<b>A:</b> Yes, here it is the building regulations for Longyearbyen with its own building regulations that are in a way anchored in the Svalbard Act (Lov om Svalbard).
<b>I:</b> This takes precedence over the national planning and building law, right?
<b>A:</b> Yes, the national planning and building act does not apply in Svalbard. But it is based on the Planning and Building Act and TEK10, and work is being done to change it to a version of TEK17.
<b>B:</b> Unsure if there is any legislation for circularity in Svalbard. Generally, there are fewer laws here than on the mainland. One kind of picks the laws they want from Norwegian law. The same applies to the building technical regulations. And the fact that we still follow Tek10 and not TEK 17 also means that we might have less regulations here than down there. Because in Tek17, there are some requirements regarding reuse mapping I assume, but as mentioned, we do not have TEK17 here in Svalbard. We follow TEK10.
<b>C:</b> Yes, we don't fully follow the standard regulations here, and many laws don't apply. We have a separate building regulation for Longyearbyen that is based on TEK10, not TEK17. There are also some specific requirements, including other technical requirements for ventilation. This can be an advantage, but there is also little focus on circularity and the use of materials. The most important thing is to have regulations with enough flexibility, allowing room to find solutions together.
<i>When we worked on the Elvegrenda project, we simultaneously worked on a zoning plan. We also have another area plan for all of Longyearbyen, with all provisions included, and not many different planning levels. A new zoning plan was developed for the Elvegrenda project with greater focus on reuse and sufficient flexibility. This was within the existing regulations, but there was close collaboration with the local council and the client regarding flexibility. The cooperation has been good and supported the intentions in the planning, from both the client and the municipality. This allowed us to design buildings and gain more flexibility in terms of ridge heights and roof angles to enable reuse, since the materials available do not necessarily conform to a strict plan. Problems can arise with reuse and materials if they don't match what is specified. That's why I believe openness is necessary, but also clear frameworks. It's important to be able to point to what is the most relevant regulatory framework.</i>

Are there any national or municipal strategies specifically aimed at promoting circular construction?

**A:** *I do not know that. A circularity statement/notification (melding) has been made. But I think it was very vague. I do not believe there was anything particularly concrete.*

**I:** *But was there something that was specially made for Svalbard?*

**A:** *No, I don't think so. It is, in a way, the Svalbard report, but it says little about that. This came out this summer. But those are at least the two. It is certainly an important document regarding strategies.*

**B:** *Yes, it is probably possible that there is something local, but something we have managed to capture so far is that there are forces within the architectural community, including LPO, that are working very much for circularity. So I would be quite surprised if they have managed to establish something together with the local government and perhaps some guidelines or something else, so it probably exists, but not in a way that we have an overview of.*

**I:** *Are there specific requirements regarding waste management in Svalbard that could affect the reuse potential of materials?*

**B:** *Uncertain. I am not good at the waste management aspect. Since we have TEK10 here, the sorting degree is not as strict. It is such that the waste we cannot handle here is arranged for transport to an approved reception. I would believe that the Waste Management Agency, as we might call it, which is also part of the municipality, has its own routines or sorting procedures for us and businesses. But I think it is very similar to what it is on the mainland.*

**C:** *On Svalbard, we started a project in 2019 to explore circular construction. It was discussed politically, but it was decided not to pursue circularity. I don't believe there are any specific municipal goals for circularity.*

### Policy Scope & Implementation

Do local governments have clear strategies or action plans for circular construction?

**A:** *Longyearbyen has been working on developing a climate, environment, and energy plan. It was up for final political approval yesterday, but it was not adopted and has been postponed. So as of today, I don't think so. As far as I can see. I can also send the existing version.*

*There is also the Local Community Plan 2022 to 2033. So at least there's something here. There's a sub-goal to reduce the amount of residual waste sent to the mainland by 80% by 2030. As for strategy, this is essentially the governing plan for the local government. It states that it is due for revision now, but it aims to support Longyearbyen in becoming a leading community in the circular economy, including efforts to reduce waste from construction and demolition through collaboration, long-term investments, and facilitation. I can send this to you.*

**B:** *I have not managed to catch that there is any central strategy regarding this. It is assumed that there are some sentences about it in some plan.*

**C:** *No, it seems to be the opposite. There has been little progress. A former leader did a good job on this, but now it has come to a halt. The thinking has stalled, and I believe the politicians (Longyearbyen Local Council) have stopped it. The administration had good intentions, but the politicians have prioritized other matters. It seems short-sighted. They're working on a community plan that includes the UN Sustainable Development Goals, but circularity is not a priority.*

*Maybe they can do more. A reassessment of the community vision is underway, and the politicians are looking at it. The area plan for Longyearbyen will also be revised, and new information will come. State-owned companies own many of the homes and are considering what to do with the buildings. It's uncertain what will happen, but there's talk of transformation, which means tearing down and building anew.*

*It makes me a bit angry. I'm going to work on a cultural-historical site analysis run by Longyearbyen, and I see that this is also important for identity. Circularity and preserving buildings are important, but that's how it is. Maybe now we're seeing a trend toward more demolition and new construction. I think circularity is very important, because they've calculated that reuse isn't more sustainable for them, even though the buildings are of good quality.*

How well are these policies aligned between EU, national, and local levels?

**A:** I don't know.

**B:** I don't know.

**C:** I don't have enough knowledge about that. I know it's about taxonomy, but I'm unsure whether the taxonomy rules apply to Svalbard. I suspect they don't, but it's important to check. I believe many of the rules don't apply here.

How do policymakers and stakeholders communicate about these policies?

**A:** I don't know that either.

**B:** We have a housing report that the state has in relation to homeowners. It does not state anything about circular economy. It states that one should investigate what is more profitable, whether to renovate or build new, and that one should follow TEK17 or TEK10 to the extent that it is appropriate. So, no clear guidelines there. While from Store Norske's strategy, there is a desire to be sustainable, and there have been projects conducted with circles that have considered circular economy here, but the conclusion is that it is more difficult to achieve this here than down south. And it is less appropriate considering that energy consumption accounts for the largest share of emissions since we rely on fossil fuels, so reducing emissions based on reducing material consumption has very little impact. In relation to the consumer's operational phase, it is the operational phase that is decisive. And since the operational phase is decisive, it is most appropriate to build new with high energy standards, with moisture-proof and good solutions and details that are durable over time.

**C:** It's a very small community where many people have multiple roles. They might represent a company on one side and sit in local politics at the same time, and maybe they're also the end users themselves. I don't think there's a direct way to influence local politics, but there might be a kind of lobbying when new initiatives are desired. Generally, in such a small community where everyone knows each other, personal contact is very important. What we've worked on, like reuse projects, has been an important part of this contact. Getting the dialogue going has been very fruitful.

#### Tools & Incentives

Are there financial incentives (e.g., tax breaks, subsidies) to support circular construction?

**A:** You can apply for climate funding (Klimasats).

**B:** Yes, there are. Yes, there are support schemes through Enova, among others, and the Svalbard Environmental Protection Fund. I believe that is something one can apply for. I do not have 100% control over it, but I think they have been involved in that project previously. The Svalbard Environmental Fund has financed much of the work LPO has done regarding circular economy here. So, you have incentives for it, but not anything that covers construction costs, at least as we see it. If there had been a specific project concerning reuse, one could probably have received funding from the Environmental Fund. But the sums are small. Say you have a small shed that is to be put to public use, and one wants to reuse it, one could probably apply for a couple of hundred thousand (NOK) and get something. But it is not decisive.

**C:** There's an overview of support schemes you can apply for on Svalbard. I'm a bit unsure. The tax rules are different here, so I don't know if that affects the construction sector much, since many things are VAT-exempt. The Svalbard Environmental Protection Fund provides support for various projects, and we've received support from them before. I think there are more opportunities, but I'm unsure if anything is directly tied to circularity. I believe the Environmental Protection Fund is relevant.

Are tools like Circular BIM, material passports, or traceability databases being implemented?

**A:** I don't actually know. I think so, but I'm not sure.

**B:** I would argue that it is very minimal. At least for us. Generally, in Longyearbyen, I also believe it is low. Very little FTV up here. What I envision is that when we start new construction, we want to have a BIM model of the new building. I don't think we have a BIM model of the folk high school that we possess either. So there is no BIM for the operational phase or the FTV phase. They started in 2019, I think. So it is quite new. Is it the newest building up here? But it is the newest purpose-built building of some size up here, at least.

**C:** I'm not very familiar with that. But simply put, it concerns large buildings that have significant potential. If the large buildings have better documentation, that's a good thing. When it comes to the demolition of Lier, it's a whole neighborhood being torn down due to avalanche risks and safety measures. There's been an attempt to preserve windows and doors for local reuse. But often things are just thrown into a container, and then you lose

*track. Maybe there are some Excel sheets here and there. It's important to understand that in the Svalbard context, depopulation is a major challenge. People move away quickly, and that affects the system. The system is also poorly implemented, so things can disappear.*

Regarding green public procurement practices in your region: Does public administration require a certain threshold for recycled/reusable materials in tenders?

**A:** *You mean, for example, a percentage requirement such as 30% reused materials? No, we don't have that, but on a few occasions, at least in projects I've been involved in, we have encouraged it. In contracts or tenders, we have stated that we want a certain degree of circularity or reused materials and encouraged contractors to use reclaimed materials. For example, there is a site hut ("Bruktikken") where almost all the modules, in addition to some concrete blocks and some reused steel, were used. Other than that, there are some misordered doors and similar items. Almost nothing is new material. It's quite exciting. I don't know the exact percentage of reuse, as I haven't calculated it. The only new materials are mostly electrical and ventilation systems and a bit of gypsum board. Otherwise, everything in the building is reused—probably 80–90% reused.*

**B:** *Fortunately, we are not subject to public procurement since we are a limited company. So we align as closely as possible to public procurement in terms of process to ensure we are organized. But regarding this, one should almost check with someone at Statsbygg if they have any specific guidelines on it? But there are probably no local guidelines in the application process. There should not be any report on reusability or environmental report included, and so on.*

**C:** *I don't know. Not that I'm aware of.*

## Barriers

### Regulatory Gaps & Challenges

In your experience, what are the biggest policy or regulatory gaps that hinder circular construction in your region, i.e. in Svalbard?

**A:** *Certificates and documentation proving that reused building materials can actually be reused are very expensive. It is costly to obtain the necessary papers or approval for reuse. This can require a lot of consultancy work, making it very expensive. I may be getting ahead of the questions here, but people feel that a lot of extra time is needed for reuse, meaning they don't have the time to do things the right way. The paperwork and documentation take a lot of time.*

**I:** *Yes, you can see the potential for reuse but simply don't have the time to get it documented.*

**A:** *Yes. And then there's the issue with consultants, which creates uncertainty regarding progress and costs. There are methods, but they are not easy to implement in practice.*

**I:** *Is there also a challenge in accessing information about available reusable materials?*

**A:** *Yes, there is so little available here. When I first started working on this, I found it challenging to know what existed. Ideally, we would know what buildings will be demolished in five years so we could start planning and certifying the materials in advance—treating them like assets in a bank. However, since the volume here is small, people have a rough idea of what is available, at least to some extent.*

**B:** *Personally, I do not believe there are any. I do not think there are any real barriers to that. I do not have the impression that there is a huge focus on it right now. But I believe that if one is to succeed, one can refer to what has been done on the mainland with the introduction of requirements for reuse mapping. But the problem on the mainland and central laws and regulations is that they impose requirements for reuse mapping, but do not impose further requirements beyond that you have done it. So all construction projects conduct a reuse mapping and create a report, and then that report is filed away. It is not used for anything meaningful afterwards.*

*At least that is my impression, and that is how we discussed it a lot at Entra, at least. Yes, and the question is whether there is anything regulatory that is a barrier? The only barrier I can see is if you have things you want to reuse that do not meet the requirements in the Technical Regulations, then you have quite a large job to document that you can meet the requirement. For example, if you want to use some windows, you may not have the U-value, and if you want to reuse a door, you may not meet the self-closing requirement for the door, and then you will still have to install new door automation.*

**C:** I think a key problem is that sustainability is not a priority. Nationally, we have high sustainability goals, but locally, it's not what's important. There seems to be a lack of mandates from clients and politicians. The regulatory framework is also a challenge, with little room for adaptation.

There needs to be a good solution for testing sustainable initiatives without having to meet all the standard requirements. There has been much discussion about this in recent years.

Statsbygg has looked at the utility value of buildings, but I think the goals often focus more on economics and energy efficiency. The building stock here is often wooden, and many buildings were not built to last long.

Since the 1970s, energy supply has been based on coal, but now we must find new solutions after coal production was stopped. It's important that everyone building takes energy use into account. It's not just about the materials, but also about how we use energy.

Have you experienced any contradictions between waste regulations and product regulations that create obstacles?

**A:** I think there might be. In practice, anything taken to the environmental station is classified as waste. But the situation here may be slightly different from the mainland.

**B:** I believe the obstacles are only economic and practical reasons, not necessarily regulatory

**C:** I think a lot of regulations don't apply. Everything is imported here. We haven't made any changes, but there are certainly some parts that could be reused. There's no local production of materials, but it's possible to upgrade existing materials, and there is a woodworking workshop. There are always trees that can be used, and we have the necessary personnel. Everything comes by boat. We submit waste reports. I'm unsure which regulations apply.

### Market & Economic Barriers

Do existing tax policies favor circular materials, or do they make it harder for companies to adopt them?

**A:** I don't know.

**B:** I would say that the existing tax policy favors what requires the least labor. Wages are, in a way, the most expensive, and there is a lot of tax on wages, employer contributions, and taxes, so if you want reuse to be used more, you need to reduce the cost of labor, I think. It takes much less time to install a new window compared to dismantling and reassembling an old one. It takes much longer to reuse. And when labor costs become the dominant factor, it does not matter that material costs are lower. If a window costs 8000 in material costs and the labor time is 10 hours because it needs to be dismantled and reassembled, and that labor time costs 800 kr per hour. That is my overall consideration regarding taxes.

**C:** Not that I know of. I think everything is VAT-exempt. In practice, one large supplier sets the terms.

Is there a lack of financial support or investment in circular projects?

**A:** I think so. It should have more prestige and be something to strive for. There aren't enough incentives to do it. As a project manager, you can end up in a difficult situation—you risk criticism for your choices, and using reused materials increases risk. The potential downside (uncertainty in progress) is greater than the upside, so the incentives are not strong enough. There should be incentives that compensate for the extra uncertainty, either as a requirement or in another form.

**B:** If you want my opinion, one should not support anything that is not economically viable.

**C:** Yes, I think it's just not a high priority.

### Technical & Digital Barriers

What challenges do businesses face when trying to implement Building Information Modeling (BIM) or Product Passports?

**A:** I don't actually know. I can't answer that. I don't know enough about it.

**I:** I think this is still a bit early—digital material and product passports are not widely implemented yet. This might be a question for engineering firms.

**A:** Yes. But it's very interesting. I'd like to know more about it.

**B:** Technical challenges. The intersection of cost and benefit. There is something regarding BIM in Norwegian standards. How BIM models should be enriched with content and so on.

They have just begun to look a bit at how it should be enriched with regard to reuse. Specifically, a model was initially not meant to say anything about reusability. It was meant to provide information about the materials used and the specifications so that everything could be found in one place in a 3D model. Thoughts around that have begun to emerge, and then the challenges with BIM are that the models often become very large and heavy, so you need a powerful PC and software that can handle it. And then there is the issue of keeping it updated when you start making small changes and renovations and replacements, so having resources to sit and do that is necessary.

Yes, and there are not many FM systems today that can handle BIM models at all. I believe that in specific purpose-built buildings where it is very valuable to know precisely what is being used. For example, in technical facilities where components must have service intervals that need to be replaced regularly, the value of having a BIM model begins to increase. When it comes to buildings where there are 15 years between each time you need to replace something, I do not think it is practical to operate it based on a BIM model.

**C:** I think availability is a problem. It's about which materials are to be used and which resources are available. If we as architects don't receive a request from the client who wants something, it's hard for us to say they should change their plans. Everything new involves a risk, and although risk is natural, people tend to avoid it. Maybe the previous question was about how orders often don't come from the large housing owners but from private individuals. Clients might want to build more sustainably or use renewable energy. But often the regulations are a barrier, and it's the private sector taking initiative. That can make a big difference. Thanks, there may be regulatory barriers that are not entirely clear.

How difficult is it to share data across stakeholders due to regulations on data privacy and security?

**A:** I don't know. I haven't experienced it as a problem.

**B:** Yes, that is a good question. I do not have a good answer.

**C:** I don't know much, but I've heard that Statsbygg collaborates with several large Norwegian owners. They're trying to build better shared knowledge, which is good since they own a lot of housing. There are many projects they can work on together. When they have the same ownership, sharing data isn't a problem. But I'm not sure if this is happening.

### Cultural & Behavioral Barriers

How do attitudes among businesses, policymakers, and the public impact circular construction adoption?

**A:** Yes, this is a very important topic. As I mentioned, there is a tradition of reuse here in Svalbard, so it might be better here than in many other places. It is important that carpenters and craftsmen are open to trying reuse.

This ties into the training opportunities available to craftsmen, ensuring they develop positive attitudes. There are always some who are strongly opposed, but many are interested in making things work. Creating a positive mindset on a construction site is essential, and the client can do a lot in this regard, such as setting requirements in tenders and continuously following up with contractors at the management level. A lot can be done to build a strong culture on-site or within a construction project. Training also plays a crucial role.

**B:** Attitudes matter a lot. I do not think the suppliers here locally have any relationship to reuse at all. It operates in a classic manner with ordering and delivery between the client and the suppliers, at least here locally.

And on a national level, one would like to, but if you go to the delivery supplier industry, there are probably some of the larger ones that are on the move. But among the smaller ones, there are often questions about who, for example, will take responsibility for complaints and such when reusing old building parts. I think there is a long way to go there.

Then it is also the case that the jobs that are most lucrative for contractors are mostly new builds, where you do not have as much unforeseen issues, and the morale at workplaces is generally better when working with new projects. It is not the most exciting job to patch up the old. So I believe it has something to do with attitudes. Generally, there is still a large gap in the construction industry between the desire to do something for the environment and the political forces and the EU, and the interests that the construction industry generally has. Here, there would need to be a specific standard for reuse that the industry can relate to, which says something

*about responsibilities. If one is to start a reuse project now, there are many loose threads, and many discussions about responsibilities and how to handle complaints, etc. If one plans to reuse 10 doors and 2 are damaged along the way, how should that be handled in a contract? There are many such issues regarding reuse. The Green Building Alliance has created some guidelines at the national level, but as long as it is not a requirement, it will just be guidance*

**I:** *A follow-up question. Longyearbyen local council believed that Arctic settlements, due to their isolated location, have an inherent culture of reuse. Is that something you notice?*

**B:** *Yes, absolutely, but it is more loose items and not so much building components. There is, of course, a culture from old times when one sets up a cabin, where they would collect planks from the shore and construction sites and other places, and eventually gather enough to build a shed, so in that sense, it is a culture. There is also a culture of exchanging among each other, selling cheaply, and giving away on, for example, Facebook, but that is at a low-threshold level. Often from something high-value to something low-value, meaning one has a door that needs to be replaced in a home, and it is given to someone who puts it in their cabin since the cabin is even worse than the home. If you put out 5-10 year old windows on the street here, there are some who will pick them up and place them in a cabin or a shed. But one also notices in that context that many talk about how the island here, or at least in Longyearbyen, is starting to become quite overcrowded with things that people are keeping precisely because of that culture, and it is becoming almost more junk piles than valuable reuse. There is junk and almost garbage in every nook and cranny here that one would actually want to remove from the island, including car wrecks. There are things that have been collected or given away, and then it ends up behind the house wall. And there are incredibly many such places, so that is also a bit concerning.*

**I:** *Which is of course cost-driving to get rid of it?*

**B:** *Yes. If Statsbygg or Store Norske put out old desks and chairs and furniture, people come and pick it up. But it also accumulates junk. It is both culture and conditions.*

**C:** *I believe that anything new or different, and that hasn't been done before, involves a risk. Building on Svalbard is also very expensive. Generally, Norwegians expect building costs there to be 1.5 times higher than on the mainland, so it's always costly. I also have some concerns related to construction and the short building season. There are many climate-related and contextual challenges that already create obstacles.*

Are there knowledge gaps or resistance to adopting new digital solutions?

**A:** *I don't know. I don't think that's the case.*

**B:** *Yes, there is a gap. To be able to use all the functions of digital tools. There has always been a gap there. It is a gap, but it is not resistance. It is more about a lack of competence. It feels like we are lagging behind. One cannot digitalize just for the sake of digitalization. It must be useful. It adds no value to create models of existing buildings; one must get more out of it. It is not resistance, but it must have a real function.*

**C:** *If people don't see the need or understand what it's about, it can be difficult for them to request it. There may be a lack of knowledge. It could be that Svalbard, being an isolated archipelago, has a history of reuse and adaptation. That has been important for the island's survival. At the same time, we've developed a construction industry here that often tears things down and builds new. I believe we should look back to better understand the context compared to other places. What does it mean to be circular? It's even more important here than elsewhere.*

**Opportunities**

**Best Practices & Success Stories**

Have you seen any successful examples of circular construction policies in your region?

**A:** *Yes, the Svea project was a political initiative with a goal of high reuse. Maybe it didn't achieve as high a degree of reuse as we had hoped, but the intention was there. Many materials and structures from Svea have been moved to Longyearbyen. The project was led by Store Norske, and even some barracks were delivered to the port for reuse. There was political backing that made this possible. Additionally, the local community plan supports reuse, and cultural and building regulations play a role in enabling these efforts.*

**I:** *I see. Is this reuse culture typical for Arctic settlements?*

**A:** *Yes, it feels natural to reuse materials here because we are so far away from everything. People are used to repairing and reusing things—it has always been done this way up here. It's important to build on this cultural foundation. In my experience, local craftsmen have been very open to reuse.*

**B:** *Seen some good initiatives. There is no lack of proposals. But they have not been fully developed. Some studies have been conducted, but it has been concluded that it would not be economically viable to implement. For example, the “Elvegrenda Nord”*

**I:** *What good initiatives are they talking about?*

**B:** *Store Norske collaborated with LPO-Architects a few years ago to map the river plain. They found that it was not economically feasible. It was difficult to dismantle and preserve things for reuse. It is a nice initiative, even if the outcome is not always as hoped. There have been several projects that LPO has worked on, including the multi-activity house/reuse house “Fønix”. There are many good ideas, and money is being allocated for this. LPO has received support and is working on it, but it is not being implemented*

**C:** *Yes, we have. Let’s talk about Sveagruva, which was shut down and then restored to nature. It was a small mining community for about 100 people, with many buildings and structures made available. There were many transformations carried out.*

*Now we are looking at what we can recover while also working on a new pedestrian bridge for Svalbard. A new steel bridge from Germany was originally planned, but instead, a coal stacker from the Svea Nord mine was used for a new pedestrian bridge over the Longyearelva river. It was adapted to meet the requirements. This project is a nice collaboration between the local council, architects, Sveagruva, and Sweco as the local structural engineers.*

*The control tower from Svea has been moved here and adapted for new use and now also helps reflect Longyearbyen’s history.*

*Some warehouses from Svea are being transported here (including the Magnetite Hall), but not everything has been put in place. Some buildings were too large, so we’ve faced challenges with adaptation.*

*We also reused demolition materials from the Lia project to build a sauna together with students from AHO (Svalbad project).*

*Some storage buildings from Lia/Bolterdalen have also been reused, and three engineer houses have been repurposed as cabins and are now spread out. Steel panels from a building/the Lunckeffjell mine are being used in the new Telenor administration building, both as wind bracing and as a visual element.*

*There are many good examples of this. We’ve had a lot of buildings and materials available, but we’ve had little time and no dedicated client/site/projects. That’s been a challenge, but we’ve managed to find some interesting solutions.*

*We’re also considering reuse within the site with buildings from an earlier period (including Elvegrenda), but that project has stalled due to foundation issues and costs. We’ve designed a folk high school with a reuse store from Svea, which has resulted in some unique rooms.*

*Are there pilot projects or case studies in your region that showcase circularity in action?*

**A:** *Yes, for example, there is a sauna called “Svalbad.” It was one of the first structures built recently with reuse in mind and has become a kind of landmark. There are several other examples, like a bridge that was repurposed from an old coal transporter and is now located in the town center—it was shipped from Svea. Also, the barracks I mentioned earlier, as well as some houses and cabins. The local government has a cabin that was transported by bulldozer on a sled a few years ago. It turned out great. There are actually quite a few examples.*

**B:** *Yes, we have several in that regard. They had the sauna “Svalbad”, which was a reuse project using materials from Svea, but I believe in practice it was the opposite of a success story because they had to rebuild it to make it work afterward. But yes, they moved the house from Svea over here and put it to use. However, we know that moving houses or buildings is just associated with costs. Yes, you get to reuse it instead of tearing it down, and of course, there is an environmental aspect to it, but it is extremely expensive. We have preserved several of the houses from the Svea mine. The flight tower is an example as well, which today is a place that can be rented for confirmations and christenings and such. In addition, there are some houses/shacks that have been reused.*

**I:** *But the term success story should be taken with a grain of salt?*

**B:** *Yes, it depends on how you look at it. It is a success story in relation to the environment, of course, but economically in no way.*

**C:** *See response to previous question.*

## Policy Innovations & Improvements

<p>What policy changes or improvements would make the biggest impact on circular construction?</p>
<p><b>A:</b> <i>I think there should be an incentive system, either by requiring a high degree of reuse or through other measures. There have been some proposals—I'm sure you know more about them than I do.</i></p>
<p><b>B:</b> <i>Yes, it would have to be that, for example, TEK17 was introduced.</i></p>
<p><b>C:</b> <i>We need a clear directive from politicians so that people finally see the value of this. It's about the circular economy and having a holistic understanding. Instead of just focusing on parts, like energy efficiency or transport, you need to look at the whole picture and have an ambition. If you just go to the store and focus on the energy components, it can become a crisis. It's important to have an overarching goal, and the changes must come from real knowledge and understanding. Often, initiatives like "smart cities" come from outside pressure, but the enthusiasm must be built from within. We've felt the situation has been good, but there have been political challenges. I know a lot has happened in the background, but customers are becoming more aware of sustainable development.</i></p>
<p>In your opinion, should there be stronger regional coordination in material and product supply chains?</p>
<p><b>A:</b> <i>Yes, absolutely. That could be another type of incentive. For example, setting up a materials bank or public initiatives to facilitate reuse—perhaps a storage facility or BIM-based material catalogues.</i></p>
<p><b>B:</b> <i>I believe the key to creating a good circular building component lies with the suppliers. It is about suppliers being able to offer alternatives that we can consider before we buy new. We need to look at what is available and usable instead of always buying new. It can be difficult to achieve in practice, but I believe that suppliers play an important role in achieving a good circular economy.</i></p>
<p><b>C:</b> <i>There are quite strict requirements. It's always about what is available in Tromsø, which sets the conditions. There are higher demands for what is used. It might be better to use more local materials that are available on the island instead of importing. If sustainable materials are imported, there should be a benefit to that.</i></p>
<p><b>Financial &amp; Market Opportunities</b></p>
<p>What type of funding or tax incentives would be most useful?</p>
<p><b>A:</b> <i>Grants would be the simplest approach. We have had good experiences with funding from the Svalbard Environmental Protection Fund, which supported the Bruktikken reuse store, for example. I forgot to mention the fund earlier in the interview.</i></p>
<p><b>B:</b> <i>I think green financing would be effective: Better loan terms if circular solutions are used. A financial incentive.</i></p>
<p><b>C:</b> <i>We should understand taxation better. This applies to Svalbard. The situation is difficult, but I believe we can make it more economically beneficial. One key thing we've seen in all projects is that economics always plays a major role. There's concern that the costs could become too high.</i></p> <p><i>It can be expensive or risky. Maybe it's a startup project linked to the river, where the idea was to purchase something. There were many challenges, and the project focused on step-by-step development. You can build knowledge from the first building, and this can create collaboration and good solutions. It benefits everyone, and you can develop knowledge that can be used further. I think it's a good approach.</i></p> <p><i>We try to say we shouldn't build everything at once, but that we can share knowledge step by step, so mistakes aren't seen as failures. If you can embrace this way of learning, like with design thinking, it would be really great.</i></p>
<p>Would a marketplace for reused/recycled materials and products help businesses implement circularity?</p>
<p><b>A:</b> <i>Absolutely. Without a doubt.</i></p>
<p><b>B:</b> <i>I absolutely believe so, but again, it is essential that the suppliers are engaged. There is a specific market for this. There is something today, but there are too many shortcomings, especially regarding logistics and practical solutions, and not least responsibility around complaints. One must be able to trust that things are usable and last long.</i></p> <p><i>I think a warehouse and a database of reused materials could work well, so that one can plan ahead, apply for approval, and then carry out the project like one would for a project with new building materials. If one is to</i></p>

retrieve materials from a warehouse, they may need to be stored temporarily for almost a year before they can be used, because one must secure the materials.

In smaller projects, a contractor could offer to replace windows with incorrectly ordered windows at a discounted price, thus functioning as a second-hand building materials store. A carpenter might say they have windows at a reasonable price and can install them. But it is challenging to plan projects when one does not know if they can obtain the materials.

**I:** A comment here, as this is the main purpose of SUM4re: that one can consider materials in existing buildings as the inventory, and through technology harvest information about materials and conditions which are then transferred to centralized and harmonized databases for reuse. This can provide an overview of future available reused materials, and where blockchain can simultaneously be used to secure rights for future use. It creates good conditions for being able to start planning in a timely manner.

**B:** Yes, I completely agree and this and SUM4re feel like a continuation of something I was involved in in Brussels in 2018 called BAMB - Buildings As Material Banks.

**I:** Jolly good.

**B:** The main idea of BAMB was precisely this, but a very theoretical approach where one could go into maintenance and operation and find documentation, thus obtaining material passports for building components. Time has passed quickly, and that was in 2018. Now we are in 2025.

**C:** All contractors have large stockpiles, and we try to get a better overview of the projects. We've worked on creating an overview of the big picture. I think it would be useful to have a shared material bank or information about what's available. It could be a place for reused materials, but we need to figure out how to make that work across the whole construction industry. Availability is really important. If the materials are ready instead of having to be ordered, that would be a big advantage.

## Role of technology

Do you see blockchain, IoT sensors, or AI playing a bigger role in facilitating material reuse?

**A:** I haven't thought about it before, but I absolutely believe so.

**B:** Yes, sensors can be important, depending on the type of sensors used. Sensors can, for example, be used to monitor conditions such as temperature and humidity over time. This can provide information on how materials are affected.

Humidity is also a factor that can change over time. It is exciting to see how new technology, such as artificial intelligence, can be used to develop better sensors that can measure different conditions. When building something new or updating existing structures, one can use sensors to monitor changes over time. There are many advanced sensors, and artificial intelligence can be used to analyze the data they collect.

It is so abstract: When talking about reuse, there are some things that are easier to reuse than others. For example, if you have a ventilation system with sensors, you can know that the motor is functioning as it should. This allows for reuse.

But in a simple room like the one you are in now. There are windows, a glass door, and drywall. Can sensors help there? Can artificial intelligence assist in reuse there? It is difficult to envision.

Many skilled architects find new uses for materials, such as using window glass for something other than windows. One can use exterior windows as glass for interior walls, for example. This gives us the opportunity to think of other ways to use things like doors and windows that may not be usable for their original purpose. I believe that artificial intelligence can be of great help in this process.

**C:** I don't know.

How can policymakers better support the adoption of these technologies?

**A:** By funding pilot projects that test these technologies. For example, using AI for approval processes—to assess the quality and reusability of materials. This could reduce manual labor and lower the cost of certifying reused materials.

**B:** If you have a financial reason for it, and can obtain a green loan, and it turns out to be almost profitable, while aligning with your sustainability strategy and image, then it will be important. But often, decision-makers think about the economy. In most cases, it is about safety and working environment, but much revolves around the economy when decisions are made by leaders or the board. It is about cost and benefit. There must be

*economic incentives. For large companies that make a lot of money, it is more about having a good reputation, making it easier to implement such measures. For an ordinary business trying to survive, the economy is crucial.*

**C:** *I'm not sure about that either. I think that if we get good systems, they could be useful. It's important to have a solid system that doesn't depend on individuals and can be used by everyone. One example of such a system is Private. It's an advantage, but I'm not sure it fully answers the question.*

### Final observations

Is there anything else you'd like to add about policies and circularity in the construction industry in Svalbard?

**A:** *Not really, but I think there are great opportunities here. More pilot projects would be interesting. Svalbard has strong core values and cultural traditions that support reuse, so building on that could be very beneficial.*

**B:** *No, what can one say to that? I believe it will come more to the agenda moving forward. There will be more focus on it because there is pressure from the mainland. But right now, local authorities have many other important issues on the agenda. It is about critical infrastructure, such as water and energy. The buildings are also important, so there are several other areas that are receiving attention. It seems that there is some chaos in local authorities right now, with many matters to handle. I think this is on the agenda, and it must be taken into account. But right now, it is not the most important thing, even though it is also important to keep in mind and to have as part of the mindset going forward.*

*When promoting things in light of sustainability, sustainability must be defined in a goal hierarchy beneath that. What is the purpose of reuse? Is it to reduce deforestation, or to reduce carbon dioxide emissions? If the goal is to reduce such emissions, one must look at the facts to find out if it actually works.*

*I had a discussion during a webinar where I said that for us in Svalbard, it may be better to demolish and build new, because the operational phase accounts for most of the emissions. The person I was discussing with thought it was better to save emissions now because it is now that we need emission reductions, but here I believe one must use a different logic where the emissions are assessed over the entire life cycle of the measure, not just the first few years.*

*When considering reuse, one must also think about the consequences for indoor climate. If reuse leads to a worse indoor climate, it can affect other sustainability goals. It is important to know what should be prioritized. There is a lot of focus on the construction industry accounting for 40 percent of the world's carbon dioxide emissions. It is easy to forget that reuse can impact other sustainability goals, so the priorities and choices that politicians and authorities make must have an overarching view of the whole.*

**C:** *Yes. I just wish people would see the value and not just the cost, because that's not good economics. Then it won't be prioritized.*

## Synthesis of Interview with a senior Manager in the construction sector: Circular Construction in the Basque Country

Detailed summaries from Spain

Policy Landscape and Implementation Challenges

Interviewee Spain1(IS1) highlights the 2021 Basque Environmental Administration Law (Law 10/2021) as the most significant regional policy impacting circular construction. It mandates that at least 40% of materials used in public works must be recycled or reused. However, he points out that this requirement is broad and hard to enforce. A 350-page implementation guide published in 2023 attempts to translate this policy into concrete practices, but its uptake remains limited. Many public works projects still overlook the circularity mandate due to inertia, lack of awareness, and long project cycles.

Barriers in Practice

Regulatory Ambiguity: Vague legal requirements lead to confusion in implementation.

Measurement Difficulties: There's uncertainty about how to calculate or verify recycled content in materials.

Slow Market Adaptation: The sector is still in a "learning phase," and many stakeholders are unaware or unprepared to comply with the circularity targets.

Generational Divide: Older professionals are often more resistant to adopting circular practices, whereas younger generations are more open and environmentally conscious.

### Material Reuse Realities

Currently, the most common form of circular practice is the substitution of natural granular materials with recycled aggregates. However, recycled concrete remains rarely used. Even when a contractor proposes it, it often triggers bureaucratic resistance due to the need to revise original project plans.

### Public Procurement and Incentives

Public procurement processes generally do not reward circular innovations. Attempts to offer environmental improvements in bids have faced legal challenges from competitors claiming unfair advantages. Although there is some occasional scoring for environmental certifications like EMAS, such considerations are minimal.

### Emerging Best Practices

*IS1* points to industrialization of construction processes as a key enabler of circularity. The Basque government is pioneering this approach with new guidelines. He advocates for integrated design-and-build contracts, which allow for early consideration of circular goals in the project design phase—especially important for enabling modular or prefabricated construction methods.

### Technology and Digital Tools

Use of BIM (Building Information Modelling) is growing among private actors but still limited in public administration. *IS1* sees strong potential in using BIM not only for construction but also for future deconstruction, enabling better tracking and reuse of materials. However, the current fragmented use of BIM (separate models by designers and contractors) weakens its effectiveness.

### Future Outlook and Capacity Gaps

Despite having laws and technical tools in place, *IS1* warns that the sector faces a major bottleneck: a lack of trained personnel. After the 2008 financial crisis, many professionals left the sector, and new entrants often lack necessary qualifications. He argues that the success of the circular transition hinges not just on regulation but on training and workforce development, which must be prioritized by both the public and private sectors.

## **Synthesis of Interview with technical expert from the research and development sector (Basque Country)- Interview Spain 2 (IS2)**

### **Regulatory Context**

IS2 outlines the key legal framework shaping circular construction in Spain and the Basque Country. At the national level, **Royal Decree 105/2008** was the first to regulate construction and demolition waste, requiring selective demolition and treatment. This was reinforced in the Basque Country with **Decree 112/2012**, which adds stricter thresholds and estimates of expected waste volumes.

Additionally, the **2022 Law on Waste and Contaminated Soils** mandates that **70% of CDW be recovered**—mostly through **recycling**, since **reuse** remains rare. While selective demolition is now more common, it's often only partial, with materials like plaster and ceramics typically mixed into general rubble rather than properly separated.

## Key Challenges

**Limited reuse practices:** True reuse of structural materials is rare, usually limited to temporary structures or elements like timber beams in traditional buildings.

**Low economic incentives:** In the Basque Country, **virgin materials like limestone** are cheap and abundant, making high-quality recycled alternatives only marginally competitive.

**Material-specific issues:**

**Concrete:** Clean recycled concrete performs well but is rarely used unless required by regulation.

**Ceramics and plaster:** Technically recyclable, but local reuse markets are lacking and contamination is frequent.

**Plaster** (not gypsum): Even though 100% recyclable, separation and transport barriers limit feasibility.

**Metals:** Almost entirely **recycled** but rarely **reused** due to cost and technical inspection requirements.

**Wood:** Only noble woods are reused; the rest is downcycled or used for energy recovery.

**Digital & logistical coordination gaps:** There is a need for traceability systems, material hubs, and pre-demolition material databases to better match supply with demand.

**Administrative bottlenecks: Small municipalities often lack the resources (not just expertise)** to evaluate circular construction proposals, slowing or blocking innovations despite available guidance and policy frameworks.

## Best Practices and Innovations

**Arigreen Plant:** A joint initiative between Viuda de Sainz and Heidelberg that produces high-quality recycled concrete aggregates, nearing the performance of virgin material.

**IHOBE (Basque Environmental Agency):** Plays a leading role in green public procurement, providing templates, technical guides, and policy support to local governments.

**Digital traceability efforts:** Projects are developing platforms using **blockchain and BIM** to certify material origin, enhance transparency, and foster trust.

**Demolition material pre-announcement tools:** Emerging tools aim to connect material generators and potential users before demolition begins, allowing for better planning and reuse.

## Recommendations and Outlook

**Close the implementation gap:** Spain has solid legal foundations and guidance, but the full potential of circularity is unrealized due to fragmented implementation and limited incentives.

**Strengthen local capacity: Municipalities need more human and financial resources** to assess, approve, and promote circular construction practices.

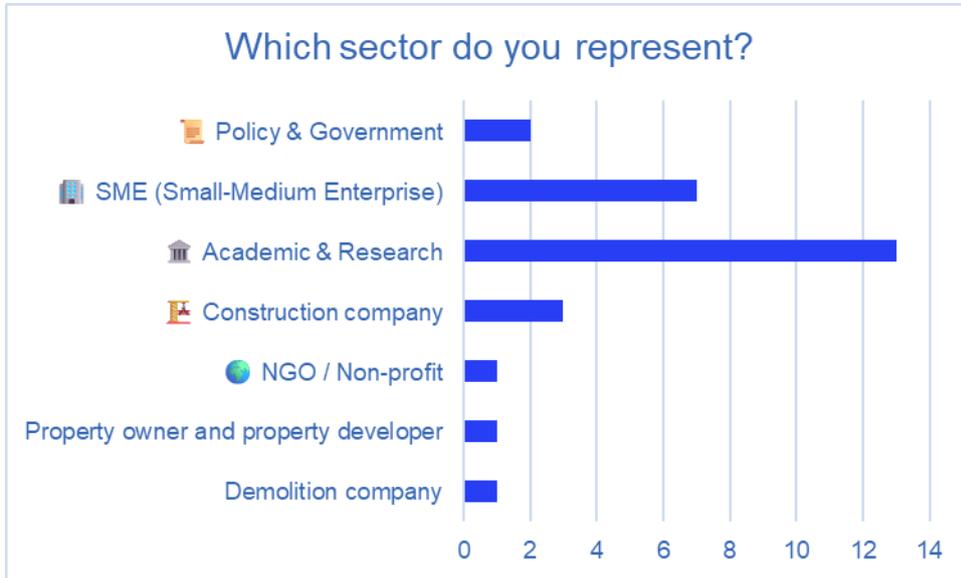
**Digitize material flows:** Widespread use of **BIM, AI, and blockchain** can improve traceability, support reuse, and reduce waste.

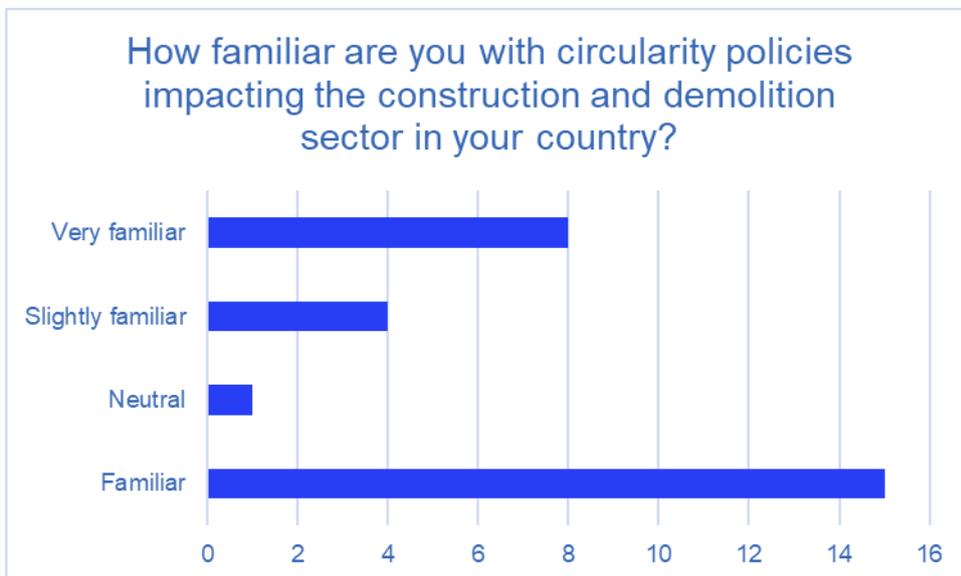
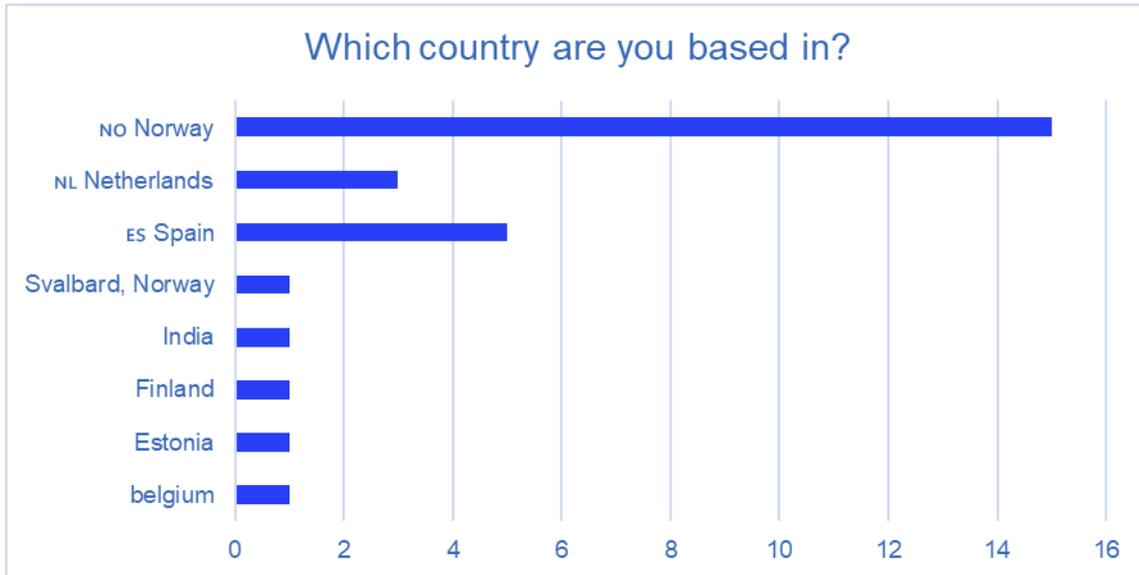
**Invest in infrastructure:** Material banks, temporary storage hubs, and marketplaces are essential to align circular supply with demand.

**Shift market logic:** Without price differentiation or tax incentives, recycled materials will continue to struggle against cheap virgin alternatives.

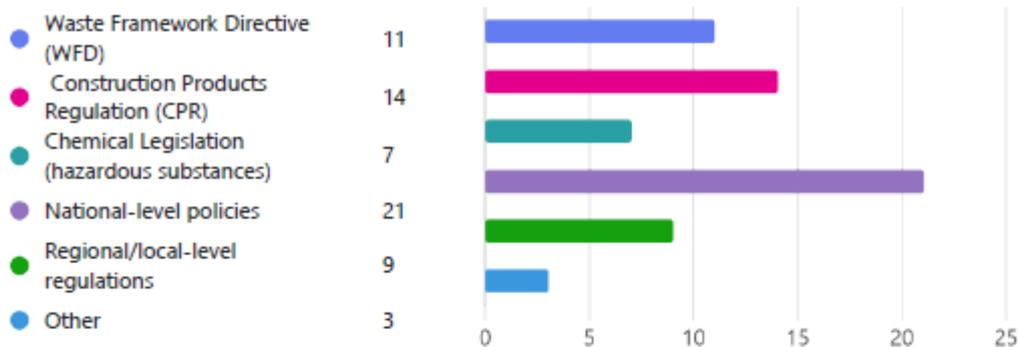
**APPENDIX D Detailed results from the survey**

28 responses



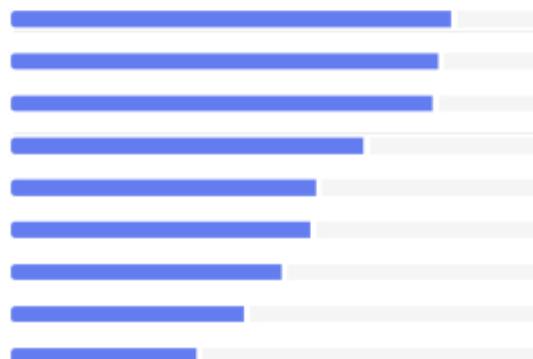


8. What policies, laws, and regulations mostly influence circular construction in your area?



9. Moving the arrows (up and down), please rank from from 1 (top) to 7 (low) the biggest legislative/policy barriers to circular construction at the local level?

- 1 📄 Lack of standardized procedures for the quality assessment of reclaimed construction products an...
- 2 💰 Financial barriers (e.g., high costs, lack of incentives)
- 3 📄 Policy gaps (e.g., unclear regulations, lack of enforcement)
- 4 🏗️ Lack of policies/incentives for promoting building design for disassembly and reuse
- 5 🔍 Lack of acceptance criteria for recovered/recyclable products (e.g., regulations...
- 6 📊 Lack of data on product/material properties
- 7 🛒 Lack of policies to support platforms for the meeting of supply and demand (e.g., market...
- 8 🤝 Lack of coordination among stakeholders (e.g., weak inter-municipal cooperation, lack of...
- 9 🛡️ Insurance or warranty-related barriers



## 10. In your opinion, what is the biggest barrier to circular construction at the local level?

25 Responses

1. quality of recovered material
2. Financial incentives, culture/practice
3. demand
4. need for cooperation and communication between local stakeholders and other businesses to make the circular economy transition work
5. Acceptance of material recovered and product made after recycling
6. New and old people within the construction sector not skilled enough
7. The prevalent business models in the construction sector where a lot of people make money out of virgin materials. Its a cultural and systemic barrier.
8. Cost and certifying products/materials (safety for use)
9. The world is a economic driven and there is to little money in circular construction for the time being. Also the practical and logistical challenges is way to big at the moment.
10. Prize
11. Lack of regulations enforcing reuse
12. See above
13. Lack of procedures for evaluation of recovered materials
14. Lack of possibility to plan with actual upcoming salvaged eligible volumes of building elements. I.e. lack of possibility to integrate representations of salvaged building elements in BIM at an early stage, to have an ID to work with, and to be able to enter into a simple contract of future ownership of the parts, as opposed to try to implement five windows of this kind, and seven of that kind found on a storage house for salvaged building materials. The latter is just ridiculous.
15. Planning, coordination, time and lack of incentives
16. Technical documentation/approval
17. Lack of reliable/predictable availability of documented reused products.
18. lack of risk taking
19. Who will pay the bill
20. The cost of selective demolition and the lack of a recycling culture (including a lack of confidence in recycled materials).
21. Not enough (political) urgency on sustainability or circular economy
22. Mindset of builders and architects concerning using post-consumer materials
23. No coordination between industries, no culture of reusing things
24. It's an "Unfamiliar" method which is an uncertainty which is a higher risk which is a higher cost.
25. Not enough stakeholders interested to make the change from linear to circular construction

**11. Contradictions in Regulations:** Do you think inconsistencies between waste regulations and product regulations create obstacles for circular construction?

- Yes 22
- No 2
- Not sure 4

**12. Financial Support for Circularity:** Is there enough financial support or investment available for circular construction projects?



- Yes, sufficient support exists 1
- No, more financial support is needed 24
- Not sure 3

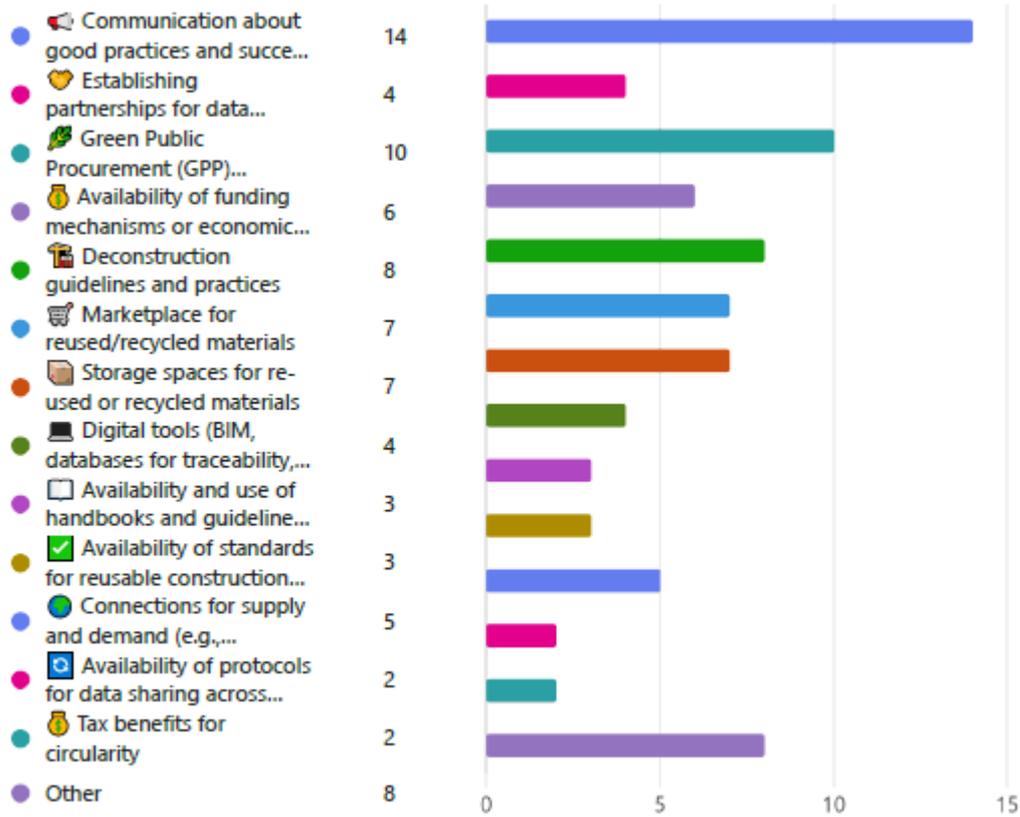
13. What type of financial support would be most helpful? (Select up to 2)



14. Tax Policies & Circularity: Do current tax policies support the reuse of materials in construction, or do they make it more difficult?



15. In which ways do current policies are already supporting circular construction in your region? (select up to five)



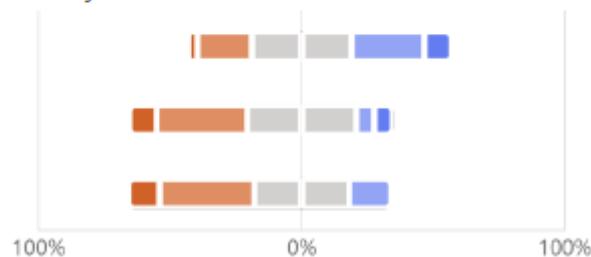
16. Please rate the following statements on a Likert Scale 1-5, from "Strongly Disagree" to "Strongly Agree"

Strongly Disagree  
  Disagree  
  Neutral  
  Agree  
  Strongly agree

The current legislative packages at the EU facilitate innovation in circularity

The current national policies facilitate innovation in circularity

The current regional and municipal policies facilitate innovation in circularity



17. In your region, are all dismantled building components/materials automatically classified as waste?

Yes 8

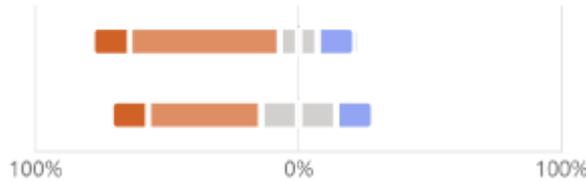
- ✘ No 11
- ? Don't know 9

18. ✎ You indicated that all dismantled materials are classified as waste. The following statements explore the challenges this creates for reuse. To what extent do you agree with the following statements?

● Strongly Agree ● Agree ● Neutral ● Disagree ● Strongly Disagree

"Classifying dismantled materials as waste creates barriers for reuse at another construction site. These barriers would not exist..."

"If dismantled materials retained product status, they would be subject to less regulation and control, raising safety concerns."



19. ✎ You indicated that not all dismantled materials are classified as waste. To what extent do you agree with the following statements?

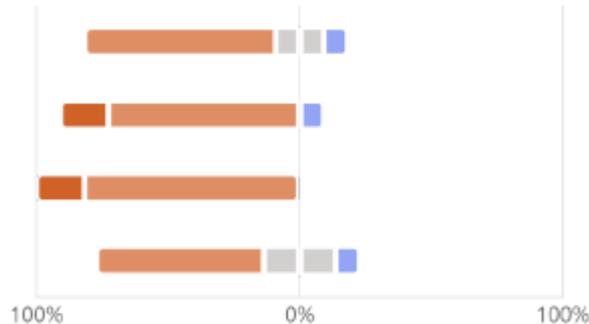
● Strongly agree ● Agree ● Neutral ● Disagree ● Strongly disagree

"In my region, some materials are classified as waste while others retain product status"

"In my region, even when materials retain product status, administrative barriers still exist for their reuse at another..."

"In my opinion, classifying dismantled materials as non-waste support circular construction practices"

"In my opinion, if dismantled materials retain product status, they are subject to less regulation, which often raises safety concerns."



20. Can you describe how the categorization of dismantled materials in your region helps or hinders the reuse of recovered materials in construction? (Open-ended, Optional)

6 Responses:

- i. it is first step to facilitate reuse but additional and often costly as well as not defined and standardized condition assessment is still needed

- ii. The categorizations doesn't necessarily helps as all is communicated through foto's and site visits.
- iii. Not entirely relevant, but the Norwegian regulations DOK implement the European CPR and were revised to exempt non-CE-marked reused building materials from prior documentation requirements, reducing barriers to reuse. However, these materials must still meet TEK technical specifications for the intended project, with properties documented per TEK § 3-1. CE-marking remains voluntary unless an ETA/EAD exists, in which case it is mandatory.
- iv. Only approved "waste handlers" can collect and store waste from other companies. Regulations are open to interpretation. For example, a material is not waste if it still has "commercial value". It is sometimes not possible to know the commercial value before analysis (e.g. of hazardous substances) or quality documentation. A major distributor of building materials that would like to collect and store used insulation materials at their facilities, pending further documentation, is not sure whether they can do this legally. Documentation at the building site is not feasible/attractive, so in practice it is often not possible to know if something is waste or not before storage and analysis.
- v. In my region, dismantled materials are categorized as waste, but their valorization is mandatory; they cannot be disposed of in landfills. However, this does not promote the use of recycled materials beyond applications like embankments, as it only results in the use of recycled aggregates for unbound materials. The only real upcycling happens on asphalt, where asphalt producers use to include 5-10% of recycled asphalt in new mixtures.
- vi. Where materials are labeled as 'continued use' or can easily reach 'end of waste' status, circular options are created.

21. **To what extent do you agree with the following statement?** *"The lack of a common definition for waste vs. non-waste materials creates significant barriers to reusing secondary materials in construction."*



22. **Can you provide examples of best practices at the local level that can inform future EU policies for circular construction innovation?** *(Open-ended, optional)*

12 Responses

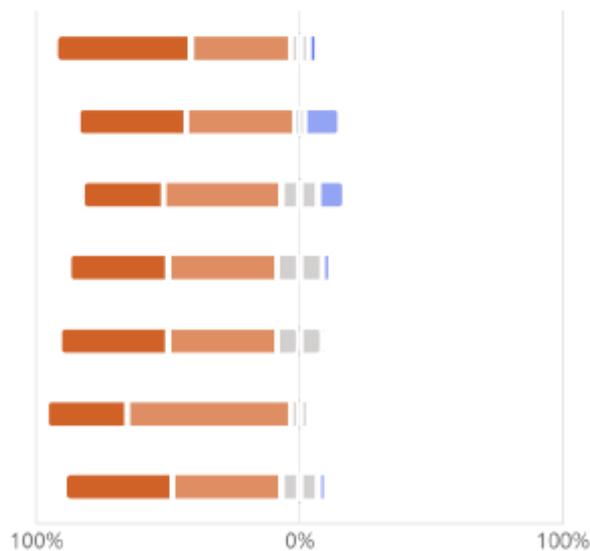
- i. GPP guidelines for demolition work to meet circularity targets
- ii. reuse stores run by the public bodies like city council unit that manages facilities, they create opportunity to which research projects, private projects or private people can connect and develop cases of reuse that lead to future standardization

- iii. Municipality-driven research and innovation into procurement practices, such as trying to investigate what type of circularity is ACTUALLY beneficial from a sustainability standpoint and how can that be described in procurement to avoid green washing and loopholes.
- iv. As buildings enter the pre demolition state buyers can walk through the building and select, see and assess the products they want. All products will be removed, stored and sold before the demolition which decrease waste and increases reuse and funding.
- v. Project reusing load bearing structure of old existing built works seems to be most successful with respect to really valuable reductions in green house gas emissions.
- vi. 12% additional overhead on reused building products for contractor by the municipality of Trondheim.
- vii. Gjenbrukslager trondheim Kommune, Trondheim Gjenbruksråd , Asplan Viak ombrukskaffe
- viii. Maximization of use of recycled aggregates for non structural concrete elements. Use of high percentage of recycled asphalt in new mistures. Mandatoryness of selective demolition together with financiacion of recycled products development.
- ix. "Local green deals on circular demolition: [https://www.noord-holland.nl/bestanden/pdf/Circulaire%20Deal%20Secundaire%20Bouwmaterialen%20NHN%20\(6\)\\_ENGELS.pdf](https://www.noord-holland.nl/bestanden/pdf/Circulaire%20Deal%20Secundaire%20Bouwmaterialen%20NHN%20(6)_ENGELS.pdf)
  - See further: [https://www.noord-holland.nl/Onderwerpen/Economie\\_Werk/Circulaire\\_economie/Circulaire\\_Deal](https://www.noord-holland.nl/Onderwerpen/Economie_Werk/Circulaire_economie/Circulaire_Deal)
  - A 'materials cycling' area in Rotterdam: <https://rotterdamcirculair.nl/de-her/>
  - Instruments for local governments for organic waste: <https://www.circulaw.nl/biomassa-en-voedsel/organische-reststromen/instrumenten>
  - The deconstruction and reuse of governmental building in Arnhem: <https://www.gelderland.nl/themas/duurzaamheid/circulaire-economie/prinsenhof>
  - The deconstruction and reuse of a temporary courthouse: <https://www.rijksvastgoedbedrijf.nl/actueel/nieuws/2021/07/02/demontabele-tijdelijke-rechtbank-amsterdam-verhuist-naar-enschede>
  - The deconstruction and reuse of a theater, The Hague: <https://circulairebouweconomie.nl/nieuws/verhuizing-circulaire-zuiderstrandtheater-officieel-ingeluid/>

### 23. What changes would help improve circular construction implementation?

● Highly Agree ● Agree ● Neutral ● Slightly Disagree ● Highly Disagree

- 🏛️ Tax incentives for circular materials
- 🌐 Regional coordination in material supply chains
- 🤝 Inter-municipal cooperation in waste management
- 🏠 Real estate tendering prioritizing circularity
- ⚙️ Stronger alignment between EU, national, and local policies
- 💻 Digital tools for circularity (BIM, databases for traceability, material passports, etc.)
- 🚀 Innovation Funds for Local and Regional Circularity



24. In your opinion, should there be stronger regional coordination in circular material/product supply chains?

- Yes 21
- No 2
- Not sure 7

25. In your region, are there any successful pilot projects or case studies that showcase circularity in action?

- Yes 18
- No 2
- Not sure 8

26. In the space below, please provide more details and references regarding the successful projects or case studies that showcase circularity in your region

## 17 Responses

- i. Demo case in EU Recreate project for dismantling building and use the recovered products
- ii. KA13 <https://www.futurebuilt.no/English/Pilot-projects#!/English/Pilot-projects/Kristian-Augusts-gate-13-Oslo>
- iii. <https://www.regjeringen.no/no/dokumenter/t-1531-fra-avfall-til-ressurs/id733163/>
- iv. Kristian Augusts gate 13 - first large-scale reuse-project in Oslo
- v. The Norwegian cluster "Nasjonalt kunnskapsarena for ombruk i byggenæringen"
- vi. Circl pavilion ABN ambro
- vii. Kristian August gate 13
- viii. Cissi Klein videregående skole
- ix. <https://www.mad.no/nyheter/ka13-findings-report-now-available-in-english>
- x. Nye Bruktikken
- xi. Trondheim Katedralskole (Trøndelag county administration)
- xii. Several examples from aquaculture, which is also subject to certification and documentation, could provide inspiration for circular construction: <https://oceanize.no/en/2023/09/07/vi-har-besokt-verdens-forste-oppdrettsmerd-av-resirkulert-plast/>
- xiii. Nordre Gate 12 , Olav Trygvasons gate 19
- xiv. There are many successful cases here in Oslo
- xv. See previous examples
- xvi. Prinsenhof A Arnhem, Temporary Courthouse Amsterdam, Zuiderstrandtheater Den Haag buildings used as a donor for building new buildings.
- xvii. SvalBad (floating sauna), walking bridge (old mine structure from svea) over Longyearlva, Svea flight tower moved and repurposed in Longyearbyen, Magnetitthallen moved from svea to Longyearbyen and others

27. In your opinion, what type of policy incentives would be most supportive for circular construction?

## 13 Responses

- i. GPP recommendations
- ii. high waste deposition fee that would force to creative reuse
- iii. Reusing the waste material in new project with incentives in terms of taxes and levies
- iv. Prohibition by far, as non-circular is cheaper and there will always be a company willing to cut corners if it is not written into law.
- v. Easier assessing of second hand product for reuse and making a special certificate for construction products.
- vi. Economic incentives and regulatory incentives
- vii. In addition to digital marketplaces for future salvaged building element where ICF/BIM objects can be downloaded and property rights bought, restrictions on dismantling load bearing constructions, and rather incentives to adapt existing built works with roof stacking and extensions would be beneficial for the overall carbon emissions and material use.
- viii. Requirements on reuse rate and waste reduction
- ix. Remove regulations on handling products where the potential for reuse is still unclear.
- x. Fund for pilots
- xi. No tax to sell reuse product

- xii. Regional agreements, see also previous examples. Also subsidies for circular construction, for governments (infrastructure), housing corporations (buildings) and developers (buildings and offices)
- xiii. Every possible form will help

28. Is there anything else you would like to add about policies and circular construction in your region? Please provide any links or references. Also, if you would like to be contacted for an interview, please leave your information below (Open-ended, optional)

#### 4 Responses

- i. there is lack of material specific or building type specific case study description and practical guidebook
- ii. <https://www.cie.nl/circ>
- iii. Longyerabyen and svalbard is a bit of a special case as not all laws and regulation are implemented here. also a small community farawwy from everything with a high artcic cliamets and permafrost.



Creating materials banks  
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