5 Towards a circular construction sector in North Macedonia

This chapter elaborates policy recommendations for promoting the sustainability and circularity of North Macedonia's construction sector across all building life stages. It gives an oversight of the current state-of-play and policy framework in the country along with areas for improvement and puts forward a set of concrete policy recommendations, enriched with insights from international best practices.

The circular economy in the construction sector

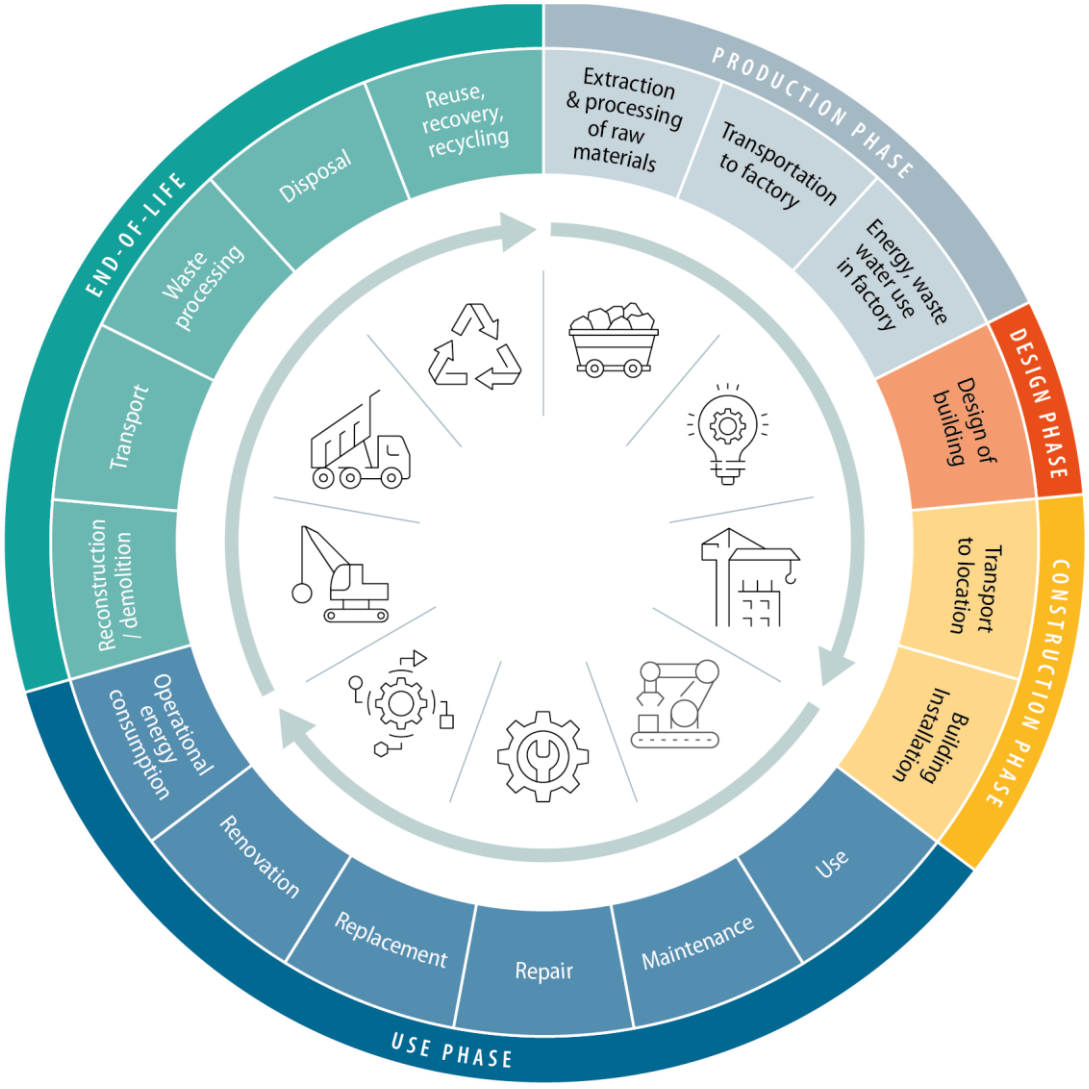
The construction sector is among the biggest consumers of energy and raw materials worldwide, accounting for about half of all raw materials extracted and nearly one-third of all waste generated globally (Breene, 2016[1]). In 2017, it was also responsible for 39% of CO_2 emissions and 36% of energy consumption (IEA and UNEP, 2018[2]; Schober, 2021[3]).

With the rise in population and urbanisation, the construction sector will continue to have a substantial impact on the demand for raw materials, further exacerbating its environmental impact. Accordingly, it is crucial for the sector to implement transformational changes and explore novel approaches to obtain, utilise and handle resources and waste in its operations.

The circular economy offers several opportunities for transforming the construction sector into a more sustainable industry with lower environmental impacts throughout the life cycle. The different opportunities, in particular for buildings, are outlined below and illustrated in Figure 5.1 (adapted from ARUP (2016[4]) and Circle Economy et al. (2018[5])).

- **Production of construction materials.** The use of virgin materials for producing construction materials is minimised and substituted with secondary raw materials, comprising reused or recycled materials, bio/renewable materials, and components. Primary preference is given to locally sourced materials. Production covers material extraction and domestic material consumption of construction materials.
- **Design of buildings.** The design of buildings adheres to a long-term perspective, focusing on modularity, adaptability and energy-efficient principles that reduce externalities. The design integrates operation and performance into the processes, while open-source architectural design techniques facilitate the sharing of ideas among designers, architects and engineers, encouraging collaboration in the development of their work.
- **Manufacturing of construction components and construction of buildings.** The construction process allows for greater flexibility, facilitating easy remodelling of buildings during renovation and easier disassembly at the end of their lifespan. Off-site manufacturing and prefabrication assist in reducing construction and demolition waste (CDW) on building sites. Innovative methods, such as 3D printing, enable the creation of construction materials, components or entire buildings with strong accuracy and flexible design, which results in efficient time management, reduced costs and minimised waste production.
- **Use of buildings.** A building's lifespan is extended by employing internal circular resource cycles, including waste capture, filtration and net-energy production. Occupants of circular buildings lease components and services, as opposed to owning them. Regular maintenance ensures the optimal use of resources within buildings and prevents the premature destruction of building components by means of repair or minor renovations. The flexible utilisation and sharing of buildings optimises occupancy rates.
- **End-of-life of buildings and new lifetime of components and materials.** The demolition of buildings is minimised and mostly limited to old and inefficient building stock. New design approaches allow easy access to building services and include demountable and reconfigurable systems. Building information modelling, along with digital product passports, among other models or frameworks, aids in the expansion, contraction, redesign, construction or deconstruction of buildings. Cloud-based building information modelling provides a chance to remotely collaborate with a greater number of stakeholders. Extending the lifespan of construction materials, products, components and entire buildings can be achieved via practices like reuse, repurposing, refurbishment, recovery and recycling. These methods help optimise the value of materials currently in use and ultimately reduce the need for new, virgin materials.

Figure 5.1. Construction life cycle phases and the circular economy



Source: Adapted from Circle Economy et al. (2018[5]).

Motivations for the selection of the construction sector as a key priority area of the Roadmap

The construction sector has been selected because of its relatively high economic importance, high policy relevance, and high circularity and decarbonisation potential for North Macedonia. The sector generated gross value added of around 5.5% of gross domestic product (GDP) and 6.5% of total employment in North Macedonia in 2022. In addition, the production of construction materials is an important economic activity in North Macedonia and has a strong link with the domestic metallurgy sector. The metal manufacturing industry is a key supplier for the construction sector, providing essential products like steel structures for infrastructure projects such as bridges, as well as smaller scale building works requiring items like steel framework networks, aluminium windows and doors, protective doors, and wire products. Its impact extends to crucial components for households, as well as companies such as hotels and

restaurants, contributing to the furnishing of these structures and their energy supply networks through cabling, solar energy panels, racks and more (Invest North Macedonia, 2023[6]). The sector also has relatively high policy relevance, as it is a key sector and waste stream in domestic policies such as the Smart Specialisation Strategy and the National Waste Prevention Plan of North Macedonia. Moreover, the government places a strong emphasis on modernising its road infrastructure and continues to invest in buildings that prioritise energy efficiency and reducing consumption. There is also a heightened focus on enhancing control measures at construction sites (Government of the Republic of North Macedonia, 2022[7]). Including the construction sector in the circular economy roadmap as a key priority can create strong synergies with these strategies. In the European Union (EU), the sector must fulfil a number of obligations and targets and is likely to be regulated even more in the future under the European Union's Sustainable Products Initiative. This is highly relevant for North Macedonia as an EU accession candidate country on the path to aligning its regulatory and policy framework with that of the European Union. Moreover, little work on the circular economy in this sector is carried out nationally, hence this roadmap can help fill this important policy gap.

Regarding the circularity potential, the sector consumes a large quantity of primary materials and contributes significantly to waste, with construction waste amounting to 3.8% of total waste generated in 2022[1] (MAKSTAT, 2022[8]). The circular economy offers many opportunities to curb the consumption of primary construction materials and generated waste, for example by increasing the use of secondary raw materials, recovery and recycling of CDW, and the production of sustainable construction materials. Applying circular economy measures and practices in the sector could also reduce greenhouse gas (GHG) emissions. Such decarbonisation potential is high, as the sector is emissions-intensive, with buildings generating 2.6% and the manufacturing/construction sector 11.1% of the country's GHG emissions in 2020 (Climate Watch, 2022[9]).

Overview and approach for selecting the proposed policy recommendations

The approach for selecting the proposed policy recommendations for the construction priority area is similar to that used for the other sectoral priority areas (biomass and food, textiles, and mining/metallurgy). Recommendations advocate for a life cycle approach with a focus on design, production, (re)use and end-of-life stages. This is because the entire construction life cycle, from the extraction of materials to their waste management, can create significant environmental pressures affecting ecosystem health and economic growth. The proposed measures also aim to bridge the gap between the current situation in North Macedonia and present as well expected obligations and targets stemming from national and EU legislation. The Waste Framework Directive includes a target for recycling 70% of CDW by 2020. As stated in North Macedonia's National Waste Management Plan 2021-2031, given the need for significant improvements in implementation, infrastructure and data systems (collection and evaluation of data of CDW flows), achieving this target may take until 2031 ((Ministry of Environment and Physical Planning, 2021[10]). The key steps to achieve this as outlined in the National Waste Management Plan include sorting construction waste into component fractions and recycling inert waste, such as bricks, tiles and concrete, into recycled aggregate.

In addition, the National Waste Prevention Plan 2022-2028 specifies several measures for the circularity of the construction sector, such as incorporating green criteria into the planning system and into the construction of facilities it owns; considering setting goals for reuse and recycling of inert waste; developing policies for ecodesign in the construction sector; new policies for the treatment and management of construction noise; encouraging the reuse of products; setting up systems for promoting repair and reuse activities for construction materials and products; and reducing waste generation in processes related to construction and demolition. The measures proposed in this roadmap also aim to create synergies and complementarity with measures proposed in both policy documents as well as in North Macedonia's Smart Specialisation Strategy. By doing so, they aim to tap into the high circularity potential this offers as

explained above, including reuse and recovery of CDW and constructing buildings in a sustainable way. Based on the current situation in North Macedonia, it is proposed that the roadmap focuses on improving three key areas:

1. cross-cutting policies that improve stakeholder engagement and collaboration and ensure funding for circular construction projects
2. managing CDW in a more environmentally sound manner, including increased recovery and reuse of CDW (this would also help provide the supply of recycled construction materials)
3. production and uptake of sustainable construction materials in construction and renovation (proposed measures in this area would primarily help increase the demand for recycled construction materials).

There are other areas the government could support to help achieve a circular construction sector, including the circular design of buildings and the use of advanced digital tools and technologies for a more efficient use of materials, as outlined in the section "The circular economy in the construction sector". Additional measures could be selected and supported at a later stage, once the key challenges and opportunities for a circular construction sector are identified in North Macedonia.

Table 5.1 provides an overview of the proposed policy recommendations to support these three key areas.

Table 5.1. Overview of the proposed policy recommendations in the priority area construction for North Macedonia

Short term	Medium term	Long term
Establish a working group on circular construction	Launch circular construction and renovation pilots	Introduce end-of-waste criteria for certain construction materials
Support scaling up innovation and ensure funding for innovative circular construction and renovation projects (initially through donor funding, link with Smart Specialisation Strategy)	Introduce (mandatory) selective demolition in combination with a gradually increasing landfill tax for CDW	Introduce quality standards for secondary and recycled construction materials
Improve measurement and monitoring of construction and demolition waste (CDW) flows	Strengthen green public procurement of construction works by public entities	
	Promote digitalisation of the construction industry	

Key proposed policy recommendations

1. Improving stakeholder engagement and collaboration, and ensuring that funding is available for circular construction projects

The application of circular economy approaches in the construction sector in North Macedonia is currently in its infancy. Efforts are underway to refine and concretise the integration of a circular economy within existing and new strategies (such as the Industrial Strategy of the Republic of Macedonia 2018-2027, the National Strategy for Sustainable Development 2008-2030, the Growth Acceleration Plan 2022-2026 or the Smart Specialisation Strategy of North Macedonia), but it is necessary to gain a better understanding of the sector, the key barriers to a circular economy transition and the best ways to advance circular economy practices within the sector.

To gain a better understanding of the sector and its opportunities for a circular economy, and contribute to more coherent circular economy-related policy actions, North Macedonia should first establish a working group on circular construction. This working group would strive to establish collaboration and a multi-stakeholder partnership, pinpoint barriers to circular construction, and deliberate strategic measures. It could recognise focal points to propel circular construction forward and serve as a

platform to elevate stakeholder awareness and education regarding circular construction. Improving co-ordination and collaboration among all pertinent stakeholders, including inter-ministerial collaboration, is imperative to promote the adoption of circular economy principles throughout the construction life cycle. Enhancing capacity-building activities, knowledge transfer and educational efforts is crucial to achieve this goal.

Such a working group could function as a sub-group of the existing circular economy stakeholder working group created to support the preparation of this roadmap. It could also be involved in the establishment of a centre in 2024 to facilitate collaboration among academia, businesses, policy makers, municipalities and the non-government sector in the realm of sustainable materials and smart buildings, which is foreseen under North Macedonia's Smart Specialisation Strategy. This strategy further envisions additional measures to engage relevant stakeholders and provide funding for advancing the most effective circular economy practices in construction. The overarching objective is to enhance public-private partnerships in this sector, including by organising workshops; developing and utilising an interactive database to address challenges; promoting co-operation among businesses; facilitating academia-business fairs to boost collaboration; and supporting municipalities focusing on energy efficiency, secondary raw materials and recycling. These actions can directly contribute to the transition towards a circular economy in North Macedonia. It is, therefore, strongly recommended to create synergies and complementarities between the Smart Specialisation Strategy and the Circular Economy Roadmap in the construction sector. The Circle Economy's recent publication includes a guide on setting up collaborations for a circular economy (Circle Economy, 2020[11]).

To strengthen stakeholder engagement in circular construction, **North Macedonia will also need to support the scaling up of innovation and ensure funding for innovative circular construction and renovation projects.** Existing and foreseen funding programmes such as the Greening Business Facility (see Chapter 4) and the soon to be established Energy Efficiency Fund[2] could be used for this purpose. Additionally, the Smart Specialisation Strategy aims to drive scientific excellence in the sector by providing funding based on grants and other financial incentives such as subsidies, or tax incentives for establishing research and innovation laboratories in the business sector collaborating with academia, along with co-financing opportunities for commercialised products. To support a circular construction sector, government support should focus on, for instance, providing grants to help domestic material producers modernise technologies and production processes in order to manufacture construction materials using recyclates,[3] and enabling market mechanisms and tools to facilitate SMEs' operations. This is in line with the measures foreseen in the Smart Specialisation Strategy; hence, strong co-ordination in this area is recommended. Alternatively, national or regional research and/or renovation programmes can also support circular renovation by providing direct subsidies and training. An example from Belgium is the regional initiative Vlaanderen Circulair (Circular Flanders), a partnership between government, businesses, academia and other experts. The initiative also targets business model innovation within the construction sector funded by grants. It includes a guide on circular school construction, a tool for the building information modelling environment and a project on financing circular materials differently (Vlaanderen Circular, n.d.[12]).

In the medium term, North Macedonia could launch circular construction and renovation pilots through the funding mechanisms established for this purpose. These pilots could test and apply circular construction innovations. Contrary to long-term infrastructure development, pilot projects can be a quick source of learning for a large-scale deployment of circular economy practices in the future. When building stock is about to reach the end of its life or will require deep renovation, North Macedonia might seize the opportunity to apply and test circular economy strategies through deconstruction and new construction pilot projects. A number of countries and municipalities have already piloted circular design principles. On the city level, a recent OECD report (OECD, 2020[13]) collects evidence of successful pilot projects to test new technologies, raise awareness and encourage public procurement. At the regional

level, one key initiative is from the Brussels-Capital Region, which established a circular renovation programme (Box 5.1).

Box 5.1. Circular renovation programme in the Brussels-Capital Region

A key example of a wider programme to pilot circular construction projects is from the Brussels-Capital Region. The regional authorities planned to: launch a study to define a strategy for reusing building materials; set up a "renovation lab" programme to support circular economy renovation projects and raise awareness; and gradually implement mandatory selective demolition (through environmental permits).

The Roadmap for the Construction Industry in Brussels – Towards a Circular Economy sets various milestones for completing a range of studies assessing the economics of reuse channels, sociological obstacles to reuse, the viability of circular business models in construction and the market potential for reusing materials not currently in the market, until 2025.

The Renovation Lab initiative ("RenoLab"), launched in September 2021, aims to show actors across the construction sector, as well as the users of the buildings, the feasibility of sustainable renovation by establishing a network/platform managed by the regional agency, Brussels Environment, to share innovative practices. RenoLab has two components. RenoLab.ID supports ideas and projects as well as tools and mechanisms that lower barriers to renovation. RenoLab.B supports circular and sustainable renovation initiatives at different stages. By launching calls for pilot projects, the initiative also aims to test and develop the tools and techniques used in the context of sustainable renovation.

The Horizon 2030-2050 Strategy for Reducing the Environmental Impact of Existing Buildings includes provisions for formulating and enacting regulations mandating selective dismantling. This is yet to be implemented, and interim targets related to these measures are anticipated in 2024.

Sources: European Commission (2021[14]); Government of the Brussels-Capital Region (2019[15]); Bruxelles Environnement (2019[16]); Renolution (2023[17]).

2. Managing construction and demolition waste in a more environmentally sound manner, including increasing its recovery and reuse

In North Macedonia CDW (mainly mineral) represents 3.8% of total industrial waste (MAKSTAT, 2022[8]). However, structural lack of data due to high rates of informal waste collection in this waste stream makes these statistics less conclusive in an international comparison[4] (Ministry of Environment and Physical Planning, 2020[18]). Municipalities are in charge of CDW, and so far no private investments have been secured to finance waste removal or processing operations (Ministry of Environment and Physical Planning, 2021[19]). CDW is currently largely disposed in waste landfills or unmanaged, and its collection, separation and recovery almost non-existent. The few recycling activities in place are largely conducted by the informal sector.

To accelerate the prevention of CDW, encourage a more appropriate use and treatment of CDW, and embed circular economy principles in the management of CDW, North Macedonia will need to implement a construction waste reform. This reform should focus on a minimum of three key elements with regard to end-of-life management of CDW:

- improving the measurement and monitoring of CDW flows in the short term through digital tools to understand what the issues are, and promoting digitalisation in the medium term to improve resource efficiency and sustainability of the sector;

- introducing (mandatory) selective demolition in combination with a gradually increasing landfill tax for CDW in the medium term to stimulate greater reuse and recycling of CDW;
- introducing end-of-waste (EoW) criteria for certain construction materials.

To achieve these goals, a clear waste legislative framework and waste infrastructure for the collection, transport and processing of CDW needs to be in place. This is planned under the National Plan for Waste Management (2021-2031), including dedicated infrastructure to provide treatment and disposal options for manufacturers and the introduction of a legal obligation for on-site waste management plans for large construction projects. Moreover, guidelines to reduce waste are under preparation, including for the construction sector under the National Waste Prevention Plan (2022-2028).

To better tailor and design existing and new policy measures and scale up the adoption of circular business models in the sector, North Macedonia will need to put in place systematic data collection and promote digitalisation of the sector. Improving data availability on CDW flows enables sustainable waste flow management from producers to final waste processors, while digital tools facilitate reporting and the exchange, processing and management of data. North Macedonia does not yet have a system for monitoring the uses of construction materials and CDW generation. A recent review of the current CDW management in European countries identifies the lack of a database for monitoring CDW quantities and a clear assignment of responsibilities to control and monitor waste management as the first obstacle to a sustainable waste flow management (Giorgi, Lavagna and Campioli, 2018[20]). An inventory should record the amounts of CDW produced throughout the economy, along with their quality specifications. To achieve this, construction companies must improve their data reporting on waste codes, lifetimes, prices and usability of different waste streams. Additionally, laboratory tests for specifying the quality of secondary raw materials recovered from CDW are necessary. This information could, in turn, inform the quality standards and labelling for secondary construction materials discussed in the section on “3. Production and uptake of sustainable construction materials in construction and renovation”. Additionally, it could facilitate matching suppliers with users of recycled construction materials, thus driving the creation and adoption of a marketplace for secondary raw materials. Ultimately, increased data availability would also aid evidence-based policy making. To build such an inventory, North Macedonia could draw on the experience from the Czech Republic and France (Box 5.2). To accurately monitor CDW flows, including CDW recovery rates, CDW flows need to be tracked to their final destination.

North Macedonia can also promote the use of different digital tools in the medium term. Digital tools, such as materials passports and building information modelling, provide detailed documentation of materials, components and products within buildings’ structures, and generate multidisciplinary data to create digital representations of buildings’ characteristics. This enables the utilisation of buildings as material banks and facilitates a transparent flow of information between stakeholders throughout the project phases (OECD, 2022[21]). These tools provide North Macedonia with an opportunity to use its building stock as a source of raw materials and to track CDW flows from construction and renovation activities. Other digital technologies include robots, drones, 3D printing and 3D scanning. Examples of digital approaches to a circular economy in the construction sector include the Danish Strategy for Digital Construction (launched to increase the productivity and efficiency of the construction sector) (European Commission Construction Sector Observatory, 2019[22]), the Digital Transformation of the Bulgarian Industry (which also addresses the construction sector) (Ministry of Transport, Information Technology and Communications of the Republic of Bulgaria, 2020[23]) and the Dutch digital approach to circular economy in construction. A recent report by the European Construction Sector Observatory (2021[24]) collects evidence and lessons learnt on integrating digital technologies (including data acquisition, automation, and digital information and analysis) into the construction sector. The European Commission also proposed to introduce “digital product passports” in its proposal for a revision of the Construction Products Regulation (European Commission, 2022[25]).

Box 5.2. International good practices on monitoring waste flows (including construction and demolition waste)

Czech Republic

Czechia's electronic registry for waste is an exemplary model of a successful national waste information database. Recently rated as the best European system for waste data management and evaluation by the European Topic Centre for Circular Economy, it employs two distinct systems. One handles the mandatory data reported by entities subject to relevant legal acts (Information System for Reporting Obligations) while the other manages the subsequent verification, processing and evaluation of the reported data (Information System for Waste Management). This streamlined process is further enhanced by extending verification authority to municipal and regional authorities. The Environmental Information Agency functions as the central data hub. By engaging a diverse array of stakeholders, including the Czech Statistical Office, the information system becomes a catalyst for the development and implementation of evidence-based waste management policies.

France's *National Buildings Database*

France's *National Buildings Database* (*Base de données nationale des bâtiments*) is an open-data project cross-sourcing geospatial information from about 20 different datasets in the public domain, representing a unified identity map of more than 21.4 million buildings on French (metropolitan) territory. The data relate to the morphology of buildings, the type of use, embedded materials and technical equipment, energy consumption and performance, as well as administrative and economic data. This unified database allows users to navigate information on the national built environment, bypassing the limitations of individual datasets. Relevant applications include the fields of energy transition (such as the Bat-ID project on monitoring buildings' energy renovation), the circular economy, social housing and infrastructure networks, among others. Since April 2022, publicly available data can be downloaded directly from the government's website.

Sources: Tuscano et al. (2022[26]); data.gouv.fr (2022[27]).

To stimulate greater reuse and recycling of CDW, North Macedonia needs to introduce (mandatory) selective demolition for CDW in the medium term. Currently, North Macedonia has failed to ensure that CDW is managed in a manner conducive to more efficient recycling and reuse. Stakeholders have voiced apprehensions about CDW being illegally disposed into dumpsites and the absence of measures to encourage separation of CDW for recovery and reuse. Selective demolition enables the removal and safe handling of hazardous substances; facilitates reuse and high-quality recycling; and contributes to the establishment of sorting systems for a number of materials, such as wood, mineral fractions, metal, glass, plastics and plaster (EU Waste Framework Directive 2008/98/EC). The process consists of four phases: 1) identification of hazardous materials and decontamination; 2) deconstruction; 3) dismantling and demolition; and 4) sorting. When employed effectively, selective demolition can retrieve high-quality materials for reuse or recycling so that only a minor proportion of rejects and hazardous waste needs disposing of. A pre-demolition survey will aid the identification of hazardous materials that require removal before the demolition, therefore simplifying the appraisal of their recycling capability. Waste sorting may occur on-site at the demolition or at dedicated sorting facilities for mixed construction waste. A systematic enforcement of mandatory selective demolition rules is necessary to ensure its uptake and compliance. In the European Union, the revised Waste Framework Directive has recommended the implementation of selective demolition. A number of countries, including Belgium, Denmark, Finland and Sweden, have already established legal requirements for materials and their specific separation of CDW at the demolition site (Wahlström et al., 2020[28]). The Austrian technical standards for the design and execution of selective demolitions demonstrate the successful implementation of such requirements within national legislation.

An example of an online traceability system providing quality assurance for the selective demolition process is the database developed in Flanders (Belgium) (Hradil et al., 2019[29]). The European Commission has also established guidelines for waste audits before demolition and renovation works (European Commission, 2018[30]).

To further incentivise recycling (rather than landfilling for backfilling purposes), North Macedonia could implement landfill taxes, including for CDW, combined with better enforcement of waste legislation to prevent an uptick in illegal dumping. Many countries levy landfill taxes to reflect the environmental costs associated with landfill use, including for inert CDW waste. These taxes are typically charged on the weight or volume of waste delivered to landfill sites, or on the authorised landfill capacity. Inert CDW tends to have a lower landfill tax rate than some other waste streams, such as municipal or hazardous waste. To ensure that CDW is diverted away from landfill, some countries have increased their landfill tax rates for CDW. A recent example is the Slovak Republic, which in 2022 amended its waste legislation to increase the landfill tax rates for CDW and industrial waste gradually, from EUR 8 per tonne in 2021 to EUR 25 per tonne in 2022, EUR 30 per tonne in 2023 and EUR 35 per tonne in 2024 of construction waste (and from EUR 7 per tonne of excavated soil in 2021 to EUR 8 in 2022, EUR 10 in 2023 and EUR 15 in 2024).

However, to prevent a rise in illegal CDW dumping, North Macedonia will also need to step up its enforcement efforts. This could be done through a combination of awareness-raising, a mandatory pre-demolition audit, and better enforcement and supervision mechanisms (including a higher probability of being sanctioned). In terms of preventive measures, for example, the Slovak Republic plans to strengthen co-operation between municipalities and police, clean up incriminated locations, punish offenders, monitor illegal waste incineration, and extend the responsibility of property owners for illegally disposed waste (Ministry of Environment of the Slovak Republic, 2019[31]). Austria organised large awareness and information campaigns, increased control and enforcement activities, and improved the electronic recording of waste streams and waste management (European Commission, 2012[32]). To fight illegal dumping from the building sector, France introduced an extended producer responsibility scheme for building construction products and materials that started on 1 January 2022. To improve the monitoring of waste streams and prevent illegal disposals, Belgium introduced a mandatory pre-demolition inventory of the types/quantities of materials present in buildings (to identify hazardous and other waste fractions) (Giorgi, Lavagna and Campioli, 2018[20]). A number of other countries are tackling fly-tipping[5] and large-scale illegal landfilling with better enforcement, including more effective control and prosecution of abusive practices. For instance, Czechia aims to improve conditions for law enforcement authorities to prevent and combat waste-related crime through a short-term national strategy. This aims to improve co-operation among the environmental law enforcement agencies, strengthen their competencies, improve the regulatory environment and build public awareness of waste-related matters (Ministry of the Interior of the Czech Republic, 2019[33]). In terms of specific punitive regulations, offenders are often pursued and have to pay the landfill tax (Fischer, Lehner and McKinnon, 2012[34]; European Commission, 2021[35]).

North Macedonia could also introduce EoW criteria for certain construction materials to further instigate their reuse and recycling in the long term. EoW criteria determine when waste ceases being waste and becomes a secondary raw material or by-product (as defined by the EU Waste Framework Directive 2008/98/EC). The revised Waste Framework Directive recommends the implementation of EoW criteria to promote a level playing field for secondary raw materials (Box 5.3). At the EU level, such criteria have been adopted for certain waste streams (including iron, steel, aluminium and copper scrap, and glass cullet). Meanwhile, individual EU member states have the discretion to confer a by-product status on other waste streams. This can be accomplished either by adopting binding national criteria or by taking decisions on a case-by-case basis.

Additionally, it is crucial to tailor EoW criteria to meet local requirements and regulations. Legislation granting EoW status for a range of construction and building materials is currently in place in Austria, Belgium, Bulgaria, Croatia, the Netherlands, the Slovak Republic and the United Kingdom. These countries

aim to target specific types of CDW, such as bricks, tiles, building waste, building and demolition wood, inert waste, concrete rubble, and various slags, among others (European Commission, 2020[36]). The aggregates obtained can then be considered for use in construction projects such as road construction, bound surfaces, and concrete and asphalt mixes. Recent analysis by the European Commission (2020[36]) has shown a case study on mineral CDW, which is used as a building material under the EoW status. An earlier report from the European Commission's Joint Research Centre outlined a methodology for determining EoW criteria, along with criteria for pilot case studies that include aggregates and metal scrap (Delgado et al., 2009[37]).

Box 5.3. Guidance for developing end-of-waste criteria

Conditions outlined in the EU Waste Framework Directive

According to Article 6 (1) and (2) of the Waste Framework Directive, "waste ceases to be waste when it has undergone a recovery operation (including recycling) and complies with the following criteria:

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

Meeting the first two conditions increases the likelihood of the material being put to a useful purpose instead of being thrown away. The third condition requires that the material be suitable for legal use, and the fourth ensures that using the material does not warrant waste legislation. To determine this, an assessment is made by comparing the environmental impact of using the material under waste legislation versus non-waste product legislation.

Alternatively, a material may cease to be waste if Article 5 of the Waste Framework Directive applies: "Member States shall take appropriate measures to ensure that a substance or object resulting from a production process the primary aim of which is not the production of that substance or object is considered not to be waste, but to be a by-product" if certain conditions are met.

Countries, in accordance with their local regulations, have established distinct terminology for end-of-waste criteria, addressing various types and compositions of construction and demolition waste. For example, the classification of recycled aggregates may be classified by weight (specifically particle density exceeding or falling below 2 000 kg/m³), size (ranging from fine to coarse to all-in) or composition (determined by the weight percentage of individual components like concrete, glass, ceramic and plaster).

The European Commission has laid down end-of-waste criteria for iron, steel and aluminium scrap (see Council Regulation (EU) No. 333/2011), glass cullet (see Commission Regulation (EU) No. 1179/2012) and copper scrap (see Commission Regulation (EU) No. 715/2013).

Sources: Delgado et al. (2009[37]); European Commission (2023[38]).

3. Production and uptake of sustainable construction materials in construction and renovation

The third key area for improvement in the construction sector that the Circular Economy Roadmap for North Macedonia could address is incentivising greater production and adoption of sustainable

construction materials. The production of building materials in North Macedonia is based on domestic resources of non-metallic minerals (marble, gypsum, brick clay, sand, gravel) and related mining activities (imports of primary raw materials are almost negligeable). The main construction products produced in the economy are cement products, plaster, plasterboard, dry mortar, clay products and bituminous insulating materials. The production of construction products has undergone major changes in recent years with the introduction of modern production lines and technological advancements (Economic Chamber of North Macedonia, 2021[39]). Overall, untapped potential remains in the production of sustainable construction materials, in particular through more resource-efficient mining operations (see Chapter 8) as well as through the use of industrial waste and the reuse of construction materials. The Smart Specialisation Strategy also advocates for more efficient use of natural resources in the production of construction materials, especially through their extraction and the development of innovative technologies enabling the production of construction materials from industrial waste (Ministry of Environment and Physical Planning, 2023[40]).

To complement the initiatives under the Smart Specialisation Strategy, the roadmap could focus primarily on incentivising the demand for and investment in more circular construction products and building services in the medium to long term. This could be supported by two key measures:

1. strengthening the use of green public procurement (GPP) for construction works by public authorities
2. introducing quality standards for recycled construction materials.

North Macedonia needs to strengthen the use of GPP criteria in the construction sector to stimulate demand and, as a result, the market for sustainable buildings construction and renovation in the medium term. As public procurement accounted for about 8.6% of GDP in North Macedonia in 2022 (European Commission, 2023[41]) and the Law on Public Procurement (2019) includes relevant provisions on life cycle costs, it can facilitate the supply of green products and services in the construction sector. The application of GPP in construction and refurbishment projects is an established practice throughout Europe and beyond, aimed at stimulating the market for sustainable public construction works and the use of recycled materials. This tool has been made a priority in policies promoting a circular economy by leaders in the field, including Belgium, the Netherlands and the United Kingdom, as well as the European Union in its 2020 Circular Economy Action Plan. To facilitate the adoption of GPP within the construction sector, the European Commission developed EU GPP criteria for office building design, construction and management in 2016 (underwent revisions until 2023) (Dodd, Garbarino and Gama Caldas, 2016[42]), as well as for road design, construction and maintenance (Wolf et al., 2016[43]). On 30 March 2022, the European Commission published a proposal for the revision of the Construction Products Regulation, which empowers the European Commission to establish mandatory GPP criteria for construction products (European Commission, 2022[44]).

However, there is no “one-size-fits-all” approach to implementing GPP in this sector and countries have so far adopted a variety of approaches as well as infrastructure delivery models (Box 5.4). North Macedonia could choose to take a mandatory and/or a voluntary approach to GPP. The mandatory approach may take the form of compulsory technical specifications, selection criteria, award criteria, contract performance clauses or targets, as appropriate (in line with the proposal for a revised EU Construction Products Regulation). Both mandatory and voluntary approaches will require building the internal capacity of all public authorities to apply and monitor the implementation of environmental criteria in public construction and renovation works.

Box 5.4. Infrastructure delivery models

The existing literature highlights that several models of construction procurement exist, yet no "one-size-fits-all" model can be recommended. A critical aspect of the procurement model is the degree of separation and integration of design and construction works, as split responsibilities and a lack of co-operation can lead to end results that do not meet the desired standards (Table 5.2).

Table 5.2. Different types of infrastructure delivery models

Model	Responsibilities and risks
Design-bid-build	• Contracting authority has completed the majority of the design work (sometimes with the assistance of specialised consultants). • Government engages contractor to build, based on supplied design. • Risks associated with design faults, changing requirements and adverse site conditions are typically borne by the contracting authority.
Design-build	• Contracting authority only provides a project brief in the tender documentation, sometimes with only performance-based requirements. • Contractor engages design consultants. • Contractors bid on their developed design and lump sum construction price. • Risks associated with errors or omissions in final design and latent conditions typically borne by contractors and design consultants. • Costs of directed variation typically borne by the contracting authority.
Construction management or general contractor	• Contractor undertakes a significant part of the project management role, including: obtaining development approvals; undertaking on-site investigations; finalisation of design; and developing a construction, commissioning and maintenance programme. • Assumes the risk for construction performance as the equivalent of a general contractor holding all subcontracts during the construction phase. • Contractors provided with incentives to manage project costs by sharing cost savings.
Alliance contracting	• Contracting authority and other alliance partners jointly develop the design and share risks. • Other alliance partners may include designers, consultants, management service providers, suppliers and construction contractors. • Often considered to be of greatest value where the contracting authority has had limited experience with the risks for the project.
Public-private partnership and concessions	• Contract between the public and private sectors, which can reflect a number of different partnership models. • Private sector delivers infrastructure and services over the long term. • Some level of private financing for the project. • Project may be funded by government, user payments or a combination of the two.

Source: OECD (2015[45]).

Examples of practices

Design-bid-build. The example of the Weiz District Authority offices renovation in Austria shows that an ambitious energy target (obtaining the A+ Austrian energy certificate) was set, and a planning and design team of architects and consultants was initially procured. This team was also responsible for preparing detailed technical specifications for the procurement of construction work (including materials) and building services, as well as the compliance assessment of bids. Construction achieved an 80% reduction in heating energy requirements.

Design-build. In the Koemarkt renewal in Purmerend, Netherlands, a two-stage (design and build) cost-led procurement model with a maximum budget was used, with award criteria solely based on quality. The contracting authority employed a consultant for the two-stage procurement process as it had little previous experience. The tender procedure involved several steps and, notably, the participation of the local population in choosing the winning bidder.

Construction management. Some authorities are also seeking to integrate design and construction with building operation and maintenance, which further incentivises the optimisation of construction works, as the contracted company may benefit from greater operational efficiency. In the Jyväskylän Optimi project in Finland, a company was employed for the design, construction and operation of a school and day-care centre with the aim of promoting innovation and life cycle thinking in procurement. Limits were set for heating and energy, electricity and water consumption, and the service provider was liable to cover any costs exceeding those limits. If energy demand was below the set limits, the benefits were shared equally among the service provider and the contracting authority.

Source: OECD (2022[21]), adapted from SCI-Network (2012[46]); SCI-Network (2012[46]).

In the long term, North Macedonia should consider introducing quality standards for secondary materials and recycled construction materials to help support the uptake and reuse of CDW by enhancing confidence in the quality and performance of secondary construction materials. It is crucial to establish a system to assess and certify the quality of the recycled construction materials for their reuse. Standards that define and certify the quality and safety of recycled construction materials place them on an equal footing with their virgin alternatives, thereby enhancing market confidence in their quality and performance (Nadazdi, Naunovic and Ivanisevic, 2022[47]). A lack of quality standards has been identified as one of the most important impediments in the marketing and use of recycled materials and construction products (Nadazdi, Naunovic and Ivanisevic, 2022[47]). Such a quality standard would provide metrics for performance measurements and reliable and repeatable tests and calculation procedures, which would help to ascertain impurity levels or suitability for high-grade recycling (European Commission, 2015[48]). A feasibility study will be required prior to the implementation of such quality standards to ensure that the local market can respond to and keep up with the standard. National standards for recycled aggregates have been widely implemented across countries.[6] More specifically, the Austrian Construction Materials Recycling Association has developed a voluntary quality label for recycled construction materials which could serve as an example for implementing such an instrument in North Macedonia. Other examples of quality standards include the quality scheme for recycled CDW in the Netherlands, the recycled wood classification in France, and the standards for recycled waste electrical and electronic equipment at the EU level (EN 50625 and EN 50614).

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Notes

[1] Despite huge potential for circularity, there is currently no system for collection, separation and processing of CDW. Data on construction waste are, therefore, to be used with caution, as current practice shows that CDW in North Macedonia is mostly informally collected and illegally dumped. There is no solid statistical evidence for the generated and used amounts of such waste (Ministry of Education and Science, 2023[49]).

[2] The Energy Efficiency Fund holds potential for circular construction, as projects funded under it will contribute to energy savings, preserving natural resources and reducing environmental pollution (Ministry of Finance, 2023[50]).

[3] "The term recyclate is used to describe a raw material transported to a waste recycling facility or a material recovering plant for processing into a newly formed material or product" (Baffour-Awuah, Akinlabi and Jen, 2020[53]).

[4] Official statistics report that only 56 000 tonnes of CDW were generated in 2020, but estimations using the average per capita generation as an indicator from other countries point to around 8.5 million (including excavation waste).

[5] The activity of illegally leaving waste or unwanted objects next to a road, in a field, in a river, etc. (Cambridge Dictionnary, n.d.[51]).

[6] An international comparison is outlined by Tam, Soomro and Evangelista (Tam, Soomro and Evangelista, 2018[52]).