**Material Passports; collecting and storing data in CDW projects**

**CDW**

|  |  |  |
| --- | --- | --- |
| Tile | Tile (v2) | Brick |
|  |  |  |
| Dimensions: 300 x 300 x 65 mm3 | Dimensions: 300 x 300 x 65 mm3 | Dimensions: 105 x 210 x 80 mm3 |
| Material: concrete (solid) | Material: concrete (solid) | Material: concrete (top layer) |
| Colour: grey | Colour: grey + P (white) | Colour: pink |
| Area: 3690 m2 | Area: | Area: 850 m2 |
| Location: 52.18877892446144, 5.994409573507057 | Location: 52.18877892446144, 5.994409573507057 | Location: 52.18877892446144, 5.994409573507057 |
| % damaged: | % damaged: | % damaged: |
| Weight: (ton) | Weight: (ton) | Weight: (ton) |
| Amount (approx..): 41.000 | Amount (approx..): 10 | Amount (approx..): |
| Theoretical life span: 30 years | Theoretical life span: 40 years | Theoretical life span: 25 years |
| Years in use: 43 | Years in use: 20 | Years in use: 43 |
| Expected life span: -13! | Expected lifespan: 20 | Expected lifespan: -18! |
| Contractor: | Contractor: | Contractor: |
| Material supplier: unknown | Material supplier: unknown | Materials supplier: unknown |
| Pressure test data (link) | Pressure test data (link) | Pressure test data (link) |

### Description

A material passport is a document containing information in the form of quantitative and qualitative characteristics of all the materials that are included in a building product, component or even construction project (see for example the table above as derived from Goselink, 2021). A databank is capable to store this information for example for a number of products and/or constructions in one or more projects in a certain region. In order to be able to get grip on the reuse potential of materials and to link incoming and outgoing material flows regarding their quantity and quality over time, materials passports need to specify the proper characteristics and a database structure needs to be available. This factsheet presents the workflow that was developed by the municipality of Apeldoorn and Saxion UAS as a tool (see Figure 1) to identify the proper set of variables and to connect complementary tools to collect and store data to facilitate a circular usage of materials.

**Step 1**

Defining quantity and quality characteristics

**Step 2**

Assessing quantity and quality characteristics

**Step 3**

Storing quantity and quality characteristics



*Figure 1: The addressed tool in this factsheet; a workflow to come to a material passport and materials databank for the demonstration project Griffiersveld in collaboration with multiple organisations.*

Keywords:

* #Road scanning
* #Data collection
* #Asset management software
* #Assessing material quantity
* #Assessing material quality

Complementary tools:

* Stakeholder consultation procedure; the co-design process
* Visualising the residual lifespan of road constructions in a 3D model
* Marketplace for used materials

Target user:

* Public works and real estate owners (local governments, departments of buildings & infrastructure, urban development and environment)

Format:

* Research report in English presenting requirements for material passports (Goselink, 2021);
* Assessment management software GBI of the Antea Group as a database of local construction materials in use in Apeldoorn (in Dutch due to the use within a Netherlands municipal organisation);
* Database completed with detailed information about the quantity and quality of in situ products (in Dutch due to the use within a Netherlands municipal organisation);
* Research paper in English presenting the followed data collecting and storing procedures in Apeldoorn (Entrop, 2022);

### Development

In Step 1 research was conducted on existing passports and material banks. Furthermore, interviews were taken among experts and practitioners. This resulted in an inventory of requirements (Goselink, 2021). At the same time, by inspecting physically on site, available materials were studied. In Step 2 innovative screening procedures were applied to assess the amount and quality of materials available on site. Scans were made by [Infrafocus](http://www.infrafocus.nl) and De [Wegenscanners](http://www.dewegenscanners.nl) and their data was shared with the municipal organisation. For an impression on how data was automatically collected, please have a look at: <https://www.youtube.com/watch?v=8UTNsyr5pZ0>. To facilitate maintenance and refurbishment plans of the municipal organisation, some data on public space and works was already stored in a GIS-based municipal database system called [GBI](https://gbibeheersysteem.nl/). The scans conducted made it possible to complete Step 3 by means of assessing the actual current state of Griffiersveld. It enabled the municipality to further complete the information stored in GBI, so that one can speak of an up-to-date material passport. Step 3 can also encompass the possibility to share data on an online marketplace enabling the matchmaking between supply and demand, but this trajectory is part of another H2020 Cityloops tool development trajectory. The whole experienced research trajectory was laid down in a H2020 CityLoops report (Entrop, 2022a) and a conference research paper (Entrop, 2022b).

### Barriers

Two companies scanned the area by using different equipment and procedures. This results in various data files that need to be interpreted and incorporated in a new database structure. The municipality of Apeldoorn was not familiar with the technical possibilities scanning companies offer. As an experiment, both companies were granted the assignment to scan Griffiersveld. As a result, more data came available than was anticipated. It has become clear that an additional study is necessary to check accuracy and flaws to make sure reliable data will be stored correctly in the newly developed database structure.

Because the municipality of Apeldoorn was not exactly aware of what data, necessary to complete materials passports, can already be collected or stored automatically, it is not an easy task for formulate assignments in which newly collected data matches the expectations ex ante regarding the opportunities for analysis ex post. When it comes to collecting data in future projects, the intention of the municipality is to come up with more direct and clearer assignments. The data obtained preferably needs to be stored automatically in the municipal GIS-based database of the asset management software.

### Deployment

Within Cityloops Apeldoorn will start working with the Griffiersveld district. Within this district, all materials were scanned using two innovative methods. This data was added to the existing database structure of the municipality of Apeldoorn. The available information now forms a material passport of Griffiersveld that can help to make more profound choices regarding circular reuse of materials.

### Replication

The H2020 CityLoops municipalities Mikkali and Bodo are also working on scanning and processing data. The methods used are comparable, but every project and organization is different. The basic idea of “knowing which materials you manage and in what qualities and quantities they are available" is the same for all organizations.

### References

Entrop, B., 2022a. *Collecting and storing data in a circular road renovation process*. H2020 Cityloops, Saxion UAS, Enschede, The Netherlands.

Entrop, B., 2022b. *The road to circularity: a framework for and experiences in collecting road data in a circular renovation process*. International Scientific Conference “Central Europe towards Sustainable Building (CESB) 2022”. July 4-6, 2022, Prague, Czech Republic.

Goselink, R., 2021. *Circular approach for neighbourhood renovation; construction material passports and databanks.* CityLoops.

**Developed by**

The approach to update data in asset management software with the assistance of innovative forms to collect data to complete material passports, originates from Sander Lubberhuizen previously employed by the municipality of Apeldoorn. The project was, as mentioned in this factsheet, executed with the help of Erik Goselink of Saxion UAS, multiple civil servants employed by the municipality of Apeldoorn and multiple external organizations. Bram Entrop of Saxion UAS helped in verifying, structuring and disseminating gained knowledge and experiences.

