



Apeldoorn

Optimised Implementation Plan – CDW

**Municipality of Apeldoorn &
Saxion University of Applied Sciences**



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Authors	Sander Lubberhuizen, Municipality of Apeldoorn Bram Entrop, Saxion University of Applied Sciences
Reviewers	Pernille Kern Kernel, Capital Region Denmark Simon Clement & Kaitlyn Dietz, ICLEI
Abstract	This Optimised Implementation Plan explains how Apeldoorn will implement the tools and processes developed in the project preparation phase in its demonstration action, and how relevant local stakeholders and CityLoops project partners will be involved.
Keywords	Demonstration; implementation; plan
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1. Demo action: Designing and reconstructing public space in a circular way

1.1. Short description

The main CDW demonstration project in the municipality of Apeldoorn will be the circular design and reconstruction of 3000 m² 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 1). Dating from the eighties, streets in this neighbourhood encompass many concrete elements. This typology of streets is quite representative of others in the area. Therefore, the potential to be upscaled makes it a good pilot.



Figure 1: Location and size of De Maten (left) and the area surrounding Griffiersveld (right).

The challenge is to assess if new materials can be made from the recovered materials, to pilot digital tools and participatory design-thinking methods to implement the circular street renovation. The street was scanned to identify materials used regarding quantity and quality. Afterwards, the retrieved data will be stored in a material databank of the municipality. Apeldoorn explores the possibility to create new concrete with a very high recycled content.

Concrete recovered from Griffiersveld (see Figure 2) is planned to be crushed, to be able to be used as an aggregate in a new recipe for concrete. This new concrete is planned to be used in streets and/or bike lanes around the city. The demolition and reconstruction of Griffiersveld are planned to occur almost simultaneously, so that residents only shortly experience some discomfort and can still access their houses throughout the works. The municipality of Apeldoorn operates a central soil and sand site, a material depot and a new physical construction material marketplace to coordinate the recirculation of construction materials within the municipality. Multiple research activities to study the current situation and design new solutions are conducted in collaboration with Saxion University of Applied Sciences.



Figure 2: Examples of concrete elements and repairs in Griffiersveld.

Before the renovation of Griffiersveld can take place in a circular way, multiple processes need to take place and to be prepared. As such, the demonstration project is significantly larger than just the practical process of taking out outdated concrete clinkers. Research projects will help to develop inventories and provide information to make decisions on what activities to do or not to do, and what tools to use. Data will also be analysed to reflect on processes executed. In general, one can distinguish activities as part of: A) social processes to involve people, B) technological processes related to execution and materials and C) economic processes related to contracting, transactions and fitting the business models. The next section shows an overview of recent and coming activities. Section 1.3 gives insights in already conducted preparation activities and their results.

The demonstration action represents a first step and learning process on the development of a more comprehensive approach to circular construction and redevelopment which the municipality of Apeldoorn hopes to scale up across the city in the coming years.

1.2. Activities

Activities	Timeline	Responsible partner
Preparation: Research into material depots handling, construction material passports/databanks, digital marketplaces, and circular construction material business models	Oct 2019 – March 2021	Saxion UAS in collaboration with the municipality of Apeldoorn
Planning and decision-making process based on design thinking approach. A template is used to work out a process journey for the circular renovation process in Griffiersveld.	October 2019 – June 2021	Contracted consultant Koos Service Design supervised by the municipality of Apeldoorn and supported by Saxion UAS.
Scanning and preparation of the street to collect data on quantities and qualities of materials.	May 2020 – December 2020	Contracted consultants supervised by the municipality of Apeldoorn
Assessment of material scan data accuracy and reliability	April - June 2021	municipality of Apeldoorn
Circular procurement process of contractor for the demolition and reconstruction works in Griffiersveld	March 2021 – October 2021	The municipality of Apeldoorn supported by RWS
Establishment of digital material passport system for use in Griffiersveld	May 2021 – October 2021	The municipality of Apeldoorn
Establishment of online construction materials marketplace using materials from project Griffiersveld	May 2021 – October 2021	The municipality of Apeldoorn and Excess material Exchange (EME)
Involvement of neighbourhood residents participation process	May 2021 – December 2021	The municipality of Apeldoorn and Saxion UAS
Selective demolition and reconstruction of Griffiersveld using reclaimed materials from other parts of Apeldoorn	October 2021 – December 2021	Contractor supervised by the municipality of Apeldoorn and Saxion UAS
Transformation of recovered concrete (cleaning, crushing, storing)	November 2021 – April 2022	Contractor supervised by the municipality of Apeldoorn
Use of recovered concrete in new concrete for streets and/or bike lanes	April 2022 – June 2022	Contractor supervised by the municipality of Apeldoorn
Evaluation of demonstration procedures	October 2021 – October 2022	The municipality of Apeldoorn

1.3. CityLoops tools/processes tested

Construction material passport and databank

A (digital) material passport is essentially a database including GIS (location) to store information about a material that is relevant for its future reuse. This information can be used for optimising CDW flows and valorising the materials via a marketplace or making them available to other projects or companies.

The material obtained from the demolition work in Griffiersveld will be stored in an enhanced version of Apeldoorn's existing material databank, which uses GBI software. In the preparation phase for the pilot, detailed, detailed scans were carried out on the Griffiersveld site, using innovative screening procedures, by two companies: Infrafocus and De Wegenscanners. These scans assessed both the amount and quality of materials available. Two companies were employed to test different approaches (laser, gamma-ray spectrometer and radar surveys), as the municipality of Apeldoorn was not familiar with the technical possibilities the scanning companies offer.

Due to the quantity and complexity of data collected, a further study will be necessary to check accuracy and flaws to make sure reliable data will be stored correctly in the enhanced database structure. Following this, the GBI database structure will be updated to allow for the inclusion of this more detailed information.

Online construction materials marketplace and physical storage

Apeldoorn's goal is to develop a functioning online construction materials marketplace to facilitate their sale/reuse in other construction projects locally. This marketplace tool is currently under construction and made by Excess Materials Exchange (EME - <https://excessmaterialsexchange.com>), following detailed research into different approaches in the preparation phase. An API is under development which will allow the data collected in the GBI databank to be directly plugged in to the marketplace to facilitate this matchmaking process.

The materials recovered within Griffiersveld will be included within the EME marketplace for potential resale. Due to timing constraints it has not been possible to require the Griffiersveld demolition and reconstruction contractor to use the EME marketplace within the pilot, so the disposal/sale of the materials remains at the discretion of the contractor. However, during the pilot a comparison will be made of the potential CO₂ gains which would derive from reuse facilitated via EME, rather than standard disposal. Afterwards, Apeldoorn will build on lessons learned to revise the practice and identify other suitable projects to apply the approach.

Apeldoorn has been successfully operating a soil and sand depot for many years, and has been exploring opportunities within the municipality to store additional materials and to offer space to services related to these materials, e.g. quality test and crushing concrete. A new

construction materials depot was opened in Kerkeveld in January 2021, and it is planned that this will play a role to provide reused materials for the reconstruction work in Griffiersveld.

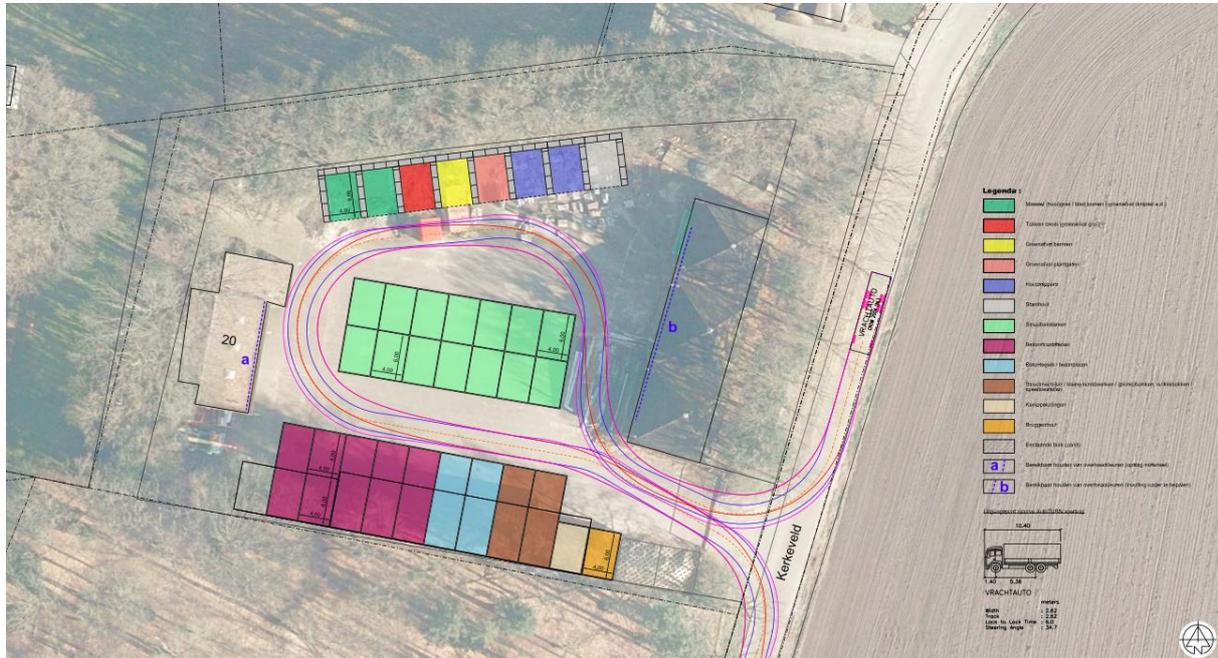


Figure 1: design for the new depot Kerkeveld

Lifecycle CO₂ calculator for construction materials

An adapted version of the CO₂ calculator developed by the CityLoops Danish partners has been adapted to include typical Dutch emissions data. In the demonstration project processes will be monitored and the tool will be used to calculate the CO₂ impact of moving soil, or other (bulky) construction materials, from a site. On the other hand, the emission savings can also be calculated for the case if these materials are not moved. Saxion will use the tool to calculate emissions impacts of soil and CDW handling in the municipality.

Co-design process for public space

Every project that influences public space needs the input of many different actors and stakeholders; Griffiersveld will not be any different. Traditionally projects are embedded in multiple departments of the municipality of Apeldoorn and in each stage of a project multiple external organisations (commercial and non-profit) will help in achieving the project goals. Other departments of city of Apeldoorn as well as material suppliers and manufacturing industry will be invited to learn about and feed into the circular design process. To get them all on the same page circular business models were explored (Tartarin, 2021) and a project by

the name of “the story of stuff”¹ was run. These trajectories² finished in April 2021 and have helped to facilitate the launch of the Griffiersveld demonstration project.

Apeldoorn wants to also involve citizens in the circular economy transition. For the Griffiersveld demonstration, an engagement campaign (between approximately May 2021 and December 2021) will make it possible to contact residents to inform them about the circular road renovation and raise awareness of circular economy more generally. Residents will also be invited to take out unused materials from their personal gardens to be reused by others via the marketplace or material hub. For this purpose, Apeldoorn is trialling the Openstad online participation tool with the residents of Apeldoorn. In the process of redesigning Griffiersveld, the interaction with the citizens will be limited due to Covid-19 regulations and due to practical - namely spatial and financial - constraints. The Griffiersveld project is the first to try out the Openstad tool. After the experience in Griffiersveld the use of the Openstad platform will be expanded across the city, including applying more of the functions the platform offers.

The tools can be seen here: [CityLoops Tool Factsheets](#)

2. Expected outcomes & evaluation

H2020 CityLoops enables the municipality of Apeldoorn to conduct research, to define processes and to develop instruments to renovate Griffiersveld in a circular way. In this project, theory and practice will come together and at the end:

- Griffiersveld will be renovated in such a way that a clear overview exists of what materials by means of quantity and quality were leaving and entering the site;
- Regarding the materials involved in the renovation project, the possibilities to close material loops with the lowest environmental impact were considered carefully. This could result in developing bike paths with a high percentage of secondary materials recovered from the demonstration site at Griffiersveld;

¹ An introductory movie about the story of stuff can be found here:

<https://www.youtube.com/watch?v=WMoG-vhNEII>

² A animation movie summarizing the trajectory of the story of stuff can be found here:

<https://www.youtube.com/watch?v=nHANab7H8LU>

- Citizens in Griffiersveld are engaged in the circular economy by means of raised awareness on how they can close material loops themselves by using an online material market place;

Further information on Apeldoorn's demonstrations can be seen at:

<https://cityloops.eu/cities/apeldoorn>

3. Planning & decision making guidelines

In Apeldoorn together with Koos Service Design, we developed and in Griffiersveld will test a trajectory for which a tool was designed and applied on the basis of a Design Thinking approach. According to the Interaction Design Foundation, design thinking is a non-linear, iterative process that teams use to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test. The approach is most useful to tackle problems that are ill-defined or unknown and it often involves five phases, namely empathize, define, ideate, prototype and testing (https://www.interaction-design.org/. 2021). The tool is an illustrated trajectory within the Design Thinking approach, as shown in Figure 6.

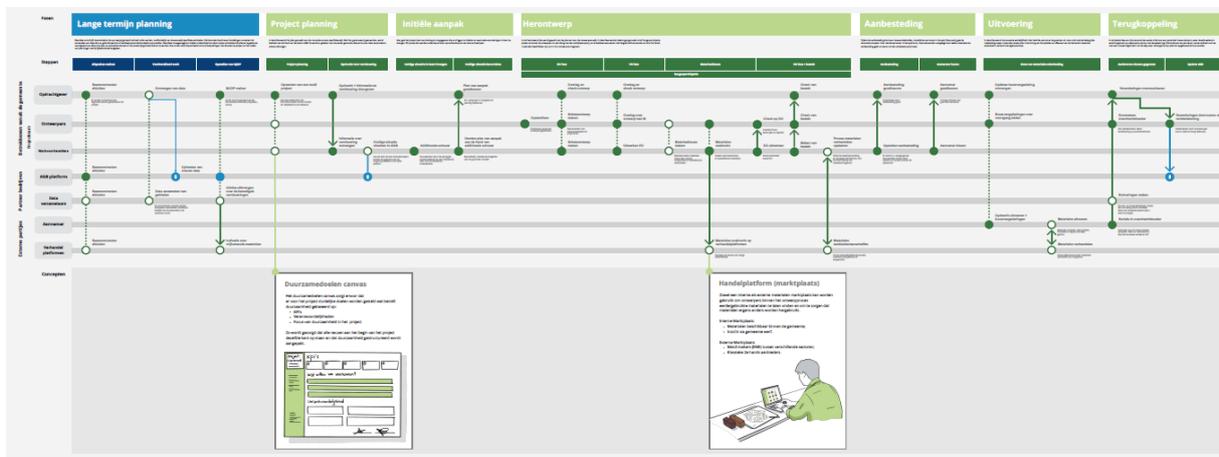


Figure 6: planning and decision making; the illustrative result of the process travel template in co-designing Griffiersveld circularly with the internal departments and external organisations involved.

Visualizing all interdependencies between departments and stakeholders resulted in a so called process journey of the project. Circular interventions were placed within this Process Travel template. With the help of Koos Service Design, different departments of the municipality of Apeldoorn involved in designing, developing and maintaining public space, were brought together to form a team for the demonstration project Griffiersveld. It shows that current ways of working to come to redesigns of public space already offer multiple opportunities to close material loops. Multiple complementary circular tools and interventions

can be adopted in the municipal existing workflows. On the basis of the illustrated process trajectory, civil servants were actively involved in defining solutions to make the demonstration project Griffiersveld more circular. Experiences from executing the CDW demonstration project in Griffiersveld will feed into the CityLoops guidelines resulting in a Circlebook.

4. Business cases

In the demonstration, Apeldoorn aims to develop several business cases for concrete materials transformation for reuse to test in the transformation period - based on the business model canvas of CityLoops. The focus will be on developing and testing new, high value applications for recovered materials, for example as sidewalk tiles and/or the reuse of concrete granulate in new concrete roads and cycle paths in the road redevelopment. These could include the cement bricks taken out of Griffiersveld. The cement bricks can be crushed, and the crushed material and remaining non-hydrated cement can be used to make new bike paths. By setting up a local digital marketplace (within Openstad), secondary materials can be sold or shared between citizens.

As mentioned earlier in this document, the success story of the sand and soil site was already studied, and these findings were laid down in a research paper. However, it is not likely that the business model at the soil and sand site can form a blueprint for other material flows directly.

5. Risks

Potential risk	Mitigation approach
Technical risk: No place to store concrete from the demonstration	A physical material bank needed to be created. This was achieved by the beginning of 2021. This risk is mitigated.
Economic risk: Material cost differences between traditional products and circular products	Emphasizing reductions in carbon dioxide emissions to come to environmental benefits.
Social risk: Little buy-in or push back from residents in the co-development process.	Current attractiveness of the street is lacking and some functionalities (e.g. parking) can be improved, so it is expected that improvements on these points might trigger residents to be involved.

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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