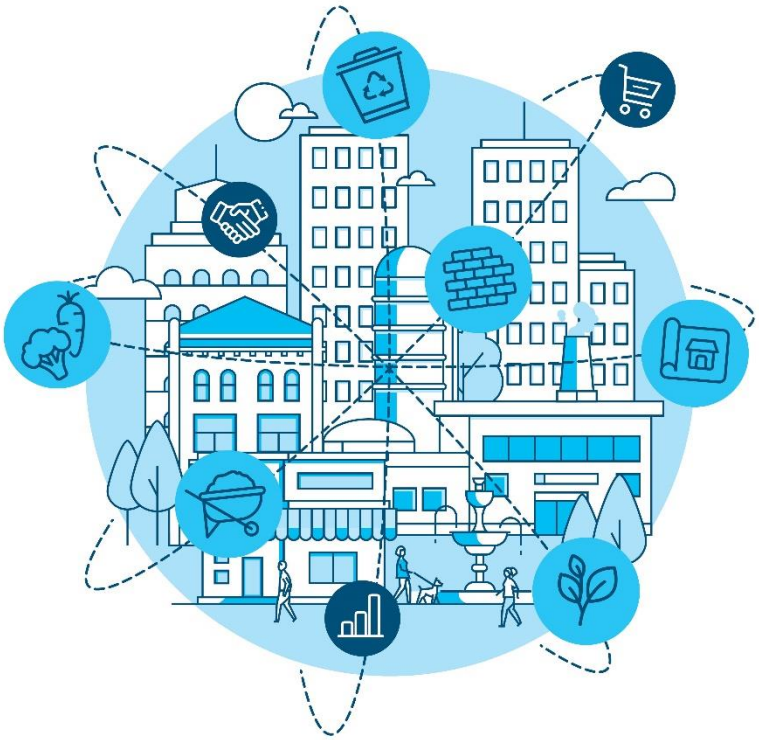
Evaluation Plan: CDW sector, Apeldoorn

Deliverable 6.2

Gemeente Apeldoorn / Municipality of Apeldoorn



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Abstract	This report details how the city of Apeldoorn will evaluate the impact of the CityLoops tools and demonstration activities aimed at improving the circularity of the Construction and Demolition Waste sector.
Keywords	Evaluation, Indicators, Apeldoorn, Construction and Demolition Waste
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Contents

1. Introduction

The objective of the CityLoops evaluation work is to ensure a comprehensive evaluation framework which is established for all demonstration actions to assess their impact on sustainability and to assess the progress towards a more Circular Economy (CE).

This document will guide the practical evaluation work based on the evaluation framework and CE indicators presented in CityLoops Deliverable 6.1 Circular City Indicator Set (Vangelsten et al. 2021). The evaluation aims to cover all the four Vision Elements at the core of the CityLoops circular city definition from Vangelsten et al. (2021), see figure 1. Thus, the evaluation will monitor local level processes and behaviour aimed at improving circularity, impact in terms of more circular material flow and energy use as well as outcomes in terms of improvements on the environment and on human wellbeing. The evaluation will focus both on the demonstration actions and on impacts at city scale.

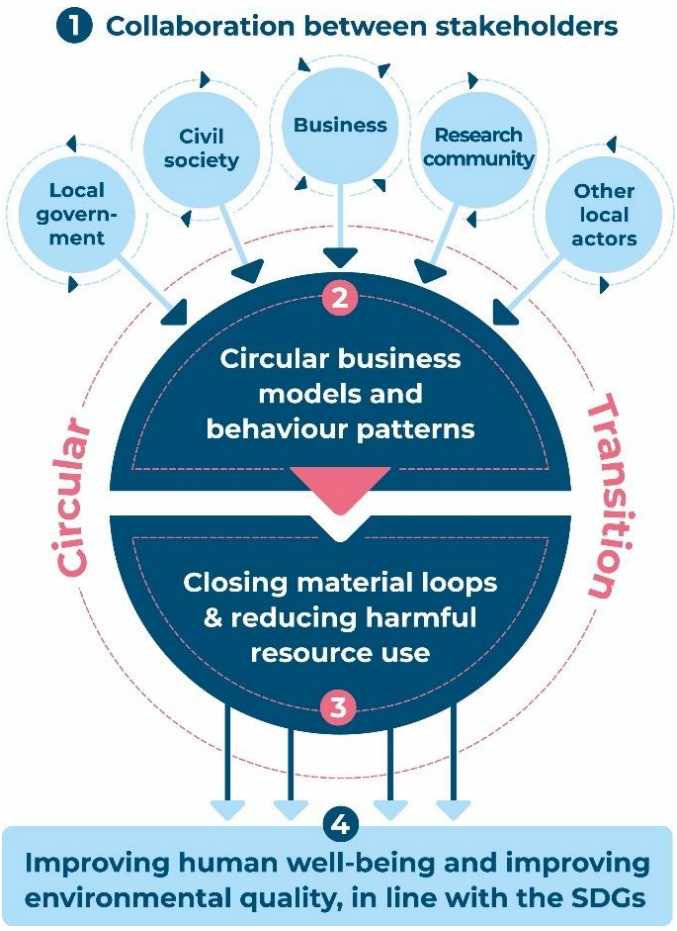

Figure 1. The four Vision Elements of the Circular City vision and causal links for CE transition.

This Evaluation Plan presents a list of specific indicators to be monitored over the duration of the Demonstration phase of the CityLoops project (Month 18-44). It further details what data needs to be collected, who is responsible for doing this, how it will be done, and when. The overall responsibility of the development of the Evaluation Plan and its implementation lies with the Evaluation Manager appointed in each city. The implementation of the Evaluation work will be documented in the Interim Evaluation Report to be submitted at Month 36 and the Final Evaluation Report to be submitted at Month 46.

The Municipality of Apeldoorn (MoA) is one of the cities which are involved in the CityLoops Project, closing urban material loops. In MoA we have formulated two main streams to address, in order to become more circular. These are infrastructure -as part of construction and demolition waste- and biowaste. MoA has the ambition to purchase 30% circularity in 2030 (in euro). Until 2025 we work according to the policy plan "Working towards our future" (https://apeldoorn.begroting-2021.nl/assets/docs/infographic2021.pdf). This policy is focusing on reducing residual waste in a sustainable way. It also contains goals to reduce the effects of climate change and to create a safe and healthy environment. Now and towards our near future.

1.1. Demonstration Action: Designing and reconstructing public space in a circular way

The main CDW demonstration project in the municipality of Apeldoorn will be the circular design and reconstruction of 3,000 m^2 of public space. This space includes pavement, sidewalks, green space, and parking space along a residential street called Griffiersveld. This street is located in the south-eastern part of Apeldoorn in a neighbourhood that goes by the name of De Maten (see Figure 2). Data from the 1980s illustrate that streets in this neighbourhood are dominated by concrete, typical of the wider neigbourhood. This feature makes the locality of particular interest in developing more sustainable and circular spaces and learnings for future 'at scale' projects.

Figure 2. Location and size of De Maten (left) and the area surrounding Griffiersveld (right).

The challenge for this pilot is to (A) assess if new materials can be made from the recovered materials, (B) be used as a learning resource to generate new digital tools, and (C) collaborative design methods towards innovative and circular approaches to street renovation. The Municipality of Apeldoorn (MoA) operates a central storage site for soil and sand with a new physical construction material marketplace where the coordination of the recirculation of construction materials takes place. In collaboration with Saxion University of Applied Sciences, multiple research activities will be conducted to explore the current state and design new solutions for construction with MoA. Developing these activities further, and moving to more circular construction methods, MoA must first develop a set of processes for the Griffiersveld renovation project. These can be divided into three distinct categories:

A) social processes to involve people,
B) technological processes related to execution and materials, and
C) economic processes related to contracting, transactions and developing the business models.

Part of this work is to collaboratively develop a materials inventory system with researchers. It is the expectation that this inventory will underpin decision-making for future activities based on the data analysis of resources (quantities, quality, etc). The following section presents the demonstration action in detail along with its expected outcomes.

Figure 3. Examples of concrete elements and repairs in Griffiersveld.

1.2. CityLoops tools/processes tested in the demonstration action

Demonstration Action (DA) part 1: LCA: In order to understand the most circular ways of working, a Life Cycle Analysis (LCA) for different material flows and streams will be carried out for the Griffiersveld renovation project. Tools and methods will be developed to meet this task. Saxion University will review Apeldoorn's current circular soil practices, associated processes and material flows at one of MoA's depots. In support of this, some progress has already been made using a Danish CO2 emission calculator tool for soil (February 2020, Roskilde University). This tool has previously been used to calculate soil handling and associated transportation to the Netherlands. It is envisaged that this tool can be used to calculate the CO2 impact of moving soil, or other (bulky) construction materials, on the Griffiersveld project.

DA part 2: Construction material passport and CDW materials databank: In March 2021, MoA will operate a physical construction material hub. Currently the municipality of Apeldoorn uses ANTEA-GBI software to store data on their public space construction projects. In the material hub anyone should drop off and/or pick up secondary construction materials free of charge.

The MoA's goal is to put materials emerging from demolition or renovation works into a digital marketplace before they are dug up, to see if there is demand, allow them to be included in design for new construction, and avoid the logistics problems of bulk storage. Apeldoorn will work with Excess Materials Exchange (EME), a start-up specialised in matching supply of secondary construction materials to demand for their future reuse. Various business subscriptions can be made to subscribe to this service (e.g., monthly fee). After a proof-of-concept phase, MoA will decide which package is most suitable. In preparation for this activity, a materials database is required. In collaboration with Saxion University, an analysis of state of the art in digital material passports will take place. This is essentially a material database which acts as an inventory and includes the GIS (location) storage information about the materials for future retrieval and reuse. In addition, Saxion University will also investigate the use of 3D modelling software, such as Revit, to visualise and store data about materials. The demonstration action will take these learnings and procure a digital material database solution, applying 3D modelling. At the same time, MoA will obtain the laser scanning of the street development under consideration and will enter this information into the (digital) material passport when it is available. During reconstruction of Griffiersveld Street, materials currently in use at the site will be documented in the material passport (with data from the scans). The materials will then be placed on the marketplace. This new approach to recording and managing CDW material flows will be used to optimise and valorise recycled materials on new projects if possible and needed.

DA part 3: Co-design process for public space: As in many large organisations, larger projects are generally embedded across multiple departments of the MoA. At each stage of a project, multiple external organisations will support in attaining the project goals. Public space projects, like the Griffiersveld project, feature the same multi-stakeholder characteristics. Other departments of MoA as well as material suppliers and manufacturing industry will be invited to learn about and feed into the circular design process. In addition, the MoA wants to involve citizens in their goal of achieving a transition to a circular economy. For the Griffiersveld project, an engagement campaign (between March 2021 – October 2021) will enable the inclusion of residents, sharing knowledge about the circular economy and the circular road renovation activities. This will include an invitation to residents to deposit any unused materials from their personal gardens for reuse on the 'marketplace' or 'material hub'.

Unfortunately, the impact of Covid 19 restrictions will impact the level of citizen interaction in the process of redesigning Griffiersveld, namely spatial and financial constraints.

1.3. Expected outcomes

The CityLoops project promotes both theory and practice of CE in European cities. Key impacts of the project as listed in the Grant Agreement are presented in Annex 1.

From the Griffiersveld demonstration action, the following outcomes are expected:

- Increased knowledge and awareness raising within municipal organisations
- Citizens in Griffiersveld are engaged in the circular economy by means of raised awareness
- Improved innovative products and services in CE practices within municipal organisations
- Results of tested tools deployed in the demonstration action are communicated and disseminated internally and externally
- By the end of the project, procurement of circular products related to Griffiersveld have increased by 10% in volume, due to awareness raising activities within MoA
- Quality assurance certification system for reuse of material fractions has been established (GBI)
- Increased number of jobs changed to include CE thinking
- Tiles, curb stones, and older concrete pavers have been reused within the municipality
- Concrete pavers have been reused in the Griffiersveld district development
- Reduced CO2 emission from reduced transport and through reusing and recycling material (3,000 m2 road), compared to conventional street development projects
- Improved wellbeing of citizens through the improved open spaces

2. Indicators to be monitored

This chapter presents an overview of the indicators that will be monitored during the CityLoops Implementation Phase (see table next page). The indicator selection has been made based on several criteria:

- Relevance to the city's circularity strategies and the DA and Tools: Each selected indicator will monitor specific processes and impacts related to the DA activities and outcomes (and if relevant the application of CityLoops tools outside the scope of the demonstration actions, i.e. city-wide). Indicators may be monitored either at DA scale or at city scale, or in some cases at both. For each evaluation scale, the indicator is paired with the expected outcome or target value listed in the table below. This will allow evaluation of the progress and impact of demonstration- and city-wide actions towards improved circularity as well as the effectiveness of activities and tools.

- Data availability and quality: Through dialogue with local stakeholders internally and externally to the CityLoops consortium, data availability, accessibility and quality has been mapped to ensure that the evaluation process for the selected indicators can be carried out in a practical and timely manner.

- Cross-city comparison and adherence to the Circular City definitions from ANNEX 1: Strategic objectives based on CityLoops' Circular City definition and ANNEX 2: CityLoops projected project impacts. As part of the process of developing the Evaluation Plans continuous dialogue between the cities and the CityLoops partner coordinating the evaluation work has been carried out to ensure some overlap and consistency in the selection of indicator between cities to allow comparison where practical. This dialogue has also ensured that indicators are selected to monitor progress towards circularity in a broad sense covering as much as possible all four Vision Elements of the Circular City definition as described in Vangelsten et al. (2021).

The table (next page) lists the selected indicators for each expected outcome linked to the four Vision Elements in the CityLoops circular city definition (Vangelsten et al., 2021). The table describes at which level (scope) the indicators will be applied (Demonstration Action or City level). In Construction and Demolition Waste in Apeldoorn we have 1 Demo Action: Designing and reconstructing public space in a circular way, applying the following tools:

1. LCA
2. Construction material passport and CDW materials databank
3. Codesign process for public space

Table 1. Linking expected outcomes to the selected indicators

Vision Element	Expected outcome	Indicators	Indicator name	Scope
1 Local Stakeholder Actions	Increased knowledge and awareness raising within municipal organisations	3	New tools for better mapping of resources and their location: Qualitative description	D
		9	New formal CE-based collaboration platforms/networks	C
		21	New planning instruments/tools for improved circularity: Qualitative description	D
	Citizens in Griffiersveld are engaged in the circular economy by means of raised awareness	4	CE-related knowledge building campaigns: Qualitative description	C
		11	Communication measures on circular transformations and waste prevention	C
	Improved innovative products and services in CE practices within municipal organisations	3	New tools for better mapping of resources and their location: Qualitative description	D
		21	New planning instruments/tools for improved circularity: Qualitative description	C
	Results of tested tools deployed in the demonstration action are communicated and disseminated internally and externally	11	Communication measures on circular transformations and waste prevention	C
		21	New planning instruments/tools for improved circularity: Qualitative description	D
	By the end of the project, procurement of circular products related to Griffiersveld have increased by 10% in volume, due to awareness raising activities within MoA	12	Circularity requirements in procurement beyond existing levels	D
		16	Procurements making use of stakeholder dialogue to strengthen circularity: Qualitative description	C
2 Circular business models and behaviour patterns	Quality assurance certification system for reuse of material fractions has been established (GBI)	2	New material passports: Qualitative description	C
		30	New digital material databank/marketplace: Qualitative description	D
		31	New digital material databank/marketplace: impact	D
	Increased number of jobs changed to include CE thinking	33	CE-based employment	C

Vision Element	Expected outcome	Indicators	Indicator name	Scope
3 Closing material loops and reducing harmful resource use	Tiles, curb stones and older concrete pavers have been reused within the municipality	27	Increased share of materials retained and reused on demonstration sites	C
	Concrete pavers have been reused in the Griffiersveld district development	27	Increased share of materials retained and reused on demonstration sites	D
4 Improving human wellbeing and reducing environmental impacts	Reduced CO2 emissions from reduced transport and through reusing and recycling material (3,000 m2 road), compared to conventional street development projects	87	Annual CO2 emissions per unit of GDP	D
	Improved wellbeing of citizens through the improved open spaces	68	Share of green space areas within urban limits	D

3. Plan for monitoring

The tables below detail the monitoring plan for each of the selected indicators. This will guide the CityLoops Evaluation work to be carried out and documented in the Interim Evaluation Report in Month 36 and the Final Evaluation Report in Month 46 of the project. The 16 metadata categories described for each of the selected indicators is based on the Circular City Indicator Set (Vangelsten et al., 2021). Metadata categories 1-5 and 7-8 are standard for all cities/waste streams whereas the others (6 and 9-16) vary from case to case and are therefore customized by each city to fit the scope and focus of their demonstration activities and the tools they will test.

3.1. New material passports: Qualitative description

Metadata group	#	Metadata category	Description/comments
Identifier	*1*	*Indicator number*	2
	2	*Indicator name*	**New material passports: Qualitative description**
Link to Circular City Definition	*3*	*Vision Element*	X Local stakeholder actions
			Circular business models and behavioural patterns
			Closing material loops and reducing harmful resource use
			Improving human well-being and reducing environmental impacts
	4	*Category*	– Engagement and capacity building – Regulation and incentives – Vision and urban management
Indicator definition and description	*5*	*Definition / Description of indicator*	Description of passport established / updated to facilitate increased circularity. E.g. type of certification/validation, name of the institution issuing the passport, material types/fractions, etc.
	6	*Rationale*	The rationale is that due to the absence of detailed quality information in the GBI on the material at hand (location, kind of material, mass of the material – how much and LCA), reuse of material is not considered. The establishment of a quality assurance certification system for reuse of material fractions (expected outcome) helps us to realize circular loops of materials and reduce the use of virgin materials. The indicator is related to the following expected outcome: • Quality assurance certification system for reuse of material fractions has been established (GBI)
	7	*Methodology*	Qualitative description
	8	*Unit*	Qualitative data
Data	*9*	*Baseline data / definition*	Baseline is 0. Currently there is no qualitative information about material and resources in the GBI system.
	10	*Data Sources / Relevant Databases*	In Apeldoorn we have a 2D information tool called Gemeentelijke Basis Informatie (GBI). This application contains no qualitative information about material and resources. There is quantitative

Metadata group	#	Metadata category	Description/comments
			information about the resources, like 3,000 square meters of concrete in neighbourhood 'x'. The GBI contains no information about m3. For demonstration case input of CDW masses to be reused at start t0= 0 ton
	11	*Overall accuracy*	GBI data is based on cadastral information and therefore quite accurate. The GBI contains no m^3 data.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Febr 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	7, 12
Other	*16*	*Comments*	None

3.2. New tools for better mapping of resources and their location: Qualitative description

. Metadata group	#	Metadata category	Description/comments
Identi-fier	*1*	*Indicator number*	3
	2	*Indicator name*	**New tools for better mapping of resources and their location: Qualitative description**
Link to Circular City Definition	*3*	*Vision Element*	X Local stakeholder actions
			Circular business models and behavioural patterns
			Closing material loops and reducing harmful resource use
			Improving human well-being and reducing environmental impacts
	4	*Category*	– Engagement and capacity building – Regulation and incentives – Vision and urban management
Indicator definitio	*5*	*Definition / Description of indicator*	Qualitative description of individual tools, including scope and scale (e.g. demonstration vs city level), target users.

. Metadata group	#	Metadata category	Description/comments
	6	*Rationale*	The rationale is that new tools for mapping providing qualitative descriptions of the resources and their locations will contribute to more knowledge and insights in the current material at hand, informing planning processes with this information. The indicator is related to the following expected outcomes: • Increased knowledge and awareness raising within municipal organisations • Improved innovative products and services in CE practices within municipal organisations
	7	*Methodology*	Qualitative description
	8	*Unit*	Qualitative data
Data	*9*	*Baseline data / definition*	0 - first check quality of data outputs tool/ after that quantities (quality assurance)
	10	*Data Sources / Relevant Databases*	Autocad is the system we test/analyse to check the suitability of the mapping tool.
	11	*Overall accuracy*	Qualitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Febr 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	9, 11, 12
Other	*16*	*Comments*	None

3.3. CE-related knowledge building campaigns: Qualitative description

Metadata group	#	Metadata category	Description/comments
Identifier	*1*	*Indicator number*	4
	2	*Indicator name*	**CE-related knowledge building campaigns: Qualitative description**
Link to	*3*	*Vision Element*	X | Local stakeholder actions

Metadata group	#	Metadata category	Description/comments
			☐ Circular business models and behavioural patterns ☐ Closing material loops and reducing harmful resource use ☐ Improving human well-being and reducing environmental impacts
	4	*Category*	Engagement and capacity building
Indicator definition and description	*5*	*Definition / Description of indicator*	Description of knowledge building campaigns. The campaigns would normally be in the form of formalized education events, e.g. classes, courses, education workshops. Describe type of groups reached and type of knowledge building campaign.
	6	*Rationale*	Participation in CE-related activities of the Municipality of Apeldoorn makes inhabitants and stakeholders more aware of the impact of CE in their lives. At this moment we involve inhabitants/stakeholders late in the process. By involving inhabitants/stakeholders earlier in the process, we are convinced that acceptance of changes happens more easily. The indicator is related to the following expected outcome: • Citizens in Griffiersveld are engaged in the circular economy by means of raised awareness
	7	*Methodology*	• Identify and categorise knowledge campaigns • Identify groups reached
	8	*Unit*	Qualitative data
Data	*9*	*Baseline data / definition*	1st time inhabitants are actively approached and engaged in a CE road construction project as such. Therefore the baseline is zero.
	10	*Data Sources / Relevant Databases*	• Newsletters / subscription lists • Information sessions • Desk research and feedback forms on engagement approaches implemented
	11	*Overall accuracy*	Qualitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area in MoA
	14	*Reference period*	Febr 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	17
Other	*16*	*Comments*	None

3.4. New formal CE-based collaboration platforms/networks

Metadata group	#	Metadata category	Description/comments
Identi-fier	*1*	*Indicator number*	9
	2	*Indicator name*	**New formal CE-based collaboration platforms/networks**
Link to Circular City Definition	*3*	*Vision Element*	X Local stakeholder actions
			Circular business models and behavioural patterns
			Closing material loops and reducing harmful resource use
			Improving human well-being and reducing environmental impacts
	4	*Category*	Engagement and capacity building
Indicator definition and description	*5*	*Definition / Description of indicator*	Number of CE-based collaboration platforms/networks Number of members in CE-based collaboration platforms/networks
	6	*Rationale*	Rationale is that by setting up formal CE-based collaboration platforms/networks, will contribute to knowledge exchange, sharing of information, learnings, and findings, and boost potential partnerships/ collaborations between different stakeholders. The indicator is related to the following expected outcome: • Increased knowledge and awareness raising within municipal organisations
	7	*Methodology*	• Number of formalised CE-based collaboration platforms/networks • Number of people in formalised CE-based collaboration platforms/networks
	8	*Unit*	Number of networks, Number of people
Data	*9*	*Baseline data / definition*	The baseline is zero as there is currently no CE-based collaboration platform/network.
	10	*Data Sources / Relevant Databases*	Meeting memos (#no of references to CE); participant lists to workshops/webinars (#no of participants reached); list of other networking meetings and interviews (date and participants)
	11	*Overall accuracy*	Qualitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Febr 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report

Metadata group	#	Metadata category	Description/comments
	15	*SDG Reference*	17
Other	*16*	*Comments*	None

3.5. Communication measures on circular transformations and waste prevention

Metadata group	#	Metadata category	Description/comments
Identifier	*1*	*Indicator number*	11
	2	*Indicator name*	**Communication measures on circular transformations and waste prevention**
Link to Circular City Definition	*3*	*Vision Element*	X Local stakeholder actions Circular business models and behavioural patterns Closing material loops and reducing harmful resource use Improving human well-being and reducing environmental impacts
	4	*Category*	Engagement and capacity building
Indicator definition and description	*5*	*Definition / Description of indicator*	Collaborative Local Networks, expert meeting, information sessions, newsletters will be kept during project.
	6	*Rationale*	Rationale is that through communication on CE towards the general public (as stakeholders), the public tends to become more aware and more engaged. The knowledge base grows capacities of internal and external stakeholders on CE. The indicator is related to the following expected outcomes: • Citizens in Griffiersveld are engaged in the circular economy by means of raised awareness • Results of tested tools deployed in the demonstration action are communicated and disseminated internally and externally
	7	*Methodology*	• Number of communication measures towards general public on CE transformation • Number of people reached
	8	*Unit*	Number of communication measures, Number of people
Data	*9*	*Baseline data / definition*	0
	10	*Data Sources / Relevant Databases*	Listing of (social media) messages available to general public (#no of references to CE), overview of emails reports and memos (internal and external), meeting minutes
	11	*Overall accuracy*	Qualitative and quantitative data will be collected during demonstration phase.

Metadata group	#	Metadata category	Description/comments
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Febr 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	17
Other	*16*	*Comments*	None

3.6. Circularity requirements in procurement beyond existing levels

Metadata group	#	Metadata category	Description/comments	
Identifier	*1*	*Indicator number*	12	
	2	*Indicator name*	**Circularity requirements in procurement beyond existing levels**	
Link to Circular City Definition	*3*	*Vision Element*	X	Local stakeholder actions
				Circular business models and behavioural patterns
				Closing material loops and reducing harmful resource use
				Improving human well-being and reducing environmental impacts
	4	*Category*	Regulation and incentives	
Indicator definition and description	*5*	*Definition / Description of indicator*	Description of requirements in procurements going beyond what is current standard practice	
	6	*Rationale*	During the project we will set up a stakeholder dialogue team to interact with the market on which circular activities can be reached in the project. (Normally the tender is traditional: we set up the requirements, market participants purchase/register.) The indicator is related to the following expected outcome: • By the end of the project, procurement of circular products related to Griffiersveld have increased by 10% in volume, due to awareness raising activities within MoA	
	7	*Methodology*	• Decide which procurements are relevant for analysis (e.g. demo action-focussed procurements only or a wider range of procurements)	

Metadata group	#	Metadata category	Description/comments
			• Describe current standard practice in terms of CE requirements • For each procurement case, describe additional requirements beyond standard practice • In case of several relevant procurements, summarize relevant progress beyond existing levels
	8	*Unit*	Qualitative data and potentially quantitative impact data
Data	*9*	*Baseline data / definition*	0
	10	*Data Sources / Relevant Databases*	Procurement process of DA analysed through qualitative description of process and analysis of the documents. Inventory of procurements in DA. Listing of stakeholders involved in dialogue / qualitative description of process and dialogue (procurement offer + activity log).
	11	*Overall accuracy*	Qualitative and quantitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Febr 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	11, 16
Other	*16*	*Comments*	None

3.7. Procurements making use of stakeholder dialogue to strengthen circularity: Qualitative description

Metadata group	#	Metadata category	Description/comments	
Identifier	*1*	*Indicator number*	16	
	2	*Indicator name*	**Procurements making use of stakeholder dialogue to strengthen circularity: Qualitative description**	
Link to Circular City Definition	*3*	*Vision Element*	X	Local stakeholder actions
				Circular business models and behavioural patterns
				Closing material loops and reducing harmful resource use
				Improving human well-being and reducing environmental impacts

Metadata group	#	Metadata category	Description/comments
	4	*Category*	Regulation and incentives
Indicator definition and description	*5*	*Definition / Description of indicator*	Description of stakeholder dialogue in procurement processes focussing on circularity (e.g. demonstration action-related or at city level)
	6	*Rationale*	For Griffiersveld, MoA requires to deviate from standard procurement practices to facilitate CE thinking and actions by their contractors. In order to explore what is possible, and ensure the line of reasoning, dialogue with stakeholders is a step in the procurement process. The indicator is related to the following expected outcome: • By the end of the project, procurement of circular products related to Griffiersveld have increased by 10% in volume, due to awareness raising activities within MoA
	7	*Methodology*	List number of procurement processes using stakeholder dialogue. For each of these procurement processes: • Describe the stakeholders/actors involved in the dialogue • Describe the dialogue, including when it is in process
	8	*Unit*	Qualitative data
Data	*9*	*Baseline data / definition*	0
	10	*Data Sources / Relevant Databases*	Inventory of procurements in DA. Listing of stakeholders involved in dialogue / scripts / recordings of dialogue (where possible). Qualitative description of process and dialogue (procurement offer + activity log).
	11	*Overall accuracy*	Qualitative and quantitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Febr 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	11, 16
Other	*16*	*Comments*	None

3.8. New planning instruments/tools for improved circularity: Qualitative description

Metadata group	#	Metadata category	Description/comments
Identifier	*1*	*Indicator number*	21
	2	*Indicator name*	**New planning instruments/tools for improved for improved circularity: Qualitative description**
Link to Circular City Definition	*3*	*Vision Element*	X Local stakeholder actions
			Circular business models and behavioural patterns
			Closing material loops and reducing harmful resource use
			Improving human well-being and reducing environmental impacts
	4	*Category*	Vision and urban management
Indicator definition and description	*5*	*Definition / Description of indicator*	Define and select planning instruments/ tools relevant to improve circularity.
	6	*Rationale*	More circular activities in implementation require proper planning of the process beforehand. Tools to guide the planning and to provide the relevant information are crucial in the preparatory work to be conducted. The indicator is related to the following expected outcomes: • Increased knowledge and awareness raising within municipal organisations • Improved innovative products and services in CE practices within municipal organisations • Results of tested tools deployed in the demonstration action are communicated and disseminated internally and externally
	7	*Methodology*	Qualitative description of each instrument/tool
	8	*Unit*	Qualitative data
Data	*9*	*Baseline data / definition*	0
	10	*Data Sources / Relevant Databases*	Autocad is the system we test/analyse to check the suitability of the mapping tool. The co-design process planning tool is a process optimalisation which we test and analyse to check if this is suitable for further use in the stakeholder engagement of the organisation.
	11	*Overall accuracy*	Qualitative and quantitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Feb. 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report

Metadata group	#	Metadata category	Description/comments
			March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	9, 11
Other	*16*	*Comments*	None

3.9. Increased share of materials retained and reused on demonstration sites

Metadata group	#	Metadata category	Description/comments
Identifier	*1*	*Indicator number*	27
	2	*Indicator name*	**Increased share of materials retained and reused on demonstration sites**
Link to Circular City Definition	*3*	*Vision Element*	☐ Local stakeholder actions ☒ Circular business models and behavioural patterns ☐ Closing material loops and reducing harmful resource use ☐ Improving human well-being and reducing environmental impacts
	4	*Category*	• Circular value chains and infrastructure • Re-use and recycling
Indicator definition and description	*5*	*Definition / Description of indicator*	The relative share of materials retained and reused on demonstration sites, measured for selected/key on-site waste material fractions and the total mass of waste materials.
	6	*Rationale*	By having more information on the material (material quality and quantity) in combination with the procurement requirements and the stakeholder dialogue, reuse is facilitated. The indicator is related to the following expected outcomes: • Tiles, curb stones and older concrete pavers have been reused within the municipality • Concrete pavers have been reused in the Griffiersveld district development
	7	*Methodology*	For selected waste fractions and total mass of waste materials: Retained and reused mass of materials / total mass of (waste) materials at demonstration site
	8	*Unit*	Mass %
Data	*9*	*Baseline data / definition*	0

Metadata group	#	Metadata category	Description/comments
	10	*Data Sources / Relevant Databases*	- GBI gives information about the type of material in m2 - Scanning delivery reports - Delivery report: In the contract with the construction contractor, there will be specifications of the volume of used materials and how many of reused (recycled) materials have been used - Interviews during the reconstruction of the road
	11	*Overall accuracy*	Qualitative and quantitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Feb. 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	6, 11, 12
Other	*16*	*Comments*	None

3.10. New digital material databank/marketplace: Qualitative description

Metadata group	#	Metadata category	Description/comments
Identi-fier	*1*	*Indicator number*	30
	2	*Indicator name*	**New digital material databank/marketplace: Qualitative description**
Link to Circular City Definition	*3*	*Vision Element*	[ ] Local stakeholder actions [X] Circular business models and behavioural patterns [ ] Closing material loops and reducing harmful resource use [ ] Improving human well-being and reducing environmental impacts
	4	*Category*	• Circular value chains and infrastructure • Re-use and recycling
Indicator definitio	*5*	*Definition / Description of indicator*	Description of the digital material databank/marketplace in term of objective, type, scope, stage of development, target/user groups and other aspects deemed relevant

Metadata group	#	Metadata category	Description/comments
	6	*Rationale*	The digital passport in Apeldoorn contains quantitative and qualitative data, where it's situated and if we can reuse the material flow. Designers and architects can, while they design new roads/pathways, consider if they can use materials which are already in the city. This will help us to realize circular loops of materials and reduce the use of virgin materials. The indicator is related to the following expected outcome: • Quality assurance certification system for reuse of material fractions has been established (GBI)
	7	*Methodology*	Description of the digital material databank/marketplace in terms of objective, type, scope, stage of development, target/user groups, and other aspects deemed relevant
	8	*Unit*	Qualitative data
Data	9	*Baseline data / definition*	The baseline is zero as there is currently no description or tool where we allocate materials in a databank.
	10	*Data Sources / Relevant Databases*	GBI
	11	*Overall accuracy*	Qualitative and quantitative data will be collected during demonstration phase.
Context	12	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Feb. 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	8, 9, 12
Other	16	*Comments*	None

3.11. New digital material databank/marketplace: Impact

Metadata group	#	Metadata category	Description/comments
Identifier	1	*Indicator number*	31
	2	*Indicator name*	**New digital material databank/marketplace: Impact**
Link to	3	*Vision Element*	Local stakeholder actions

Metadata group	#	Metadata category	Description/comments
			X Circular business models and behavioural patterns
			Closing material loops and reducing harmful resource use
			Improving human well-being and reducing environmental impacts
	4	*Category*	• Circular value chains and infrastructure • Re-use and recycling
Indicator definition and description	*5*	*Definition / Description of indicator*	The impact of the digital marketplace is assessed by estimating the mass and value of material registered and traded per time period.
	6	*Rationale*	The digital passport in Apeldoorn contains quantitative and qualitative data, where it's situated and if we can reuse the material flow. Designers and architects can, while they design new roads/pathways, include information about the use of materials which are already in the city. This will help us to realize circular loops of materials and reduce the use of virgin materials. The indicator is related to the following expected outcome: • Quality assurance certification system for reuse of material fractions has been established (GBI)
	7	*Methodology*	Mass of materials registered per time period Mass of materials traded per time period Value of materials traded per time period Time period can be month or year Total mass should be registered, and optionally key material fractions
	8	*Unit*	Tonnes / year, Monetary value/time
Data	*9*	*Baseline data / definition*	The baseline is zero as there is currently no description or tool where we allocate materials in a databank.
	10	*Data Sources / Relevant Databases*	GBI
	11	*Overall accuracy*	Quantitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Feb. 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	8, 9, 12
Other	*16*	*Comments*	None

3.12. CE-based employment

Metadata group	#	Metadata category	Description/comments
Identifier	*1*	*Indicator number*	33
	2	*Indicator name*	**CE-based employment**
Link to Circular City Definition	*3*	*Vision Element*	Local stakeholder actions
			X Circular business models and behavioural patterns
			Closing material loops and reducing harmful resource use
			Improving human well-being and reducing environmental impacts
	4	*Category*	Private investments, jobs and gross value added Well-being
Indicator definition and description	*5*	*Definition / Description of indicator*	Assess the impact of demonstration actions or at sector/city level by estimating the increase in CE related job
	6	*Rationale*	The indicator is related to the following expected outcome: • Increased number of jobs changed to include CE thinking
	7	*Methodology*	For a selected time period (e.g. year, project period, etc.) estimate: • Number of new CE related jobs • Number of existing jobs becoming circular If deemed practical for the evaluation, jobs that have a range of responsibilities, of which some are related to circularity and some are not, can be assigned a “percentage of circularity”. Using this principle, a change in the percentage can be assigned for existing jobs that become more circular
	8	*Unit*	Jobs
Data	*9*	*Baseline data / definition*	0
	10	*Data Sources / Relevant Databases*	Organised focus groups and interviews
	11	*Overall accuracy*	Qualitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Feb. 2022: completion of baseline data collection July 2022: completion of interim data collection

Metadata group	#	Metadata category	Description/comments
			Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	7, 8, 13
Other	*16*	*Comments*	None

3.13. Share of green space areas within urban limits

Metadata group	#	Metadata category	Description/comments
Identifier	*1*	*Indicator number*	68
	2	*Indicator name*	**Share of green space areas within urban limits**
Link to Circular City Definition	*3*	*Vision Element*	Local stakeholder actions
			Circular business models and behavioural patterns
			Closing material loops and reducing harmful resource use
			X Improving human well-being and reducing environmental impacts
	4	*Category*	Well-being
Indicator definition and description	*5*	*Definition / Description of indicator*	Define requirements for an open green space, for example using the EEA definition for publicly accessible green space per inhabitants. The resulting green space area is divided by the total urban area as defined by the city.
	6	*Rationale*	Through a co-design participation process, the residents of the neighbourhood are engaged in the planning of their neighbourhood. The indicator is related to the following expected outcome: • Improved wellbeing of citizens through the improved open spaces
	7	*Methodology*	Green space within urban area divided by total space of urban area.
	8	*Unit*	%
Data	*9*	*Baseline data / definition*	Baseline is current situation
	10	*Data Sources / Relevant Databases*	- Areal pictures of the neighbourhood - GBI (DA mapping of neighbourhood and identify and measure square meter of green (baseline) / DA mapping of neighbourhood identify green spaces (after intervention)) - Interview/survey
	11	*Overall accuracy*	Qualitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW

Metadata group	#	Metadata category	Description/comments
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Feb. 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	11, 15
Other	*16*	*Comments*	None

3.14. Annual CO2 emissions per unit of GDP

Metadata group	#	Metadata category	Description/comments
Identifier	*1*	*Indicator number*	87
	2	*Indicator name*	**Annual CO2 emissions per unit of GDP**
Link to Circular City Definition	*3*	*Vision Element*	Local stakeholder actions
			Circular business models and behavioural patterns
			Closing material loops and reducing harmful resource use
			X Improving human well-being and reducing environmental impacts
	4	*Category*	Environment impacts (global)
Indicator definition and description	*5*	*Definition / Description of indicator*	The indicator calculates the annual direct emissions of CO2 at city level per GDP.
	6	*Rationale*	The division of information management of Apeldoorn collect data of GHG from the 'klimaatmonitor'. Data sources are different, but mostly CBS. Municipality of Apeldoorn does not measure general GHG information. In the business cases we also want to calculate theoretically what the exposure/emission of transport movements are in the project per business case. The indicator is related to the following expected outcome: • Reduced CO2 emissions from reduced transport and through reusing and recycling material (3,000 m2 road), compared to conventional street development projects
	7	*Methodology*	Direct CO2 emissions divided by GDP at city level. Calculated per year.
	8	*Unit*	Tonnes CO2 / Monetary unit

Metadata group	#	Metadata category	Description/comments
Data	*9*	*Baseline data / definition*	1 tonne concrete paving contains 87.9 kg of CO2 for production. 45 stones will go into 1 m2. Every stone/concrete paving is 3.95 kg. So in Griffiersveld: 3,000 m2 x 45 bricks = 135,000 bricks x 3.95 kg = 533,250 kg of bricks. 1 tonne = 1,000 kg. 533.25 tonnes x 87.9 kg CO2 = 46,872.68 kg CO2 is the baseline if we bring new bricks to the area.
	10	*Data Sources / Relevant Databases*	CO2 indicator model Saxion / de hamer (materialen depot)
	11	*Overall accuracy*	Qualitative data will be collected during demonstration phase.
Context	*12*	*Sector coverage*	CDW
	13	*Reference area / Spatial implementation scale*	During the project: demonstration area
	14	*Reference period*	Febr 2022: completion of baseline data collection July 2022: completion of interim data collection Sept 2022: completion of interim evaluation report March 2023: completion of final data collection May 2023: completion of final evaluation report
	15	*SDG Reference*	7, 13
Other	*16*	*Comments*	None

4. References

Vangelsten, B.V., Bjarne Lindeløv, Nhien Nguyen, Jens Ørding Hansen, Are Jensen, Nikolai Jacobi, Simon Clement, Carolin Bellstedt, Aristide Athanassiadis, Pernille Kern Kernel, Edwin Keijsers (2021). Circular City Indicator Set. CityLoops Deliverable 6.1. 2021.

5. Annex 1: CityLoops impacts as listed in the Grant Agreement

Scientific impacts

- Sector and City-Wide Material Flow and Stock Accounting Methodology
- Development of an open-source urban metabolism data repository
- Circular Procurement tools and indicators
- Operationalisation of EC circular economy monitoring framework to small and medium cities
- IT decision making support tools
- Planning and decision-making framework for reuse and recycling of CDW

Innovation/economic impacts

- Increased CE jobs potential in demonstration and replication cities
- New innovative CE-related procurement partnerships and dialogues in demonstration and replication cities
- Growth in green economy (e.g. increase in reuse / recycling infrastructure capacity)
- Business cases for valorisation of CDW and soil
- Increased use of new decision-making support tools to improve circular management practices
- Optimised and new links between the social economy and other sectors, promoting circularity (e.g. links between food distribution sector and the social economy sector decreasing food waste production)

Societal impacts

- Sustained community benefits including skills, training and green jobs
- Improved Well Being (e.g. QoL indicators)
- Provision of food support to economically disadvantaged families in the social economy sector
- New jobs for currently unemployed people due to development of CE

Environmental impacts

- Increased reuse and recycling of CDW and soil resulting in reduced energy consumption, improved resource efficiency, reduced heavy-duty transport
- Recycling of OW
- Reduced landfill
- Reduced greenhouse gas emissions

6. Annex 2: Strategic objectives defined in D6.1

Vision Element 1 “Local stakeholder actions”: Strategic Objectives

- Facilitation of repair and reuse platforms, and the secondary materials market
- Increased capacity building on CE for public employees and other local stakeholders
- Increased collaboration with local and regional stakeholders in CE planning and implementation, and the promotion of regional upscaling
- Increased engagement with national and international policy makers and researchers on the CE
- Increased provision of information on CE to local stakeholders
- Improved regulatory framework to support circularity
- Increased use of economic incentives and fiscal measures to promote circularity as well as removal of subsidies hindering circularity
- Integration of circularity principles into public procurement and financing processes
- Existence of city-wide strategy on CE with measurable objectives translated into targeted actions
- Integration of circularity principles into asset management, including publicly owned land, buildings and infrastructure
- Integration of circularity principles into urban planning decisions such as zoning and planning decisions, construction and demolition permits, and mobility planning

Vision Element 2 “Circular business models and behaviour patterns”: Strategic Objectives

- Increased asset lifetimes, including through flexible design and use
- Increased provision of local, sustainable and healthy food
- Increased rate of exploitation of assets (including equipment, machinery, buildings, infrastructure)
- Increased sustainable urban mobility options
- Enhanced waste collection, treatment and processing systems, including increased on-site reuse and treatment of waste
- Increased cooperation among sectors
- Increased use of repair and reuse platforms, and the secondary materials market
- Localisation of supply chains
- Increased gross value added of circular economy activities (repair, reuse, sharing, recycling)
- Increased number of jobs in the local circular economy (repair, reuse, sharing, recycling, ecodesign)

Vision Element 3 “Closing material loops and reducing harmful resource use”: Strategic Objectives

- Reduced (harmful) raw material consumption
- Reduced overall energy demand and increased share of renewable energy
- Increased share of renewable and secondary raw materials in overall material demand
- Increased self-sufficiency / self-reliance
- Increased quantity of materials available for the next cycle
- Reduced waste generation
- Reduced incineration and landfilling activities and amounts subjected

Vision Element 4 “Improving human wellbeing and reducing environmental impacts”: Strategic Objectives

- Improved education
- Improved public health
- Improved recreational services
- Improved access to basic services
- Reduced unemployment
- Reduced poverty and inequality
- Human-centred land-use and urban planning
- Biodiversity loss and deforestation
- Improved water quality
- Improved air quality
- Reduced soil degradation
- Mitigate climate change
- Reduce global adverse environmental impact of local consumption
- Transformed, sustainable local economy
- Increased resilience of local economy
- Reduced risk of urban infrastructure against natural disasters

CITYLOOPS

CityLoops is an EU-funded project focusing on construction and demolition waste (CDW), including soil, and organic waste (OW), 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 OW, 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 aspect of CityLoops are stakeholder engagement and circular procurement.

CityLoops runs from October 2019 until September 2023.

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