

## **CIRMAP**

Circular economy via customisable furniture with Recycled Materials for public Places

<https://www.nweurope.eu/projects/project-search/cirmap-circular-economy-via-customisable-furniture-with-recycled-materials-for-public-places/>



## **1 Project description**

3D Printing (3DP) is developing rapidly in the field of construction. Fast realisation of customized or complex geometries, optimization of shapes ... are amongst the main advantages of the process that could allow significant breakthroughs. 3DP of concrete pieces without moulds could in particular be of great interest in precast industry when unique and costly pieces have to be built, as for the production of urban furniture where local public authorities want furniture to be a banner of their identity. However, mortars used in 3DP contain very large amounts of cement and natural sand in comparison to ordinary concrete and the overall ecological and economic balance seems unfavourable to 3DP. Meanwhile, Construction and Demolition Wastes (C&DW) are produced locally in urban centres and some of them, in particular Recycled Concrete Aggregates (RCA), could be used as a local resource of granular materials. The coarse fraction of RCA (larger than 4mm) can be re-used efficiently for the manufacture of new concrete. On the contrary, adherent cement paste concentrates in fine RCA during crushing which makes it much harder to valorise into concrete. However, recycled sand and recycled fine particles could be re-used as raw materials for the manufacture of 3D printing mortars for urban furniture where high mechanical behaviour is not required.

The project aims at developing new solutions for the design and manufacture of urban furniture by 3DP with ecological materials. Design and optimization of shapes will allow a

reduction of mortar's quantity. Use of local recycled sand will allow natural resources depletion and avoid landfilling. Substituting natural constituents by recycled ones could reduce the regularity of the printed material and improving online monitoring during printing will allow to compensate properties variability. Moreover, the durability of mortars could be affected by the use of recycled materials and mixes will also be optimized with regard to this aspect. The project will address north of France, Belgium, west of Germany, Netherlands, United Kingdom and all the North West Europe where similar typologies of recycled/substitution materials can be found.

The project will be carried out in the continuity of several cooperative research works, in particular of the SeRaMCo project (Interreg NWE) and the MATRICE project (ERDF region Hauts de France). The SeRaMCo project already explored the re-use of RCA for the manufacture of concrete precast products using traditional casting technology. In particular, concrete furniture were manufactured with cast concrete using RCA. The MATRICE project delivered a proof of concept for the application of concrete 3D printing in construction. In particular, specific customized shapes, printing mortars, and 3D printers have been developed in the frame of the project and are now operational for the 3D printing of concrete products of sizes compatibles with urban furniture. Combining knowledge acquired in these two projects would allow designing and printing customized urban furniture with recycled concrete.

## **2 Consortium**

The project is led by ARMINES and gathers the 17 following partners and sub partners:

ARMINES, Manchester Metropolitan University, Pompes Funèbres de l'Avesnois, Technische Universität Kaiserslautern, NEO ECO DEVELOPPEMENT, Université de Liège, Université d'Orléans, Heberger GmbH, VICAT, Gemeente Almere, Stadt Pirmasens, Université de Lille, CERIB, Centre technologique international de la Terre et de la Pierre, Association pour le redéploiement économique du bassin sérésien, Centre National de la Recherche Scientifique, École Nationale Supérieure d'Architecture et de Paysage de Lille.

Several associate partners also support the project:

Greenflex, Chryso, PREFER, BESIX Group, DBV, Autodesk, Hamilton Labs, GMCA, BRBS Recycling, Betonhuis, and CSTC

## **3 Cirmap Network**

[https://www.armines.net/sites/default/files/join\\_the\\_cirmap\\_network.pdf](https://www.armines.net/sites/default/files/join_the_cirmap_network.pdf)

In the frame of the Cirmap project, a network is being created in order to gather all the potential stakeholders of the future industrial field that is intended to be created. Entering the Cirmap Network is free and will allow you to get in touch with the latest results of the project. You will be

invited to join the Advisory Board of the project in order to share your views and interact with partners, sub partners and associate partners.

Whether you are a private company working on concrete manufacture, production of materials, design, 3D printing machines ..., a local public authority interested in new developments in the field of recycling and design, a laboratory, a university ... you are welcome to join the network.

#### **4 How to join the Cirmap Network**

Simply send your request by email to [sebastien.remond@univ-orleans.fr](mailto:sebastien.remond@univ-orleans.fr) specifying:

- Your Name, Position, Institution, and your contact details
- The field of activity of your institution

What is of interest for you in the Cirmap project