Public Procurement of Circular Construction Materials

Key takeaways from the Big Buyers Initiative working group

The Big Buyers Initiative is a European Commission Initiative for promoting collaboration between big public buyers in implementing strategic public procurement. Public procurement can be a key tool in driving the development of innovative goods and services on the European market. By working together and pooling their purchasing power, cities, central purchasing bodies, and other major public procurers can maximise their market impact.

The Big Buyers Initiative is currently managed by ICLEI - Local Governments for Sustainability and Eurocities.

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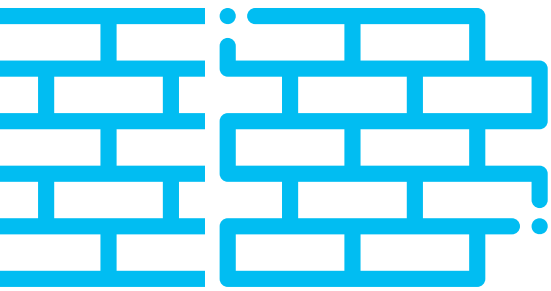
1. The Big Buyers Initiative Working Group on Circular Construction Materials

Through the Big Buyers Initiative, a working group on Circular Construction Materials brought together public procurers representing **Amsterdam**, **Belgian Post**, **Brussels city.dev**, **Budapest**, **Haarlem**, **Helsinki**, **Lisbon**, **Oslo**, **Paris**, **Porto**, **Rotterdam**, **Stavanger**, **Vantaa**, **Vienna** and **Zurich** to promote circular economy approaches to the construction sector, focussing on construction materials in civil and building works, and covering the value chain from disassembly to material transformation and new construction.

By applying circular economy principles to public construction projects and supporting the growth of a local circular economy sector, these entities share a common ambition:

- to keep existing materials in use and retain their value, thus avoiding waste,
- to stimulate market innovation for less resource-intensive materials (e.g. bio-based building blocks or low carbon concrete), and
- ultimately, to reduce the embedded carbon of construction materials and lessen the environmental impact of raw material demand.

The group began collaborating in October 2019, and herein shares key takeaways from a year of capacity building, market dialogues, and learning-by-doing through pilot procurements with selective demolition procedures, inclusion of secondary or bio-based materials, and creative use of reclaimed components. Although they travel in a common direction, the participating cities are in different stages of the transition to circular construction materials - a diversity that reflects the European urban context and strengthens the exchange among them.



What experience do we draw upon?

Eight working group members have conducted pilot projects on circular construction or demolition of infrastructure or buildings, addressing different challenges to circularity of construction materials across the value chain. These pilots include:

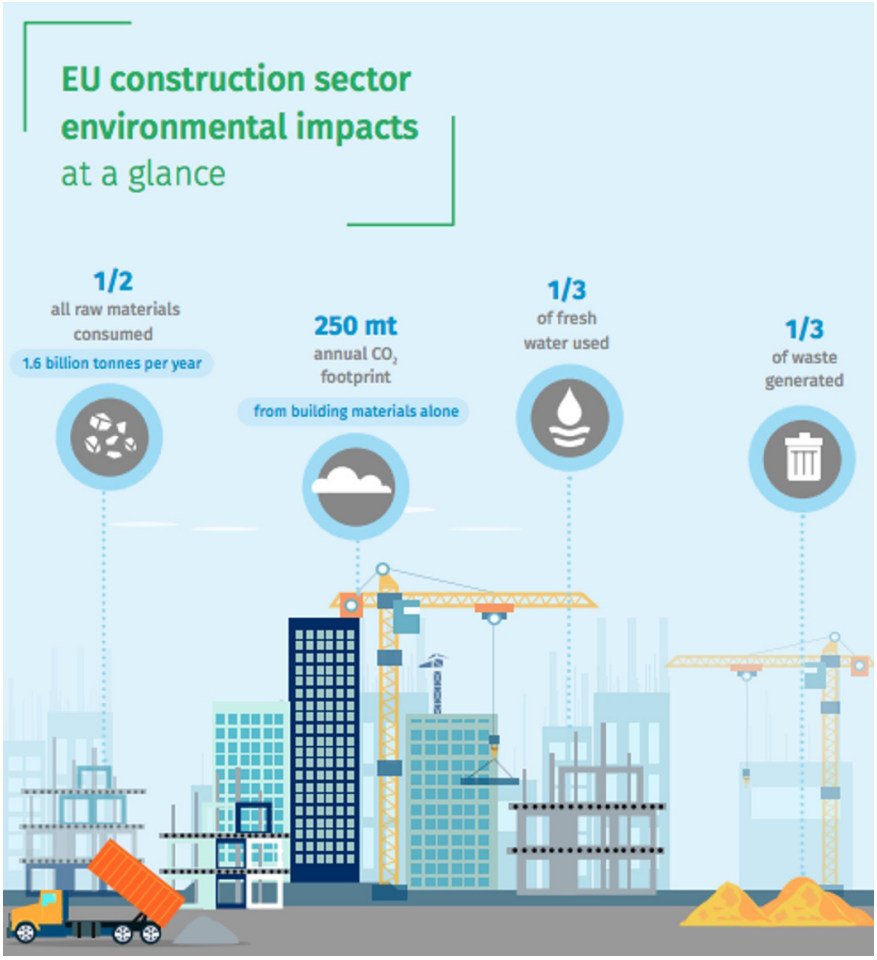
- Testing of digital tools for tracking material composition, quantity and quality (material passports/ buildings as **material banks**),
- **Selective demolition** of a hospital and several schools to recover contained materials and components
- **Social urban mining** approach of cooperating with social economy enterprises (focus on social inclusion and green jobs for un- or underemployed persons) to remove, separate and transform secondary construction materials
- Procurement requirements for **life-cycle assessment** (LCA) calculations, environmental cost indicators (ECIs) and **environmental product declarations** (EPDs) for the principle construction materials
- Creation of a '**circularity index**' to compare tenders in procurement considering value maintained, e.g. of concrete infrastructure
- Municipal-led circular **land mass coordination** between all construction sites in the city
- On-site transformation of old concrete for new **recycled aggregate**
- Inclusion of **reclaimed materials** and components in new constructions or renovations (doors, technical ceilings, bricks, floor boards, furniture)

Further relevant experiences look into how a city-wide circularity strategy can be implemented in the construction sector, public leadership for necessary infrastructures or platforms to facilitate circular construction, and how procurement policy can be a tool to promote these practices.

2. The Circular Economy & Construction Materials

Buildings and construction are responsible for 39% of global carbon emissions, while construction works and materials alone represent 11%.[1] Although great strides have been made in operational energy efficiency of buildings, there is growing concern for embedded or upfront carbon - all that goes into material extraction, processing, transportation, and construction works. Construction materials account for half of raw materials used in Europe, while construction and demolition waste represent 1/3 of all waste - one of the largest waste fractions by volume in the EU.[2] Building materials therefore show an enormous untapped potential for a circular economy.

Public authorities - as managers of large portfolios of real-estate assets, as custodians of urban infrastructure and as regulators and enablers through zoning and permitting - have a key role to play in implementing the circular economy in the built environment. Learnings from the BBI working group show experiences of leading European cities in procuring, participating and piloting policies and projects for circular construction. While key hotspots for improvement have been identified, so have remaining barriers. We hope these examples will inspire other cities to join the transition.



Source:
Towards a greener construction products policy - ECOS

1 Bringing Embodied Carbon Upfront - WGBC
2 Circular Economy in the Construction Sector - European Council Conclusions

3. Key learnings from the working group

Circular approach to deconstruction and demolition projects

RETHINK & REDUCE

First and foremost to avoid waste, reconsider (re) use of what is already built. The EU's Urban Agenda Partnership on Circular Economy has published the Sustainable Circular Reuse of Spaces and Buildings Handbook to guide the transformation and reuse of existing buildings and spaces.

MATERIAL INVENTORY through pre-demolition audits & selective demolition procedures

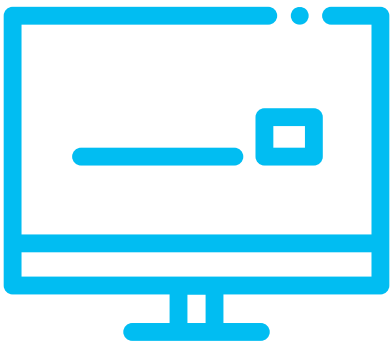
For a circular approach to materials in a building slated for demolition, first those materials must be properly identified - quantity, dimensions, technical function, maintenance, toxicity, etc. This can be found out via an auditor touring the site and making an inventory manually, or through creating a 3D digital model (BIM - Building Information Modelling) of the building. It is important to note the presence of harmful substances (e.g. asbestos) and whether or not the materials can be dismounted without damaging them (e.g. irreversible joints or composites). Often not enough time or budget is allocated to allow for proper identification and testing of materials, so things with reuse potential may be discarded as waste. To improve circularity, more parameters should be taken into account when making the material inventory to make upcycling and recycling initiatives more feasible (such as remaining technical lifetime, aesthetics and the capacity to be stored and transported).

PLANNING & PARTNERSHIPS for recovering value of reclaimed materials

For circularity principles to influence demolition of a building, stakeholders must be involved early on in the planning process. To make the business case for salvaging materials at the end of life of a building, these materials should ideally have a possible next use lined up. Selective demolition can cost up to 30% more and take more time (2-6 months, depending on building type and size) than a conventional demolition. Regulations increasingly require pre-demolition screenings to ensure hazardous materials are properly disposed of and salvageable materials are not discarded. Early experiences show there is potential for significant cost and carbon savings if reclaimed materials are separated at source and are revalorised in subsequent uses. To avoid carbon emissions from heavy transport, secondary materials should also have potential for transformation and employment in new uses within a reasonable physical distance.

Digitalisation in Helsinki

In Helsinki, a pilot project to create a 3D BIM model of a building slated for demolition proved costly and hard to justify. This is a problem for existing older buildings that do not have a 3D model, but will be less of a barrier in the future as buildings are increasingly designed and delivered with BIM. In the meantime, more simple material inventories can be done without a digital model by contracting an expert auditor to visit the site, identify materials with high reuse potential and make a plan for selective demolition. In later pilots, Helsinki puts more emphasis on finding suitable future uses of materials in coordination with the selective demolition approach.



ZOOM IN ON PRACTICE

PARIS

Paris strives to use its procurement to further the city's overall climate goals. To promote circular CDW management, a 'Framework Agreement for demolition work and deconstruction' was initiated on a voluntary basis in 2018. It involves three public authorities (including the demolition permitting department) in just one tender. Components of the contract are weighted as *40% Price* (Negative prices when it's possible to reuse the materials), *35% Relevance of intervention methodology*, and *25% Quality of human resources*. Regarding the intervention methodology, bids should detail the method used to manage and trace site waste from production to disposal. Points are awarded according to the following criteria:

- Documents set up to organise waste tracking for the construction site
- Organisation of material sorting on site
- Transporting waste to a recycling platform or in adapted channels
- Traceability of site waste disposal
- Rate of recovery of site waste

LESSON:
Procurement is a powerful tool to achieve local government goals. Increasingly ambitious considerations should be brought to the market in a transparent and incremental way, e.g. shifting from voluntary or award criteria to minimum requirements over time.

HELSINKI

To integrate a circular approach, the city of Helsinki developed a set of instructions, checklists and template documents to be used for all public demolition and refurbishment contracts to ensure environmental quality and occupational safety for the different phases of demolition projects, including procurement of expert services (e.g. demolition mapping, project planning and inspection services) and procurement of demolition contractors. Requirements in the guidance for procurement of a demolition contractor include, for example, that a minimum of 70% of the waste generated on site should be recycled or reused as a material. The following fractions must be collected separately and recycled: metal, glass, plasterboard, wood, concrete and brick, roofing felt and asphalt.

LESSON:
Internal capacity building and collaboration across city departments is needed to integrate a circular way of working into the construction project value chain. Local governments can - and should - lead by example.

ZOOM IN ON PRACTICE

OSLO

The city has allowed small social enterprises to reclaim components such as doors and ducts from public social services buildings being demolished. Though the city is willing to give away materials for now, a legal barrier identified is that only persons permitted on demolition sites could be allowed into the building. In the future, the city hopes to sell revalorised materials from demolition sites. Until a stable market exists, giving materials away is still a cost saving for the municipality, as they pay less for demolition works and waste treatment. Selling the materials is hindered by a need to certify their quality, which causes an administrative burden diminishing the business case. Consequently, and given the large public real estate portfolio, the city building agencies aim to include recovered building materials in its own renovations and new constructions.

LESSON:
Through various circular demolition pilot projects, experience shows the most straightforward way to ensure feasibility of reuse of materials is to minimise changes of ownership.

The municipality of Oslo keeps a database of the planned and ongoing demolitions in the city - including public and private projects, which the city can influence through demolition permitting. This database allows city architects and project managers to consider those sites as material banks and include reclaimed materials in plans for new construction or renovation projects.

LESSON:
Due to the timeline and complexity of construction projects, access to information on upcoming demolitions in advance is fundamental to allowing inclusion of reclaimed materials in designs for new uses.

ZOOM IN ON PRACTICE

VIENNA

In Vienna, local material reuse was taken to the most literal sense: Thanks to coordination and aligned ambitions in the early planning phases of the Seestadt Development, 1m tonnes of excavated earth and aggregates sourced, cleaned and crushed on the site were used in the construction of 3,000 new housing units. Such mobile machines save 90% of CO_2 emissions compared to using an aggregate processing plant 25 km away due to avoiding heavy-duty diesel transport.

LESSON:
From a design perspective, material decisions should be made to prioritise low-carbon options that are available locally.

The social enterprise BauKarussell improves circularity of demolitions while also addressing social inclusion in Vienna and other Austrian cities. The association carries out 'social urban mining' by connecting local social enterprises for people far from the labour market and developers with buildings to be demolished for sorting and dismantling building components and material from demolition sites for reuse or high-quality recycling. Income from the value of recovered materials finances the labour force.

LESSON:
Thinking out of the box with circular business models can lead to achieving multiple sustainable development strategies simultaneously - environmental and social goals have to go hand in hand.

While BauKarussell operates primarily at the end of the life cycle of a building, the Vienna based architectural start-up materialnomaden acts at the very beginning of the lifecycle - namely the programming, planning and execution-phase. On a basis of tangible implementation projects, consultant activities, creation of pilots and prototypes, and supply of salvaged components, they demonstrate the constructional, architectural and artistic benefit of buildings considered as material banks.

LESSON:
For circular construction materials and products, by default the beginning and the end of the lifecycle of a building need to be linked by raising awareness, especially in the design and planning industry.

Procurement process for new construction and renovation works

SET THE SCENE: Formulate the ambition & engage with market actors

First, build up political backing and ambition from the internal organisation. Getting a green light for pilots is a good way to begin by showing the potential benefits of circular construction. As in most pilots, the first circular construction project will likely require more time and costs than a conventional one. Bear in mind the lifecycle perspective and investment required for process innovation.

Second, involve market actors as soon as possible. In order to ensure the ambition of the city is rooted in realistic targets given the maturity of the market ecosystem, engage in dialogues to see what is and is not yet possible. By presenting to the market the contracting authority's goals (e.g. for material recovery, use of secondary content and/or carbon targets) rather than being prescriptive in requirements, suppliers can offer varied solutions. This encourages market innovation and diversification, and also gives the market more flexibility to meet your needs.

- **Trust partnership in Amsterdam**: Leading up to the tender of the trust partnership model, frequent consultations were held with market parties to ensure that Amsterdam's sustainability ambitions were given as much substance as possible and were realistic at the same time. Among other things, the tender resulted in different asphalt mixtures with lower environmental cost indicators than usual and the use of electrical equipment.

- **Innovation challenge in Vienna**: IÖB innovation platform for public procurement launched a challenge for "an economically self-sustaining marketplace which meets the requirements for a circular construction industry". The city of Vienna seeks exchange with companies to launch and operate a Europe-wide marketplace or platform for reuse in construction and materials management as a self-sustaining business model. Through the challenge, Vienna looks for business cases and subsequently will enter a partnership to support the concept implementation. The marketplace should allow stakeholders of the construction sector to advertise and sell their relevant services and products, while secondary materials and demands are matched spatially and temporally.

- **EPDs in Rotterdam**: In Rotterdam, where EPDs have been used since 2015, rather than asking suppliers for use of a certain material or method, the city encourages supplier innovation by asking them to demonstrate the environmental cost as a performance indicator, in whatever way it is that the supplier approaches and achieves that. Rotterdam buys material for infrastructure projects directly from industry suppliers (e.g. a framework contract for €3m per year for pavers). A benefit of this is that as a big buyer they can dialogue directly with suppliers to push them to invest in innovation and get the EPD as a single score for their product.

DESIGN considerations

Embodied carbon of a building's materials is largely decided by design decisions and is later much more difficult to avoid. Up to now, buildings have been material-consumers rather than material stocks, and are conventionally built that way. If the use of materials and products that can be recycled is not taken into account at the planning stage of a renovation or a new building, this cannot be made up for. Retrofitting to improve resource efficiency is not feasible.

As a construction client, suggest flexible spaces which can be adapted for multiple programmatic functions without requiring intensive renovation. Optimised use of space and occupancy efficiency as design considerations can avoid the material, cost and carbon for underutilised spaces. Consider setting carbon as a criterion for design competitions or even incrementally introducing emissions limits for construction projects city-wide, by setting maximum carbon emissions and/or embodied carbon per square meter (according to building or material type). Further key design considerations for circular buildings are included in the table below.

Design considerations for circular buildings	
Strategies	*Solution / measures*
Robust material selection	✪ Minimise the number of different materials and components ✪ Choose homogeneous materials (mono-materials), where all components consist of the same material. ✪ Use **durable** materials that can be reused in several generations of buildings ✪ Avoid the use of substances that are harmful to health and the environment (even if the amount of substances is within permissible limit values), and avoid surface treatments where this is not necessary to reduce wear or degradation of the materials. ✪ Use **modular** design, standard dimensions and low complexity of components and building parts.
Flexible connections	✪ Use **reversible connections** between components and between building parts, e.g. screws and bolts. Avoid welding, glue, putty and sealants / foam ✪ Minimize the number of different connectors, and plan for the use of common tools ✪ Use components and building components with adapted tolerances for repeated disassembly and reassembly ✪ Project the construction systems as independent, and arrange them according to the expected service life of the components
Available information	✪ Label materials and component types ✪ Mark attachment points and make sure they are visible and accessible ✪ Require a **digital material passport** (to include information about products and materials, including EPD and maintenance advice, as well as information about the building system with disassembly instructions) ✪ The geometry of the building is documented through open BIM
Manufacturer agreements	✪ Leasing agreements with manufacturer / supplier instead of purchasing, e.g. for lighting, furniture or technology systems ✪ Take-back schemes or **extended producer responsibility** with material manufacturer / supplier

Source: FutureBuilt Criteria for Circular Buildings - FutureBuilt is an alliance of Norwegian partners for future-proof construction, led by the City of Oslo.

PROCUREMENT of circular construction materials

When it comes to the procurement procedure, there are many ways to incentivise circular construction materials. The city of Amsterdam has published a comprehensive, step-by-step guide on how to conduct circular construction procurements, including example criteria for different aspects of a building or civil works project (with criteria text, justification, calculation and validation) and an example tender text. The Roadmap to Circular Land Tendering covers four steps to a circular procurement: (1) framing the construction baseline, (2) formulating the ambitions for the site, (3) choosing an appropriate procurement procedure, and (4) drafting an integrated tender with circular construction criteria.

To systematically shift to total cost of ownership and life-cycle thinking in line with the circular economy, it is necessary to develop new models for competitions so that the design is not completely separate from the construction and financing. For example, if a building were not handed over immediately by the contractor as is conventionally done, but instead remained liable for a time post-occupancy to ensure operation as planned and penalise if material and energy performance is not as expected. For new construction procurement, this means reconsidering the length of contracts and the lifetime of buildings, and shifting the conversation to be about global costs.

As a baseline, the European Commission has published the recommended Green Public Procurement criteria for office building design, construction and maintenance. In addition to the design considerations above, the table below includes procurement criteria that have been used or are under consideration by participants of the working group that may promote circular construction and refurbishments.

Example procurement criteria for circular construction materials

Criteria	*Explanation*	*Example of use*
Require extended contractor responsibility; Use of total cost of ownership (TCO) as price criterion	Contractor or material supplier has responsibility for maintenance for a specified time range after project delivery and/or take back of the materials at end of use, which incentivises the choice of durable, recoverable materials.	✪ The **Paris** 2024 Olympic arena construction contract will be awarded based on the global cost for 30 years, of which for the first 10 years the constructor is still liable for all materials and operation cost. ✪ In **Amsterdam**, a bypass (temporary road) will be built with a target to be 100% circular. The material cycle will be organised on a local scale and the bypass will be offered to Amsterdam as a service, meaning that the contractor is the owner of the materials being used. The contractor is in charge of the design, realisation, maintenance and removal of the bypass.

Example procurement criteria for circular construction materials		
Criteria	*Explanation*	*Example of use*
Require use of lifecycle analysis (LCA)	LCA accounts for environmental impact from cradle to grave, and can be conducted at the product, component, system or whole project scale. The LCA methodology should be clarified for tenderers and should not hinder competition - e.g. in the case of using a specific tool, training and accessibility should be considered. National methods and tools should align with the European Commission's Level(s) and European Standards. Many cities in the working group use LCA as a standard requirement in public construction procurements, though accuracy of data and methods are being constantly refined.	✪ In **The Netherlands**, the Building Act requires all residential and office buildings whose surface exceeds 100 m^2 to account for their embodied impacts at the building-permit application stage in the form of an LCA using the national assessment method and associated database. Since 2018, this includes a mandatory environmental impact cap for buildings at 1.00 EUR per m^2 and year. ✪ **Helsinki** uses the OneClick LCA tool in its construction procurements, providing the tool and training for use to tenderers. In the construction of wooden apartment blocks at Kuninkaantammi, the carbon footprint was weighted at 14% of the award criteria and must be calculated twice in the design and once in the construction phase.
Require use of at least a minimum percentage of reused and/ or recycled materials	Requirements for secondary material content of which the application may be specified - e.g. recycled aggregates in concrete - to avoid downcycling and undesirable trade-offs.	✪ In Zurich, concrete in public constructions e.g. for social housing and roads use up to 70-98% recycled aggregate and asphalt respectively. The city has worked to raise the percentage of recycled materials in its construction materials incrementally over the past 15 years. ✪ **Rotterdam** procured road works with 99% reclaimed asphalt granulates.
Require Environmental Product Declarations (EPDs) for the main construction materials	An EPD can certify the comprehensive environmental footprint and performance of a building material. Requirements for their use can be applied, for example, for the top ten materials by volume or value.	✪ In **Oslo**, for municipal buildings it is required to collect at least 2 EPDs from a minimum 10 of the largest (by volume) material groups. Products with the lowest climate emissions should be chosen.

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Example procurement criteria for circular construction materials		
Criteria	*Explanation*	*Example of use*
Foresight for on-site material management	In order to avoid construction waste, a plan is required of the construction contractor for how they will sort and manage materials on-site.	✪ In **Copenhagen**, a plan for handling construction waste must be submitted before a project starts. The plan must specify which waste fractions are to be sorted at source on-site, how the waste is to be stored, and where the waste containers are placed. ✪ In **Vantaa**, on each construction site, the city performs a geotechnical soil survey, then the project team aims to maximise on-site soil reuse. Land masses that must be displaced to other locations are assigned to another site within the city. Site proximities are preferred to avoid transportation costs.
Maximum embodied carbon limits for new and leased buildings	An embodied carbon limit could be set for all new constructions, with a maximum carbon footprint per square meter according to building type. Embodied carbon footprints take into consideration emissions up the supply chain, including material extraction, processing and transportation.	✪ **Oslo** is currently exploring the application of an embodied carbon limit on new constructions with an aim to reduce the embodied carbon footprint of the city's real-estate portfolio 50% by 2030. ✪ **Vancouver** uses embodied carbon targets to progress towards its goal of reducing the embodied emissions of its building stock 40% by 2030.
Early design carbon limits for infrastructure projects	Require the project to have a baseline for carbon impact in the earliest feasible design phase. Infrastructure projects vary widely and cannot be standardised by type (unlike buildings), so the baseline becomes a contractual obligation for the contractor to not surpass the set carbon limit.	✪ Since 2018, **Stockholm** has required lifecycle carbon footprint declarations for all large infrastructure projects.
Use of low carbon cement and concrete	As concrete is one of the most common but also most carbon-intensive construction materials, special focus can be given to incentivise innovation to reduce its footprint (e.g. by inclusion of by-product additives or including recycled aggregates)	✪ In Zurich, low-carbon CEM III/B cement and at least 25% mixed demolition aggregate is required in public construction city-wide since 2013. ✪ **Oslo** has incrementally increased ambition on concrete types for public projects. A pilot specified use of 2nd generation concrete in the tender, resulting in 70% CO_2e reduction. ✪ In **Amsterdam**, the use of low carbon cement and concrete is pilot-based (e.g. pilot project 'Rechtboomsloot').

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Example procurement criteria for circular construction materials		
Criteria	*Explanation*	*Example of use*
Require calculation of project carbon footprint	Carbon calculations at the product-level are advanced, but further data is needed on works to accurately understand a project's whole footprint. Requirements to calculate this can strengthen available data and be used early on to make design decisions and keep a project on track to the expected carbon budget throughout project development.	✪ In **Trondheim**, carbon calculations are required for large projects and reviewed in four phases of the construction project: (1) a reference building, (2) design phase, (3) as built and (4) in use. ✪ In **Amsterdam**, builders are challenged to design and build a 'green' construction shed. Candidates have to make the whole-building carbon calculation using DuboCalc (the national LCA tool) to prove their green concept. For specific suitable projects the carbon footprint calculation is used for tender criteria. ✪ Based on the Finnish Ministry of Environment's guidance, **Vantaa** and **Helsinki** are beginning to require carbon footprint calculations for public works. Renovation, design and construction are performed following low carbon emission criteria. This is controlled twice during the design process via a LCA and carbon footprint calculation. In addition, a similar control is performed during the construction process.
Require reducing transportation and/or zero-emission transport of bulk/ heavy materials to/ from and around the construction site	The supplier is awarded points for the ratio of zero-emissions and/or biogas vehicles used to transport bulk materials to/ from the construction site. For larger projects, the supplier is also awarded points for reduced transport of bulk materials, based on the number of kilometres and the number of tonnes of materials.	✪ **Oslo's** environmental criteria for construction works uses this criterion weighted as 5% in public construction procurements to support their target that by 2025, all vehicles for transport of bulk materials to/from construction sites shall use zero-emission or biogas vehicles that meet the requirements for Euro 6/V. ✪ **Vienna** held a competition for a 900 unit housing project with reduction of 67 % transport kilometres by restriction in procurement and logistic management onsite. ✪ In **Amsterdam**, contractors of the buyer-supplier trust partnership use hubs outside of the city centre to store materials. Heavy transport is needed to supply these hubs, but smaller electric vehicles are used for transportation of the materials to work sites within the city.
Mandate assessment of renovation vs knock-down and rebuild comparison	Requiring a comparison of cost and carbon for renovation and refurbishment versus complete demolition and rebuilding can incentivise deep renovations, with material, energy and carbon savings.	✪ **Vienna** does this based on ÖNORM B 3151 "Dismantling of buildings as a standard method for demolition" and on EPDs (if available).

Further public levers for promotion of circular construction

SET A STRATEGY to give clear direction to the local transition

Many cities of the BBI working group have a dedicated circular economy action plan, or even specific strategies for circular procurement and circular construction. Having carbon and/ or raw material reduction targets and timelines for procurement policy shifts can signal to market actors a need to invest in innovative ways of working for the future in order to remain competitive for large public buyers.

- **Rotterdam**, where construction materials and buildings account for 25% of the city's €1.3 billion annual spend, has a Circular Materials Purchasing Strategy - considerations include non-ownership components, servicisation and carbon/ LCA for purchases. The Circular Rotterdam Strategy strives for 50% reduction of primary resource consumption by 2030. The Circular Amsterdam Strategy aims that by 2023, all of Amsterdam's invitations to tender in the built environment will be circular. Like Rotterdam, by 2030, Amsterdam will use 50% less raw materials. As a member of Metropole Amsterdam, the city of **Haarlem** has also committed to circular procurement targets and is using the Roadmap Circular Procurement and Commissioning to achieve their goals.
- Helsinki's Roadmap for Circular and Sharing Economy focuses on action in the construction sector, setting out the following goals:

2020–2021	2021–2025	2025 →	2035
We will create shared understanding of circular economy in the City's own construction projects and commit to this.	We will prepare and adopt new circular economy requirements and procedures that promote circular economy.	We will take the lifecycle costs of construction sites into account when making decisions about construction.	We will implement carbon-neutral circular economy in land use and construction; this means an economy where natural resources are used sparingly and their lifecycle carbon footprint is small.
We will increase knowledge and competences in the City's own construction projects to define circular economy requirements.	We will continue the pilots of various circular economy requirements.	We will establish circular economy criteria and new procedures for construction in the City's own construction projects, design competitions and plot conveyance conditions.	
We will pilot the first circular economy requirements in the City's own construction projects, design competitions and plot conveyance conditions.		We will apply circular economy requirements on market-determined construction through land use planning and licencing, among other measures.	

FACILITATE THE MARKET SHIFT
with municipal infrastructure & coordination

A key barrier to viability of secondary construction material markets is logistics. By creating digital and physical platforms to coordinate efforts, cities can accelerate private actors' contributions to a circular construction sector. A principal necessity is accessing information on waste with potential to be a resource or input to other processes. Creating a circular innovation park or physical hub for material storage and/or circular economy activities can also boost local SMEs while raising awareness of the city's circular aspirations. Finally, to facilitate material circulation and build relationships between key stakeholders of the construction value chain, many cities are creating dedicated coordination roles.

- Community Hub in **Paris**: Paris formed a working group with local associations and social economy actors to explore necessary infrastructures to facilitate emerging circular business initiatives. Maison Les Canaux, a historical building renovated with 95% material reuse, now serves as the city's hub for circular and social economy projects.

- Municipal Material Depot in **Malmö**: By founding a municipal depot for construction and demolition waste, sorting, cleaning, treatment and storage, such as Malmö Återbyggdepå, households and minor construction companies can reliably drop off and pick up secondary building materials. Dialogue with reclamation companies showed the pressure to locate such places more centrally to make their use more convenient and their reclaimed materials more competitive - something cities may struggle to do on valuable urban land.

- Land Mass Coordinator in **Helsinki**: In Helsinki, the position of Municipal Circular Land Mass Coordinator was created in 2014. The coordinator oversees master planning and construction projects to clean and repurpose up to 1.1m tonnes of soil and crushed concrete per year, saving the city €47m and avoiding 17,100 tonnes of CO_2e by 2020. In the city's process outline for construction and demolition works, coordination with this person is obligatory to incentivise resource-wise movement of masses around and between sites. **Rotterdam**, **Haarlem** and many other Dutch cities have a similar position and thus avoid unnecessary contamination, transport or landfilling of excavated earth.

- City Materials Manager in **Oslo**: In a scoping research undertaken for the City of Oslo, where public projects represent 20% of construction works, there is a recommendation under consideration to establish a new position of 'City Materials Manager', who would be responsible for mapping demolition and renovation projects, selling/transferring of used materials to other city agencies or private sector actors, and to work closely in early phase with architects and advisors to include those materials.

- Cooperative Supplier Management in **Haarlem**: The city of Haarlem uses a cooperative approach to supplier management to achieve a circular and sustainable city. By working closely with public maintenance suppliers, trust partnerships were created in which suppliers ensure that the city's social and sustainability goals are met, while given the freedom to innovate in how they deliver their services. A digital material hub was created for exchanging material between the suppliers.

- Circular Construction Industry Coordinator in **Vienna**: In August 2020, Vienna decreed a Municipal Coordinator for Circular Economy in the Construction Industry, with the following main tasks:

  - Coordination and leadership in the development of a circular economy strategy for buildings and infrastructure and a Circular City Vienna Roadmap, in cooperation with municipal departments, companies and enterprises, as well as with regional, national and international organisations, consultants and initiatives.

  - Management of the **DoTank Circular City 2020-2030** programme and coordination of the follow-up, pilot and lighthouse projects derived from it. The focus of this program is to create the necessary framework conditions, solutions for specific problems (e.g. retrofitting neighbourhoods, urban renewal) and product innovations (services and production) in transdisciplinary cooperation between administration/politics, research and industry. In the first three years, the extent to which the city's circularity factor can be raised under the current conditions will be examined. This will trigger a number of regulatory and funding changes, which will be implemented over the next three years. In the last phase, the chosen path will be strengthened towards the goal of raising the built environment to a circularity factor of 80%.

REGULATE to incentivise circular construction, renovation and dismantling practices

Through a local government's mandate of urban management, they also handle construction and demolition permitting as well as zoning regulation. This can be further explored as a lever to promote more circular works, e.g. by mandating pre-demolition material audits for the issue of demolition permits- as is done by the permitting authority of Vantaa. By doing this, cities also have the opportunity to collect data relevant to material types and recyclability during the permitting process. In turn, they can develop insights to further improve and support selective deconstruction in the future. Setting minimum standards on energy performance, raised incrementally over time, to be able to sell or rent a property stimulates sustainable renovations and upgrading of the existing building stock. In any case, this kind of regulatory intervention should be context-appropriate and accompanied by fiscal measures to structurally support equitable access to energy and decent, affordable housing.

- Circular District in **Amsterdam**: In Amsterdam, the city is facilitating the development of Buiksloterham into a circular district. Underutilised plots owned by the city are being leased for construction projects on the basis of circular criteria.

- Innovation Strategy in **Vienna**: WIEN 2020-2030 sets regulatory and quality standards for lifecycle and circular planning and construction to boost resource conservation.

- Minimum Energy Performance in **Boulder**: Boulder, Colorado enacted SmartRegs ordinances that require all single family and multifamily rental properties to meet a minimum energy efficiency standard by January 2019. The SmartRegs initiative aims to help the city reach its carbon emissions reduction goals and to improve the quality, safety, and marketability of Boulder's rental housing stock. Through the Renovation Wave Strategy, the European Commission recently announced minimum energy performance standards for the EU as well.

4. Reflections on furthering circular construction in the EU

Construction is a sector with largely local and regional-scale market actors. Cities are leading the way in innovative circular economy approaches to construction and demolition projects - but more could be done at other scales to accelerate and structurally support this systemic transition. The cities in the Big Buyers Initiative working group take this opportunity to highlight remaining barriers and recommend priority areas for action beyond their jurisdiction, at a national and European scale - grouped into (1) funding, (2) guidance and tools, (3) regulation, and (4) raising awareness.

Funding

Funding should emphasise and support the integral **lifecycle planning process**. Closed-loop planning has a higher degree of complexity and consequently requires more time. This needs training of the integral planning process on the one hand, and on the other hand financing through innovative burden-sharing throughout the entire life cycle (e.g. participation processes regarding the connection between the beginning of the lifecycle of a building - project development and planning, and the end - deconstruction and reuse concepts, resource management). Pilots tend to address one end or the other, but insufficient focus on closing the material loop completely.

Financial support is needed for **innovative material transformation** (by waste management companies, start-ups, etc.) of what is now considered CDW to develop new building products/ materials from waste. Likewise, funding can support development of innovative processes to design and produce construction products/ materials which are durable, demountable, and ready for reuse later on.

We call for funding for **capacity building of local government** stakeholders - through initiatives such as the Big Buyers - as well as the establishment of CE coordination bodies to exchange practical knowledge and consolidate best practices. Considering the need for a multi-stakeholder approach required for a circular economy, further attention should also be given to **market dialogues** and innovation partnership efforts.

While more funding is rightly being allocated for pilots and innovation, we reclaim also for **upscaling and replication** efforts to make circular construction standard practice. Many innovative CE pilots are one-offs without funding to upscale, which is fundamental to the systemic approach required of circular economy transition. Funders should explore **innovative financing schemes** for circular construction projects, such as Public-Private-People Partnerships or connecting circular business models to social and sharing economies.

Guidance & Tools

Based on our pilot experiences, we find that each city pays a high price to develop tools, processes and procedures themselves. Currently many different processes and methods are used in different places to plan, manage and monitor circular construction works. **Standard indicators and methodologies** at an EU-level - with initiatives such as Level(s) - could drive increased market acceptance and single-market competition. EU-level action should set the ambition and direction of travel through establishing common targets, linked indicators and guidelines (such as the Green Public Procurement Guidance for Office Buildings, and the Guidance on Pre-Demolition Audits), that should then be specified at national level and adapted to local needs. On the other hand, specific tools at a national level may continue to coexist. For example, in the Dutch (DuboCalc and Environmental Cost Indicators (ECI)) or Finnish (OneClickLCA) cases, promotion of a common life cycle costing tool at a national level has strengthened market performance - allowing procurers to demand use of the tool and receive quality bids, while also encouraging market actors to master one tool for use in multiple procurement procedures. The Netherlands has a similar national approach to EPDs, which has allowed for upscaling requirements for EPDs in procurements.

The most prominent remaining challenge, commonly faced by the cities in the BBI working group, is how to address **certification**, **liability and trust in the quality of secondary materials** and building products. Use of circular materials can cause a shift of responsibility and leadership among key stakeholders (owner, designer, construction contractor, material supplier, user) in the design, planning, construction and operation of the building. In pilot project experiences, the public authorities as owner and construction client ended up taking on greater responsibility and risk so that the construction contractors (who are typically liable for performance of each building element) would agree to build with secondary materials. Further work on the CE marking and **Construction Product Regulation** to create

market confidence in secondary construction materials will be key for mainstreaming their use. In addition, requirements for documentation are an administrative burden that increase the cost of secondary materials and therefore diminish their economic advantage, as they often don't have an industrial process at scale behind them like primary materials do.

Regulation

The working group notes the importance of the upcoming EU Strategy on Sustainable Buildings - together with other strategies such as the new Circular Economy Action Plan, the Ecodesign Directive, updated Green Public Procurement criteria for public/ office buildings - to signal to the market a systemic shift. This power of influence plays a key role even in regional or local markets. Regarding this strategic leadership at an EU-level, it should include circularity aspects in the project development and planning phases. Currently, the regulations regarding circular economy are disproportionately focused at the end of the life - although the CEAP signals that this may change.

Regulation that would enable secondary construction material markets should clarify legal rules on **definition of waste** (e.g. an end of waste concept only exists now in 5 EU MSs) and propose standards for various secondary materials (especially for main construction products like concrete, masonry and steel). The currently underdeveloped market for circular materials (characterised by limited amounts of heterogeneous products) causes higher prices; the regulatory framework for construction materials should **enable better competition** by eliminating barriers that put more sustainable options at an economic disadvantage.

We call on the EU to support an increased use of secondary (including recycled or reused content) and bio-based building materials in the Construction Product Regulation, through transparent, accessible and comparable information on the lifecycle environmental impact of materials.

Raising awareness

Overall, we recognise a need for **capacity building** on the circular economy for the public sector. Targeted training materials for municipal staff dealing with buildings and construction can increase understanding of the co-benefits of more circular materials, including secondary and bio-based solutions. Furthermore, EU promotion of a circular construction transition will lead to greater **citizen buy-in and support** of the municipalities' efforts. It is clear that a real circular transition will require a wider educational effort to civil society - especially changing curricula for key stakeholders in the construction value chain, e.g. architects and engineers.

The EU's extensive communication outreach has a powerful potential to change the narrative, by bringing to light the transversal positive impacts of the circular economy and demystifying the concept by proving its practical applicability. The awareness raising can disseminate circular strategies as a real opportunity for cross-cutting positive transformation, including environmental benefits such as less primary material extraction and less waste generation, and social benefits such as job creation and promotion of the sharing/ social economy. Against the often misconceived perception of circular economy as wise waste management, communications should inform about the economic gains of using circular materials, which can be an important point for post-covid recovery (e.g. linking with green jobs for building renovations and as a way to attract investments and tenders).

5. Conclusion

The collaboration between cities of the Big Buyers working group on Circular Construction Materials proved fruitful in helping us to learn from each others' processes, to celebrate and be inspired by each other's successes and to encourage each other to keep pushing forward. We hope that our insights can be of use to other cities at any stage of a circular economy transition, and are open to opportunities for future collaborations.

Get in touch!

For more information on the Big Buyers Initiative, visit:

https://sustainable-procurement.org/big-buyers-initiative

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Links to further resources

Agenda for Transition to a Circular Construction Economy by 2050 - Strategy, the Netherlands

Bringing Embodied Carbon Upfront
- Report, World Green Building Council

CB'23 Platform & Core method for measuring circularity in the building sector
- Website, CB'23 Association of construction sector actors in the Netherlands

City Policy Framework for Dramatically Reducing Embodied Carbon - Report and webinar series, Carbon Neutral Cities Alliance and OneClick LCA

Clean Construction Policy Explorer - Web tool, C40

FutureBuilt Norway; Criteria for Circular Buildings
- Guides & Case studies, City of Oslo & partners

Guide for facilitating the integration of reclaimed building materials in large-scale projects and public tenders - Guide, FCRBE Project

Guideline for environmentally friendly construction site management for the areas of transport, construction and environmental supervision of construction work
- Guide, ÖkoKauf Vienna

Manual of Recycling - Buildings as sources of materials
- Book, Wuppertal University

Municipalities as drivers for circular economy in construction and refurbishment projects
- Case studies, EIT Climate-KIC

Pre-demolition Material Audit Guidance
- Guide, EIT Raw Materials, VTT, VITO, VCB

Roadmap Circular Land Tendering: an introduction to circular building projects - Guide, City of Amsterdam

Roadmap to Circular Procurement & Commissioning
- Guide, Metropole Amsterdam

Sustainable & Circular Re-use of Spaces and Buildings
- Handbook, EU Urban Agenda Partnership

Sustainability in Construction and Civil Works
- Strategy, City of Copenhagen

The challenges and potential for circular procurements in public construction projects
- Case studies, EIT Climate KIC

Circular Economy Action Plans
from the working group:

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