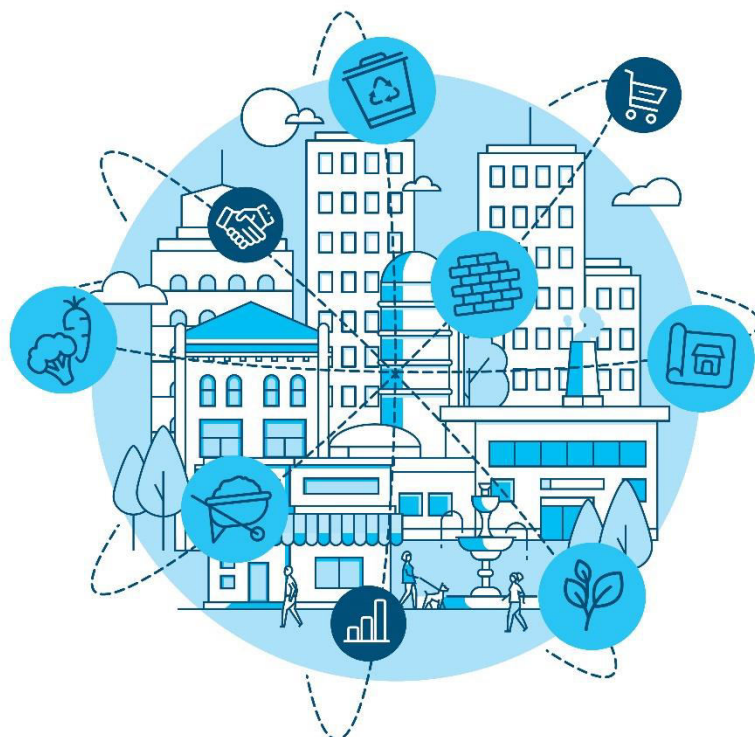




Material banks and marketplaces in Roskilde

Extract from the Demonstration Report

Roskilde, Denmark



Contents

Introduction to demo actions in Roskilde _____	1
Material Bank _____	1
The waste hierarchy as guide _____	6
Cooperation amongst municipalities _____	10
Procurement _____	10
Risk management _____	12

This text describes Roskilde's experience in physical material banks and digital marketplaces. The sections come from Roskilde's CityLoops demonstration report available [here](#).

Introduction to demo actions in Roskilde

The transition towards a circular build environment requires new approaches to construction, demolition and urban development. In the EU 2020 project CityLoops, the municipality of Roskilde, have developed procedures, methods, tools and generated knowledge to promote a circular transition, through a series of demonstration projects. These activities were based in the urban development area Musicon, a transformation of an old concrete factory and former waste deposit. The area contains a series of production halls, and the development of the area focuses on preserving the industrial aesthetic as well as the existing buildings, to be a hub for creativity, music and cultural activities.

The demonstration projects concern the 1) partial demolition and transformation of some secondary buildings, 2) construction of two Car Parks and 3) circular soil management in the area.

Material Bank


Local access to reused and recycled building materials are central elements in achieving the transition to circular constructions. In order for the municipality to have a steady supply of circular building materials, it was decided to establish three collaborative efforts to facilitate the circulation of the municipality's own building materials.


In order to be able to work with direct reuse in more and larger projects and thus ensure continued good development within circular construction, the requirement to obtain sufficiently good used building materials is increasing. The administration will therefore ensure access to recycled materials by facilitating the circulation of primarily the municipality's own excess and used building materials and thus service the municipality's own constructions and demolitions. This is done through three collaborative efforts:

a) A virtual material bank with an online platform that conveys both available and requested building materials. The virtual material bank is based on a commercial online platform that is already used in the municipality. The platform was adapted to the municipality's needs so that it can contain additional information about the materials' environmental and technical specifications/properties/conditions.

Upcycling Forum

Intern Materiale Rediger >





Brune vingetegl

Brune vingetegl i dansk normalformat
Opbevares i bigbags med ca. 100 tegl pr. pose
100 bigbags

Potentiel CO ₂ e besparelse	Pris
Pr stk: 2 kg CO ₂ e	Pr stk: -
Total: 18.157 kg CO ₂ e	Minimumsordre: -

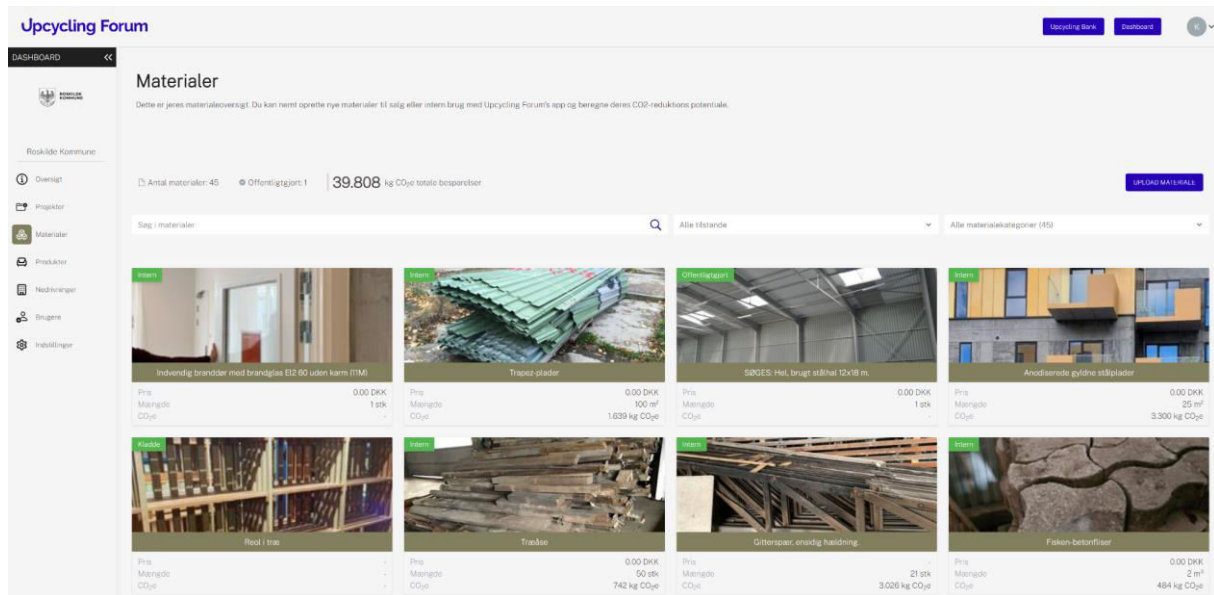
1

[Tilføj til mit projekt](#)

[Send forespørgsel på materiale >](#)

Materialetype	Materialekategori: Tegl	Materialetype: Tegl, tagsten	Kilde: Fra nedrivning	
Mængde	Tilgængelig mængde (total): 10000,0 stk			
Dimensioner Pr stk	Bredde: 24,7 cm	Længde/Højde: 41,4 cm	Tykkelse: 1,0 cm	Diameter: -
	Vægt: 3,0 Kg			
Tilgængelighed	Tilgængelig fra: Tor. Sep 1 2022		Tilgængelig til: Tor. Jun 1 2023	
Lokation	Land: Dk	Postnummer: 4000	By: Roskilde	
Tilstand	Rengjort: Nej	Miljøscreenet: Nej	Produktionsår: -	

Basically, the virtual material bank is a database, where all circular building materials are listed. Each material is registered with basic information regarding Origin, present location, environmental testing, future use and description of the material regarding size, weight and type. The virtual material bank allows the municipality to exchange information regarding available material with advisors and contractors, in order for them to suggest solutions using the available materials in the municipality. In time it will be possible to exchange materials with other municipalities and to sell circular construction materials on normal commercial terms.

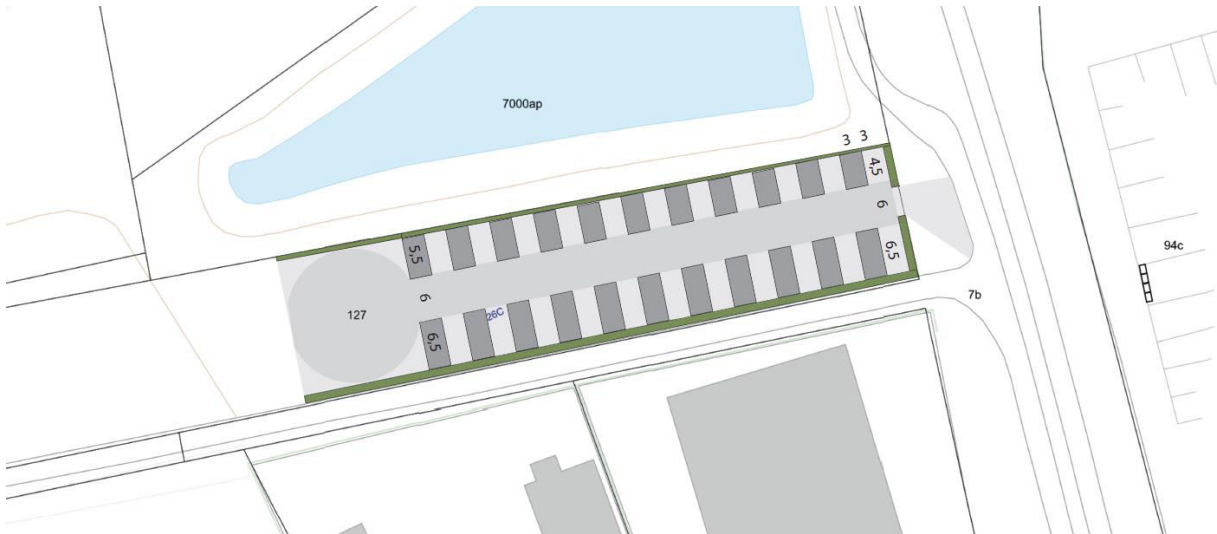


Beside the commercial platform “Upcycling Forum” the municipality is registering its existing buildings in a database, where information is stored in both 3d BIM files as well as in attached files containing information such as environmental product declarations etc. This is especially important for buildings that were constructed as “design for disassembly”. The building model contains information on all relevant materials used in the building, their expected lifespan, the amount of the material and instructions on how to take the material out of the building, without damaging the building.

The transformation of information from existing buildings has allowed us to cooperate more closely with the maintenance department and has created a common understanding of the potential in reusing building materials.

b) A central, physical material bank, which is permanently located outside the centre of Roskilde at Vestre Hedevej and will function as the municipality's primary physical storage area for used building materials. The materials are managed and disseminated via the virtual material bank. In the long term, it is appropriate to upgrade the site with a smaller storage hall for materials that must be stored under roof. The space will replace a previous and temporary physical material bank that has operated in Hall 1 at Musicon since 2019 but will be closed at the end of 2023 in order to be transformed into a local district square for the benefit of surrounding housing.

The material bank covers an area of 7500 m² and will have a classical layout with fractions placed on each side of a central access road.



c) A local pop-up material bank at Skt. Hans, which will service the temporary need for local handling of used building materials and will be shut down again when the need ceases. The material bank is placed in an existing garage building and managed via the virtual material bank. Similar to this, it may also be relevant elsewhere to establish a temporary pop-up material bank. Furniture is also kept in a pop-up material bank.



The material bank aims to investigate the possibility of recycling materials locally and at the same time get the circular economy going. It turns out that the absolute greatest benefit, economically and environmentally, occurs if we are able to recycle building materials as high up in the waste hierarchy as possible and as locally as possible. So, if we can use building materials as close to the same function and design as originally, and preferably in the same place, we get the biggest benefit.



If the concrete walls of an existing building can be reused directly in a new building in the same place, then that is the best we can do. It is the highest level in the hierarchy and the most local reuse, which is what we aim for. If we can reuse an entire wall disc elsewhere at Musicon, that's great. If we have to break it down and reuse it in a new concrete, that's still okay, but not as good.

If it is a question of rafters, we try to preserve them as whole rafters instead of dividing them into laths and beams. Because it may be that we can reuse them in their original form somewhere, and if there is a need for separation, we will do so afterwards. We look at recycling before recycling.

The waste hierarchy as guide

The waste hierarchy has shown to be a very efficient way to navigate in the early investigations. And this is reflected in the material banks. First priority is to keep materials on site in the building, this is the case in Hal 12, where almost all load bearing structures are maintained. The virtual material bank's main purpose is to catalogue existing materials while still incorporated in buildings. This allows us for optimal planning and preservation of relevant building elements. Second priority is to extract building components in their original shape

and reuse them directly in other buildings. This is where the physical material banks come into play. They absorb materials in the timespan from extraction to reuse.

The material bank operates practically by storing primarily reclaimed materials from demolition projects at Musicon, as well as materials from other buildings owned by the municipality. When there are projects that require the recycling of building materials, advisers and contractors participating in the bidding process have the opportunity to visit the material bank. They can physically inspect the available materials and select the specific ones they would like to incorporate into their projects. These material selections are then included in their bidding proposals, allowing for project planning to proceed accordingly, taking into account the chosen materials. In the future, there are plans to expand the material bank into a virtual platform that covers the entire district, providing remote access to a wider range of materials. The primary objective of the material bank is to promote sustainable practices in the construction industry by encouraging the reuse and recycling of building materials, ultimately reducing waste.



All buildings constructed in Musicon are included in the material bank. The municipality is actively registering and analysing these buildings to identify any environmentally harmful substances. This comprehensive catalogue of the existing building stock allows for effective

future planning. By identifying buildings that may become obsolete in the next 5-10 years, the municipality can anticipate the release of materials such as concrete, which can be broken down and reused.

In addition to creating a material passport that indicates the presence of environmentally harmful substances in the materials and their appropriate usage contexts, the municipality also develops a Building Information Model (BIM). This BIM records the quantities of all materials used in the buildings and notes any potential challenges associated with them.

The screening process takes into account the presence of dangerous substances. This aspect is of great significance for risk calculations and management in new circular projects. By considering the potential risks associated with demolishing a building and reusing its materials in a nearby construction project, contractors must factor in these risks when submitting their bids. Consequently, this may lead to a higher price for the client. However, if the developer assumes these risks, it is possible to maintain a competitive price without compromising environmental safety.

In Roskilde Municipality, the construction process is divided into several sub-contracts, and an environmental screening of materials is conducted in advance, as required by legislation. This comprehensive screening ensures that the contractor does not face any specific risks in the demolition contract. Instead, their responsibility is to deliver materials for recycling rather than disposing of them in a landfill. Once the demolition contract is completed, the municipality receives the materials, which are then analysed to determine their potential for recycling. This valuable data empowers other contractors to confidently state, "I could use that!"



There are already notable examples of buildings where the material bank concept has been successfully applied. One such instance is the recently constructed car park in Musicon. Designed by Mangor & Nagel and built by MT Højgaard as the turnkey contractor, this project incorporated the principles of the material bank from its inception. During the construction process, specific requirements were set regarding the quantities of building materials, taking into account life cycle analyses and overall project economics. These requirements ensured efficient resource management and facilitated the inclusion of data into the virtual material bank for future projects.

Moreover, the car park project embraced the concept of "Design for Disassembly." This design approach allows for easy disassembly and the potential reuse of materials in the future, further enhancing the sustainability and circularity of the building. By implementing the material bank and prioritising sustainable design principles, the municipality showcased its commitment to reducing waste and promoting a more environmentally friendly approach to construction in Musicon.

Cooperation amongst municipalities

Several municipalities in Denmark are actively involved in the recycling of building materials. While many municipalities have strategies in place to reuse common items like wooden doors, the importance of assessing the environmental and financial feasibility becomes more pronounced as we delve deeper into the waste hierarchy. For instance, if we were to request a factory to collect concrete for crushing and repurposing it in new factory concrete, the immediate environmental advantage would be negated due to exorbitant transportation costs. Although there would be a gain in terms of raw materials, the overall advantage in relation to the life cycle analysis diminishes significantly if the transportation distance exceeds 50 km.

It is crucial to conduct a meticulous evaluation that weighs the environmental benefits against the associated costs at every step of the waste hierarchy. By making informed decisions regarding the recycling and reuse of building materials, municipalities can strike a balance between sustainability and economic considerations. Thankfully, this approach is being embraced by numerous municipalities across Denmark, contributing to the larger goal of creating a more resource-efficient and environmentally conscious construction sector.

While achieving a completely circular material economy is an ambitious goal, it is essential to maintain a realistic perspective. It is unlikely that we can entirely eliminate the need for new materials in certain contexts. However, it is worth noting that buildings incorporating reused building parts offer a unique aesthetic value. By blending old and new materials together, such as combining recycled building materials with "affordable" options like trapezoidal panels and plywood, an appealing visual harmony can be achieved. This approach not only enhances the environmental benefits but also creates captivating architectural compositions.

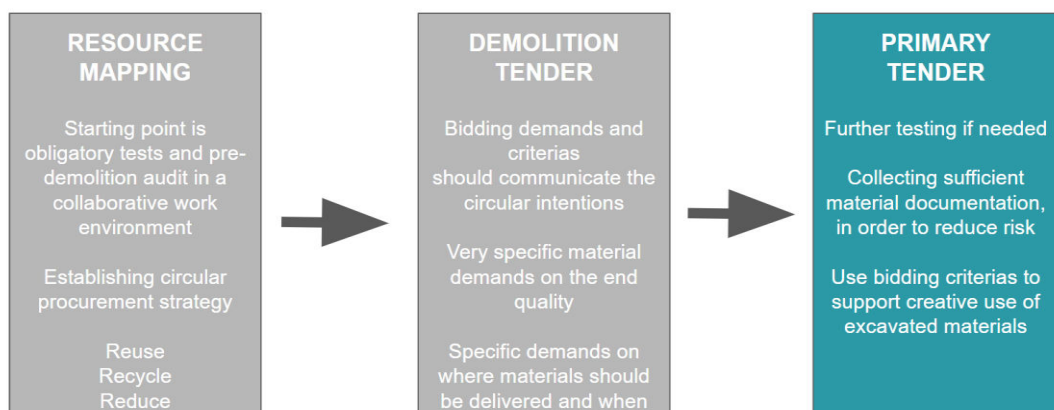
It is encouraging to see that numerous advisors have embraced this concept and are successfully implementing it in their projects. By striking a balance between recycled and new materials, they demonstrate the possibility of creating structures that are both visually striking and environmentally conscious. While a fully circular material economy may present challenges, the integration of sustainable design principles and the thoughtful use of recycled materials contribute significantly to the overall goal of fostering a more sustainable and aesthetically pleasing built environment.

Procurement

Working with Recycling and Reuse can be associated with several practical challenges. This is because the Recycled and/or Reused building materials will not always be thoroughly tested, and because several of the construction processes that are linked to building with these products and materials, are still relatively new.

The early collaboration is particularly important in construction projects that begin with an Environmental and Resource mapping of a building ready for demolition, because this gives the parties the opportunity to identify together the places where Recycling and/or Recycling of materials is possible. The contractor's knowledge is an important contribution to the advisor's work in the very early phases and in screening the Environmental and Resource Mapping. The detailing process around material use, construction technical conditions and technical assessments of a material's qualitative nature and thus future use can have an impact on how the material is used in relation to the planning, detailing architectural and technical aspects. Based on interdisciplinary discussions in the project, a common knowledge base and a common process are created regarding the development of prototypes of the selected Recycled and/or Recycled materials. When knowledge about the use of materials is brought to the table, the demolisher can prioritise Selective removal of a building and its building parts, which must be brought to Recycling or Recycling. Parallel to the subsequent planning in accordance with YBL 18, it will be advantageous to initiate a further one product qualification and development in collaboration with relevant manufacturers and contractors.

3 STEPS OF CIRCULAR PROCUREMENT



It is recommended that, prior to the Circular tender, the client sets objectives for which Circular principles the client wants to work with in the current construction. The objectives for Circular principles can be drawn up in collaboration with the Sustainability Management.

As an example, the client can set concrete targets for CO2 savings, targets for use of Circular principles such as Design for separation or the degree of use of Recycled or Recycled materials in the building when it is finished. The National Strategy for Sustainable Construction can advantageously be used as a baseline when targets for CO2 impact are to be set. The objectives for Circular principles must be transparent for all parties in the construction, including builder, contractors, consultants and ultimately the end users. The objectives can be linked to incentive schemes to motivate the advisers and the contractor.

In connection with the client having to set targets for, for example, Recycled or Recycling of materials, a calculation of any CO2 savings (LCA calculations) could support the decision-making process. In order to identify all aspects of such a saving, and because in the industry does not yet have LCA calculations for many Recycled or Recycled materials, will it be necessary to bring more expertise across the value chain into play in order to enlighten everyone prerequisites for the recycling of the material. The Circular principles and requirements should be laid down already at the conclusion of the contract.

In the Circular turnkey contract, the objectives for Circular principles in construction are set by the client in collaboration with the Sustainability Management prior to holding the turnkey contract tender.

The key to innovation in a building with Circular principles assumes that the client can have an open and trusting dialogue with the contractor and advisers. The dialogue is the prerequisite for that the Circular principles in construction are as much as possible assessed from both an environmental point of view and architectural value, costs, quality, etc. The framework for innovation and the challenges involved should therefore already be discussed at the negotiation meetings, where the parties should articulate the special conditions that require dialogue and openness.

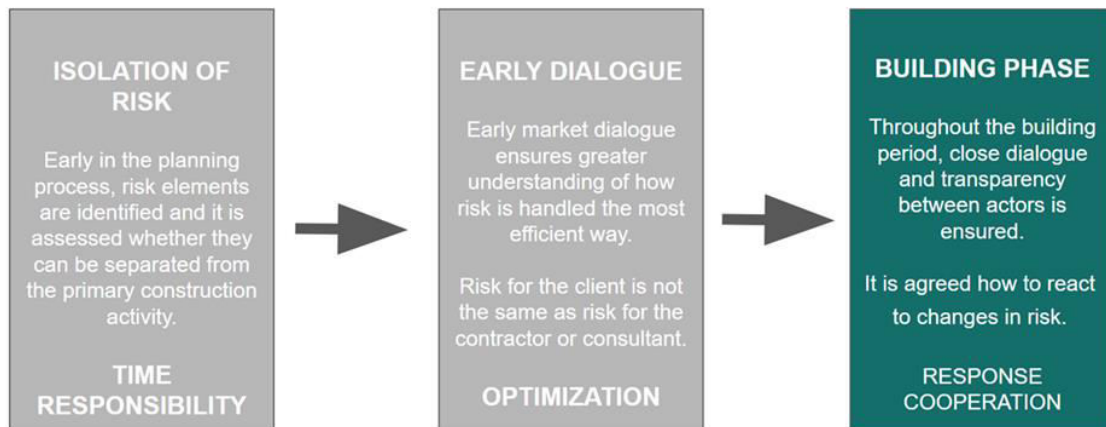
The negotiation topics below are an expression of the issues where law is particularly affected by the Circular principles. Dialogue about the themes creates transparency about what can be created in particular insecurity on the part of both the client, contractor and advisers.

Negotiation meetings can be structured in many different ways depending on the purpose of the negotiations and which resources are used. Since the negotiations are part of the evaluation of the offers, the client can advantageously divide the negotiation meetings so that they follow the award criteria in the tender conditions. This makes it easier for the client to give constructive feedback during the dialogue, just as it is easier for the tenderer to adjust his offer on the basis of the negotiations and the client's feedback.

Risk management

Risk management is a fundamental element within the planning process of circular projects. As a starting point, any potential risk factors should be identified as early as possible, followed by a risk assessment where responsibilities, risks, and consequences are described. Based on the risk assessment, an evaluation is made to determine if there are opportunities to mitigate the risks and ensure that responsibility for risk management is appropriately assigned. Frequently, rigidly assigned responsibilities can impede proactive problem-solving and risk mitigation. Therefore, it is crucial to maintain an open-minded approach towards each risk, accepting alternative responsibility placements if they prove advantageous in resolving the issue.

RISK MAPPING



Incorporating proactive, transparent, and mutually agreed-upon rules for identifying, managing, and allocating responsibilities and risks among project stakeholders adds value to the project. Often, open dialogues about risks can help minimise the potential consequences resulting from triggered risks.

The nature of each risk determines the approach to its elimination or reduction. Certain types of risks can be neutralised through increased knowledge acquisition, such as conducting sampling. This is particularly relevant for risks related to insufficient information regarding scope and consequences. Identifying a risk associated with the presence of environmentally harmful substances early on provides an opportunity to investigate and address it directly, instead of delegating the risk to a consultant or contractor who may include it in their bid.

As part of the risk assessment process, early market dialogues are conducted with key stakeholders. Circular construction projects encompass a broader value chain compared to traditional construction, and individual stakeholders often have differing perspectives on risk. Therefore, assigning responsibility for a particular risk to the actor who has the best means to neutralise it presents a significant potential advantage. This approach can be effectively integrated into the tendering phase, encouraging bidders to identify risk elements impacting their responsibilities that may be beyond their immediate influence. This allows for the proactive management of risks to be addressed during contract negotiations.

During the construction process, new risk factors may emerge, or known risk factors may change, necessitating alternative management approaches. Hence, the tender should include a process description detailing how newly identified or altered risks will be managed throughout the construction process.

Presenting known risk factors and outlining the strategies for managing emerging risks should be included within a Risk Management Plan when submitting a bid.

CITYLOOPS

CityLoops is an EU-funded project focusing on construction and demolition waste (CDW), including soil, and bio-waste, where seven European cities are piloting solutions to be more circular.

Høje-Taastrup and Roskilde (Denmark), Mikkeli (Finland), Apeldoorn (the Netherlands), Bodø (Norway), Porto (Portugal) and Seville (Spain) are the seven cities implementing a series of demonstration actions on CDW and soil, and bio-waste, and developing and testing over 30 new tools and processes.

Alongside these, a sector-wide circularity assessment and an urban circularity assessment are to be carried out in each of the cities. The former, to optimise the demonstration activities, whereas the latter to enable cities to effectively integrate circularity into planning and decision making. Another two key aspects of CityLoops are stakeholder engagement and circular procurement.

CityLoops started in October 2019 and will run until September 2023.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 821033.

Disclaimer: The sole responsibility for any error or omissions lies with the editor. The content does not necessarily reflect the opinion of the European Commission. The European Commission is also not responsible for any use that may be made of the information contained herein.