

Interreg 
North-West Europe
CIRMAP
European Regional Development Fund

 **Manchester
Metropolitan
University**

PrintCity

3D · Innovate · Educate · Collaborate

CIRMAP

Rochdale BC/APSE

Circular economy via customisable furniture with
Recycled MAterials for public Places



50 billion tonnes
of sand is used every year



The Burj Khalifa tower in Dubai required almost 122,000 tons of concrete to build.
CHRISTOPHER FURLONG/GETTY IMAGES

50 billion tonnes



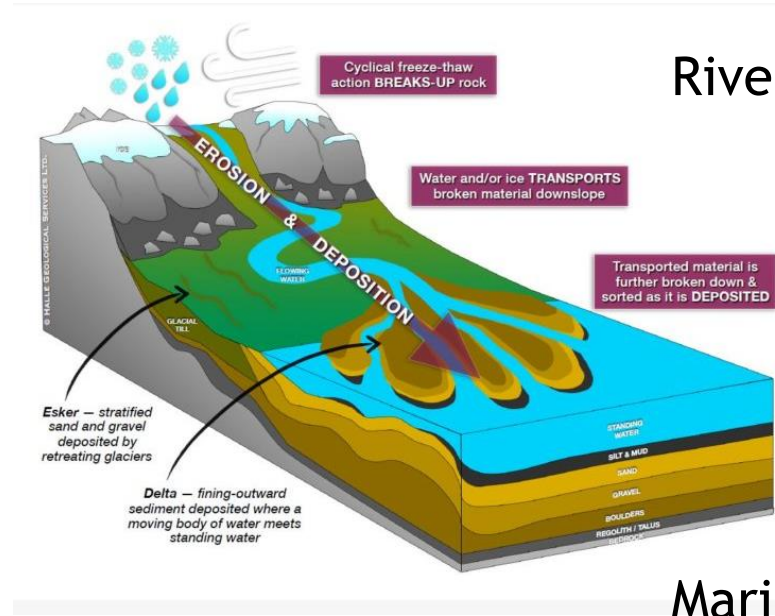
Types of sand



Desert sand is too round



Land
mining



Riverbed

Marine

Credit: Shaw Resources

Land quarries



In the UK there are;

- 270 sand and gravel quarries
- 263 crushed rock quarries
- 159 depots or wharves
- 33 railheads
- 17 silica sand quarries
- 131 recycling plants

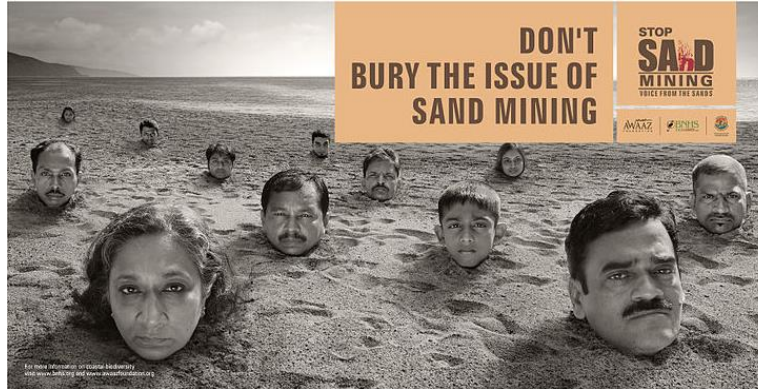
(data from 2019)

Gallagher Aggregates Ltd's planning application was **increase the number and HGV movements** in and out of Hermitage Quarry, **Aylesford**, by 100 at peak times.

Beaches



Morocco



County Mayo, Ireland

UN Convention on Biodiversity, Conference of Parties 11 in Hyderabad India

Rivers



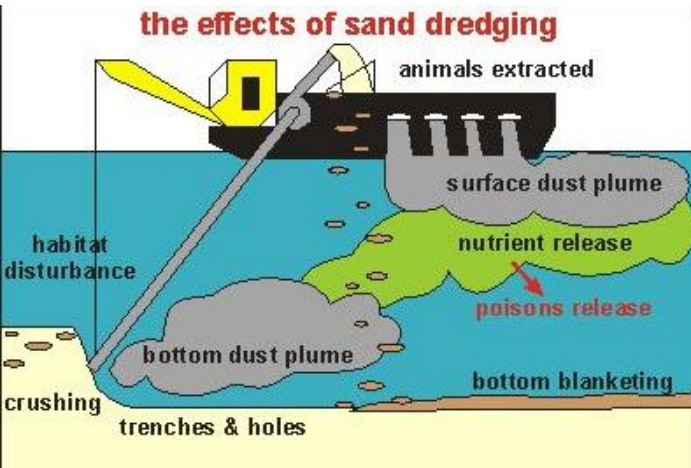
SAND MINING

*Riverbed Mining India 2021 Overview:
Destruction of Rivers, Infrastructures,
Governance*



Drone footage collected in Vietnam captures numerous blue sand mining ships collecting sand from the Mekong River. Credit: Southern Institute of Water Resources Research

Marine dredging



An aerial view of man-made Palm Jumeirah Island in Dubai. GETTY

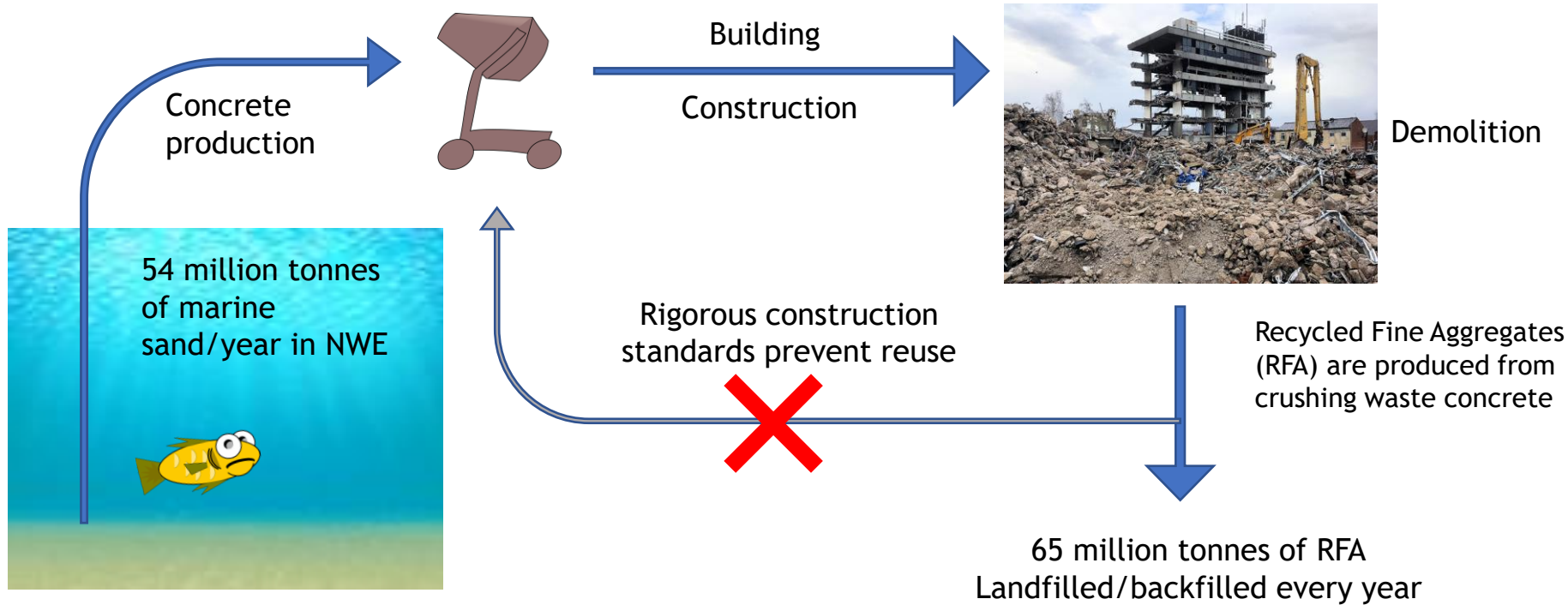


Are we running out of sand?



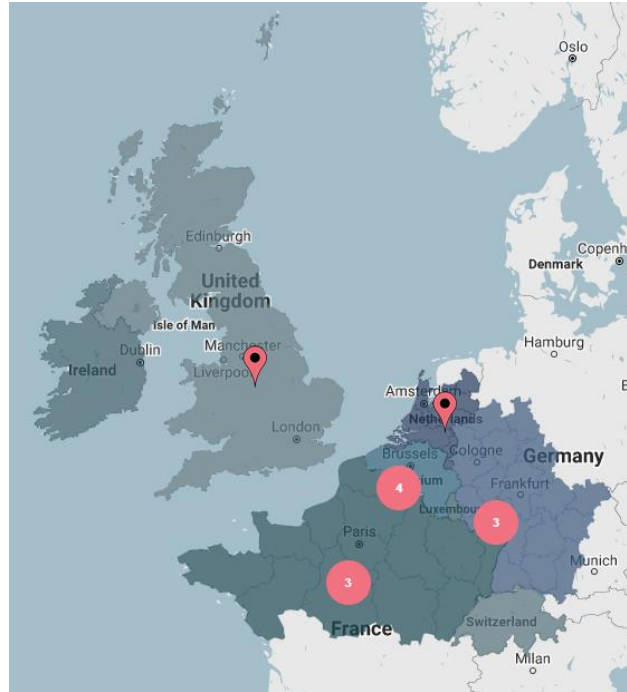


Concrete



CIRMAP

- 13 partners from 5 countries in NW Europe (FR, UK, DE, BE, NL)
- Project timeline 2020 to 2023 (36 months)
- Total budget £6.26million



Project Partners

- Association pour la Recherche et le Développement des Méthodes et Processus Industriels (Lead partner)
- Manchester Metropolitan University
- Pompes Funèbres de l'Avesnois
- Technische Universität Kaiserslautern
- SAS NEO ECO DEVELOPPEMENT
- Université de Liège
- Université d'Orléans
- Heberger GmbH
- VICAT
- Gemeente Almere
- Stadt Pirmasens
- Université de Lille

RFA and concrete 3D printing

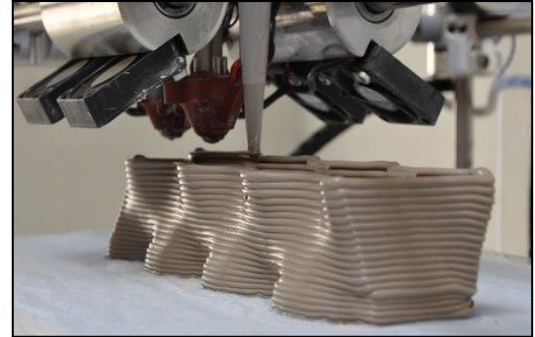
RFA from
crushed waste
concrete



Mixture
Proportioning
Method (MPM)

3DP mortar

Concrete 3D Printers
(25t RFA)



25 x Customizable Urban,
Memorial or Garden (UMG)
furniture

Closing the loop

Circular Economy

MMU Robots



EVA1600



iMakr

Benefits of 3DP

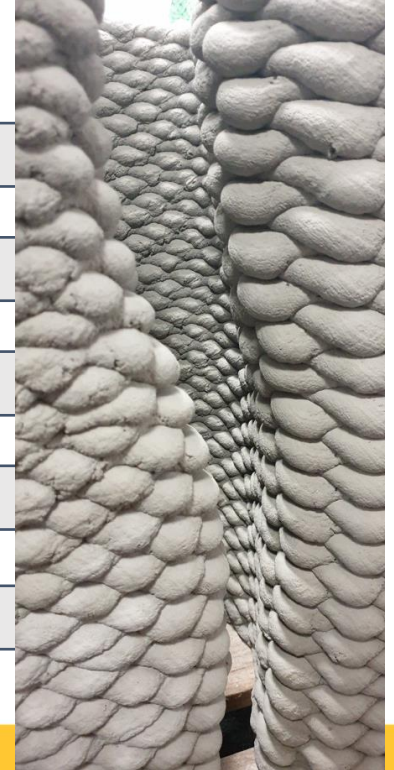
Less waste - only use the material you need.

Less waste - no moulds or casts.

Design for sustainability - control air flow, minimise material use.

Customisable and complex geometries - shape optimisation, hybrid functionality.

Fast and economical



Examples



Dutch couple become Europe's first inhabitants of a 3D-printed house



Harrie Dekkers and Elize Lutz outside their 3D-printed house in Eindhoven, the Netherlands. Photograph: Judith Jockel/The Guardian

Examples



Examples



Tables



Examples

