EARTH
CLAY
SOIL
MUD
MUCK

FROM WASTE TO RESOURCE
Circular Economies for
Construction Spoil Clay

Contents

Introduction

FROM WASTE TO RESOURCE Circular Economies for Construction Spoil Clay

This document marks the culmination of a 19-month research project exploring how construction spoil clay, often treated as waste, can be reimagined as a valuable resource. Led by Claire Baily in partnership with British Ceramics Biennial and Louise Trodden (HS2 Arts & Culture Team), the project sits within urgent conversations about material re-use in the face of the ecological crisis.

We begin with the wider importance of soil and the ground beneath our feet, before narrowing the focus to construction spoil, the excavated material generated during groundworks and specifically to its clay component, referred to here as spoil clay. While spoil is a mixed material stream, clay holds particular potential for creative and circular re-use.

The terms soil, spoil and spoil clay are therefore used deliberately throughout to reflect different scales of the same system: ecological, industrial, and material.

Construction generates vast quantities of spoil that are routinely downgraded, discarded or sent to landfill despite their material potential. The environmental cost is significant: carbon emissions from transport and disposal, pressure on landfill systems and the continued extraction of depleting virgin resources. At the same time, artists, designers, engineers, architects and community practitioners are demonstrating alternative approaches—revealing how spoil clay can support new forms of making, building and collaboration.

This document does not present a definitive answer or single solution. Instead, it offers a snapshot of the field as it stands at this moment: a survey of practices, pressures and emerging

Playscape, British Ceramics Biennial 2025. Image by Jenny Harper.

possibilities. It shares learning gathered through research, case studies and collaborative exchange. A public conference brought together practitioners from art, construction, science and design, creating space for cross-disciplinary dialogue, revealing the innovative and imaginative potential of partnerships between construction and the creative industries.

Its purpose is to raise awareness, support knowledge exchange and encourage further research and experimentation.

Progress in this area depends on collective action across policy, industry, design, engineering and cultural practice. While this research project concludes here, it highlights the complexity of clay re-use, including its barriers and opportunities, and the importance of translating learning into positive action going forward. By reframing spoil clay as a catalyst for innovation and storytelling rather than a waste to be managed, we open space for others to continue imagining and building circular futures.

Why Does Soil Matter?

Soil is a valuable non-renewable resource that must be taken care of. A teaspoon of healthy topsoil can contain up to a billion bacteria, and it can take hundreds to thousands of years to form one single centimetre[1]. Soil underpins life on earth and is something we cannot live without.

Made up of topsoil and subsoil, it is a complex living system of minerals, organic matter, organisms, air and water. Together, these components support plant growth, regulate water, store carbon and sustain biodiversity. So why are we throwing this material away?

Construction activity in the UK excavates thousands of tonnes of soil each year. Often unwanted and undervalued, this material is commonly classified as waste, removed from site and sent to landfill. Soils make up 57% of the total tonnage received by landfill sites[2], yet only 1.5% of this material is classified as hazardous. The vast majority of soil being discarded is healthy, usable material.[3]

In 2020, the UK generated 191.2 million tonnes of waste. A staggering 61% of this came from construction, demolition and excavation (CD&E), with soil accounting for 28% of that total.[4]

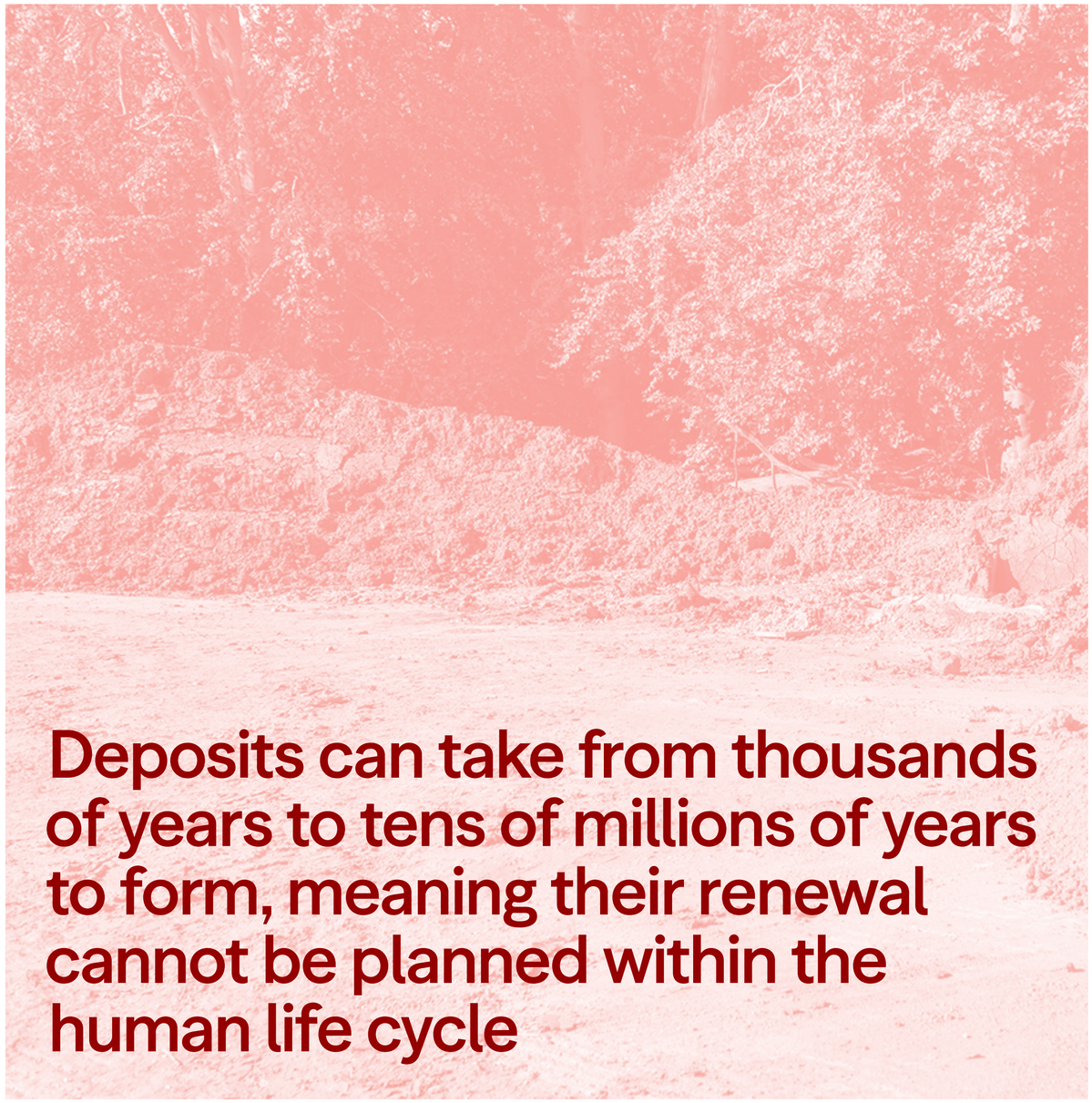
Clay forms part of the subsoil. It is a versatile material with expansive usage in our daily lives. When kept in an unfired state, clay is inherently circular, able to be reused and reworked without an end of life.[5] These fine-grained materials form through the chemical, mechanical, and hydrothermal weathering of rocks, which break down over time into clay-rich deposits. These deposits can take from thousands of years to tens of millions of years to form, meaning their renewal cannot be planned within the human life cycle. The London clay formation, which underlies much of the southeast of England, was formed 56–49 million years ago.

Throughout history, geological processes and human innovation have gone hand-in-hand. Humans have relied on the extraction, processing and consumption of the earth's natural resources, leaving lasting impacts on the earth's surface. Today, the scale and intensity of this activity exceed the earth's capacity to recover, contributing to the environmental challenges we now face.[6] This linear model, dominant since the Industrial Revolution, is no longer sustainable. Whilst progress is being made through industry and government sustainability agendas, a faster and more ambitious shift towards circularity is urgently needed.

In construction, excavation to prepare land for buildings, infrastructure and groundworks is often unavoidable; however, its impacts can be significantly reduced. Early consideration of soil through material management plans and strategies is essential. Thoughtful planning and design are critical. Design is a powerful force for change, and by thinking creatively and collaboratively, higher value re-use and repurposing opportunities can be unlocked.

The climate crisis calls for a shift in culture and mindset. Circularity and economic value are not opposing goals. Re-use should be seen as an opportunity for innovation, imagination, resilience and long-term regenerative value creation.[7] Soil — whether called clay, muck, mud, or dirt — is not a waste. It is a valuable asset and a vital resource.

Example of Soil Strata.



Deposits can take from thousands of years to tens of millions of years to form, meaning their renewal cannot be planned within the human life cycle

57%

of the total tonnage received by landfill sites is made up of soils

98.5%

of discarded soil received by landfill sites is uncontaminated healthy soil

28%

of the UK's 191.2 million tonnes of waste generated in 2020 was made up of soils

Why Is Soil Going To Landfill?

In the UK, gaps in policy and legislation mean that soils on construction sites are poorly protected, resulting in large quantities of soil being damaged or lost.

Defra's Construction Code of Practice for the Sustainable Use of Soils on Construction Sites[8] remains the primary governmental guidance, yet it dates back to 2009 and has seen limited uptake in practice due to its voluntary nature and narrow scope.

An update is anticipated which, will hopefully bring meaningful regulatory reform. Within an industry that is often resistant to change, there is a clear need for strong, coherent guidance supported by financial incentives and/or enforcement. Robust policy has the potential to shift attitudes and perceptions, helping to overcome the structural and cultural barriers that currently limit more sustainable soil management practices.

In the absence of clear regulatory direction, there are several best practice initiatives encouraging re-use in construction, in particular, CL:AIRE[9] and the Soils in Planning and Construction Taskforce.[10] These organisations play an important role in raising awareness of the value of soils and promoting sustainable practices through practical and actionable guidance. Together, they demonstrate what is possible; however, without systemic change, such approaches remain inconsistently applied and far from embedded as standard practice.

Existing guidance and industry practice also tend to focus on conventional, low-value re-use routes, such as landscaping, capping, or infill. There is limited recognition of non-conventional or higher-value re-use pathways, representing a missed opportunity to unlock the full environmental, social and cultural potential of soil. Looking beyond established re-use models through imagination, collaboration and material-led design opens possibilities for added value and innovation.

These challenges are not isolated to one area of practice but reflect the cumulative effect of decisions made across the lifecycle of construction projects. Decisions made by clients and developers, the timing and priorities of design and planning stages, the availability and viability of re-use pathways, the structure of the supply chain and policy influence all play a critical role in determining whether soil is re-used, downgraded or sent to landfill.

The reasons soil continues to be sent to landfill are complex and nuanced, requiring collective action across the industry. For practitioners, understanding this system becomes a source of agency to advocate for change and contribute to wider systemic shifts.

The visual on pages 12 and 13 identifies key themes that operate across the system, setting out where the construction industry currently sits, where it needs to move towards and the actions that could support this shift. There is significant overlap between the themes and the framework is not intended as a definitive account but as a tool for discussion, outlining the barriers to soil re-use and highlighting opportunities for change.

→ Robust policy has the potential to shift attitudes and perceptions

Image of the EX-Clay Innovation Project, demonstrating the importance of collaboration between industry and academia in transforming surplus excavation material into supplementary cementitious material (SCM) for use in concrete, replacing Portland cement. Image by HS2.

Policy

Where we are

Guidance is outdated and difficult to navigate. Soil re-use is voluntary and complex waste classification increases perceived risk and prevents re-use on other sites.

Where we need to be

Clear updated guidance, stronger incentives and taxation, simplified licensing and regulatory reform.

How we get there

Re-use is incentivised, rewarded or mandatory — supported by robust and coherent policy. Higher landfill tax and more inclusive building standards discourage disposal and enable mainstream re-use.

Playscape, British Ceramics Biennial 2025.
Image by Jenny Harper.

Knowledge & Skills

Where we are

Limited awareness of the value of soil for planetary and human health means it is often treated as waste.

Where we need to be

Soil literacy is standard across design and construction teams with re-use normalised.

How we get there

Training, case studies, expert partnerships and shared learning platforms.

Public Workshop, BC Studies.
Image by Thomas Nocero.

Design & Timing

Where we are

Re-use is considered too late in the project lifecycle. Limited understanding of soil applications means material is often downgraded or disposed of.

Where we need to be

Soil re-use is integrated into early project design and planning decisions and embedded into contracts. High-value, site-specific re-use is prioritised.

How we get there

Early soil audits, material-led design and soil management enforce responsibility and guide handling and re-use throughout the construction ecosystem.

Rammed Earth House Site, Tuckey Design Studio.
Image by Jim Stephenson.

Value Perception

Where we are

Value is understood narrowly in financial terms. Within this framework, soil is routinely disregarded and its potential for higher-value re-use is rarely considered.

Where we need to be

Value is understood holistically—including social, cultural, and environmental benefit. Re-use is recognised as value creation.

How we get there

Reward re-use in procurement, recognise wider social and environmental value and share successful projects to demonstrate viability.

Pile of Clay, HG Matthews.
Image by Claire Baily.

Collaboration & Infrastructure

Where we are

Decision-making is fragmented across the supply chain, with limited coordination and few established pathways for higher-value soil re-use.

Where we need to be

The supply chain supports re-use through coordination between clients, designers, contractors and suppliers with clear routes for materials to circulate.

How we get there

Engage local re-use networks, align contracts and material management plans across the supply chain and create platforms for coordination and knowledge sharing.

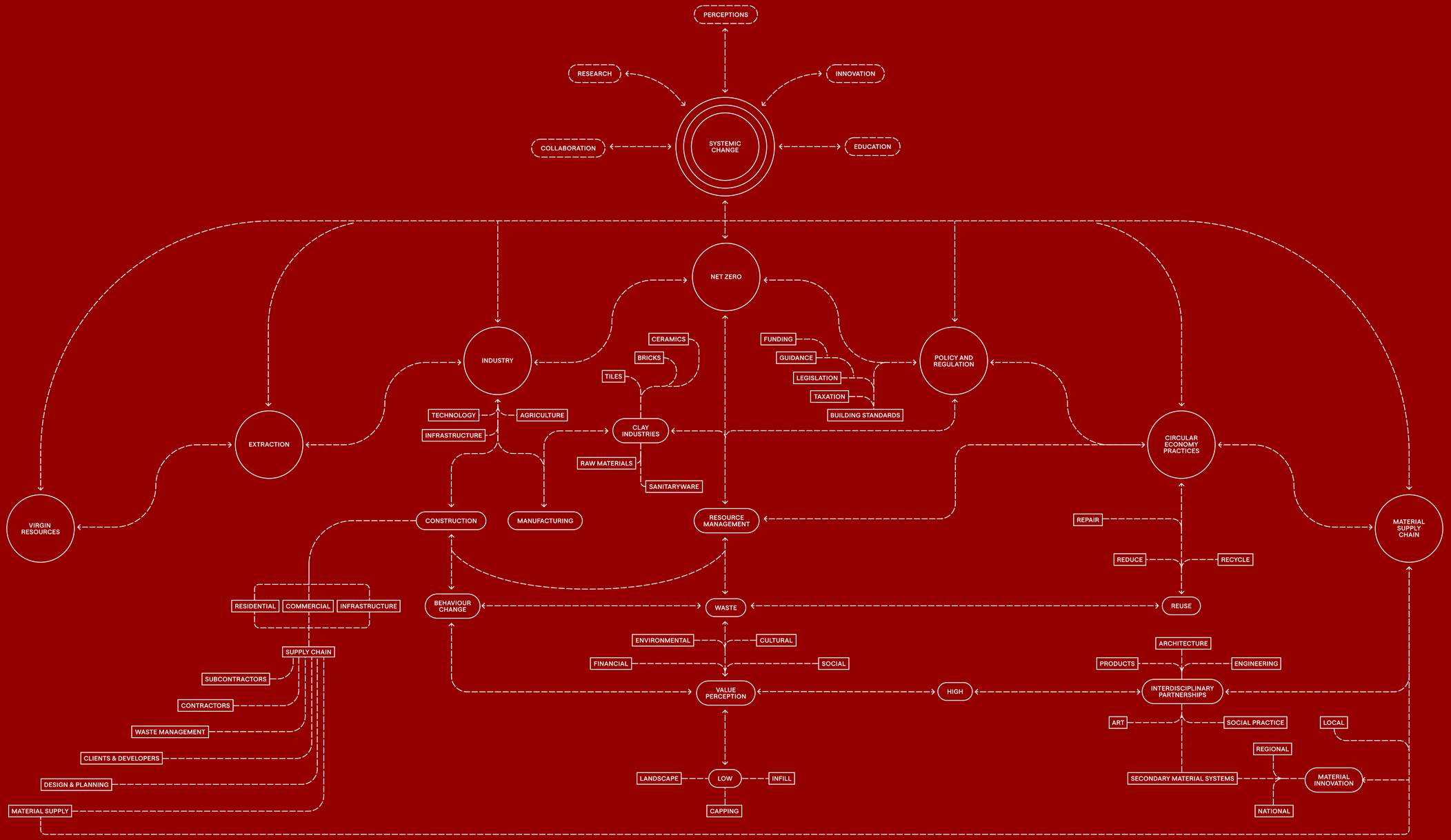
STROCKS™ Production, HG Matthews.
Image by Olivia Aspinall.

Collective Action

‘The rescuers we need are mostly not individuals, they are collectives — movements, coalitions, campaigns, civil society. Even the world’s greatest conductor needs an orchestra. One person cannot do much; a movement can topple a regime.’

Rebecca Solnit, ‘No Straight Road Takes You There; Essays For Uneven Terrain’, 2025

Soil re-use is not the responsibility of one sector or discipline. It depends on coordinated action across policy, industry, design, engineering and cultural practice. The following diagram illustrates an interpretation of this interconnected system, shaped by the findings of this research. Progress does not emerge in isolation, but from relationships between people, materials and collective action. There is no single solution or clear resolution—only a complex and evolving field of responses. This publication offers one response within that system; its continuation depends on the shared effort of those who carry the work forward.


PERCEPTIONS
RESEARCH
INNOVATION
COLLABORATION
SYSTEMIC CHANGE
EDUCATION
NET ZERO
INDUSTRY
CERAMICS
BRICKS
TILES
FUNDING
GUIDANCE
LEGISLATION
TAXATION
BUILDING STANDARDS
POLICY AND REGULATION
TECHNOLOGY
AGRICULTURE
INFRASTRUCTURE
CLAY INDUSTRIES
RAW MATERIALS
SANITARYWARE
EXTRACTION
CIRCULAR ECONOMY PRACTICES
VIRGIN RESOURCES
CONSTRUCTION
MANUFACTURING
RESOURCE MANAGEMENT
REPAIR
REDUCE
RECYCLE
MATERIAL SUPPLY CHAIN
RESIDENTIAL
COMMERCIAL
INFRASTRUCTURE
BEHAVIOUR CHANGE
WASTE
REUSE
ENVIRONMENTAL
CULTURAL
FINANCIAL
SOCIAL
ARCHITECTURE
PRODUCTS
ENGINEERING
SUPPLY CHAIN
SUBCONTRACTORS
CONTRACTORS
WASTE MANAGEMENT
CLIENTS & DEVELOPERS
DESIGN & PLANNING
MATERIAL SUPPLY
VALUE PERCEPTION
HIGH
INTERDISCIPLINARY PARTNERSHIPS
ART
SOCIAL PRACTICE
LOCAL
REGIONAL
LANDSCAPE
LOW
INFILL
CAPPING
SECONDARY MATERIAL SYSTEMS
MATERIAL INNOVATION
NATIONAL

Creative Re-Use Of Construction Spoil Clay

Creative re-use of construction spoil, in particular spoil clay, spans art, architecture, design, engineering, manufacturing, social practice, and secondary material systems.

Many projects operate across more than one of these domains, for example, certain arts organisations run both community workshops and manage material redistribution.

This section presents an index of practices happening today: fluid, interconnected, and working across multiple scales. Together, they demonstrate how spoil clay can generate added value and innovation.

Tuckey Design Studio. Image by Jim Stephenson.

Case Studies

Image by Morgane Renou.

BC Architects “Atelier Luma”

In 2019, BC Architects and Assemble were commissioned by the Luma Foundation Arles to renovate a 2100m2 former 19thC train depot in the Parc Des Atelier, Arles. The renovation provides a new workspace for the design and research laboratory Atelier Luma, including workshops for timber, metal, ceramic, and textile, alongside dedicated algae and mycelium laboratories, meeting rooms, desk and production space, library and resource centre. Working in close collaboration with Atelier Luma, Assemble and BC set out an ambition to create a flagship piece of bioregional design that facilitates, encourages and expands the ambitions of the Atelier, presenting a new attitude towards materials, promoting and highlighting innovation in ecological and bioregional design practice.

Architecture

Image by Jim Stephenson.

Tuckey Design Studio “Rammed Earth House”

In the Wiltshire countryside is a pioneering new build homestead that’s relearnt an ancient building method. Located on a former brickworks, the series of buildings has risen upon an area of clay-rich soil which, alongside recycled aggregate from demolished outbuildings, forms the composition for the rammed earth. The home is one of a few examples in the UK that utilise unstabilised rammed earth: a circular construction method involving no cement in the mix.

Architecture

Image by Sara Howard/Golden Earth Studio.

Golden Earth Studio

Golden Earth Studio connects artists with the construction industry, giving creatives access to demolition and excavation by-products, which are transformed into artworks and reintroduced into interiors through the Golden Earth Gallery. Working in partnership with Golden Earth Developments, clay excavated from site is bagged up and made available for collection for free.

Art — Ceramics

Social Practice

Secondary Material Systems

Image by Jenny Harper.

British Ceramics Biennial “Playscape”

Playscape (2025) uses rammed earth—a sustainable, ancient construction technique—to explore how clay-rich waste materials can be transformed into a joyful, playful and creative public space. Inspired by a lack of play facilities in Stoke town centre, this project invites communities to connect through clay, storytelling and design. The project is a collaboration led by BCB Associate Artist Sarah Fraser with Architects Tuckey Design Studio, Samsoum Studio, WoodCast Designs and the University of Staffordshire BA Architecture students.

Art — Public Artworks

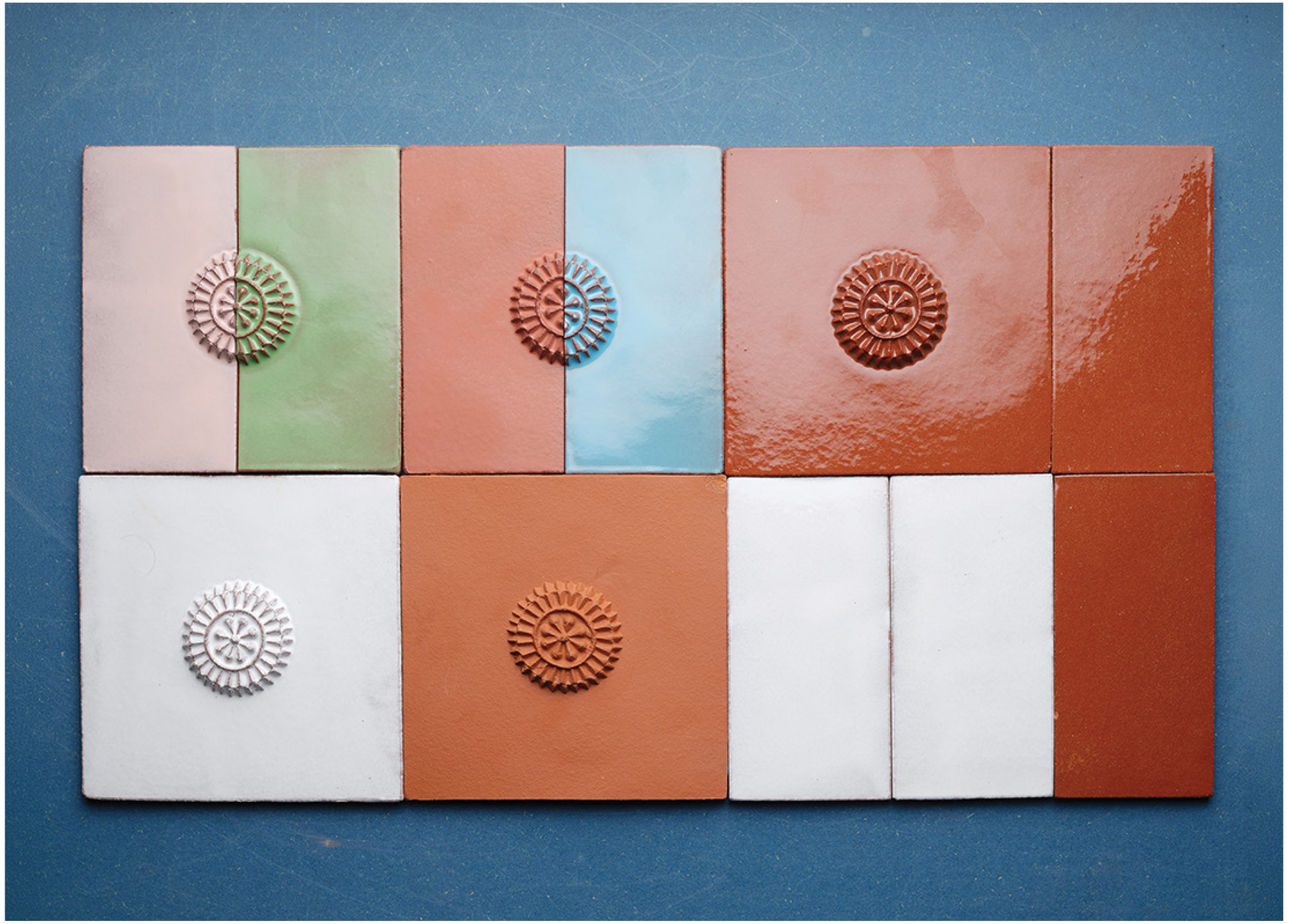


Image by Bahbak Hashemi-Nezhad and Rafael el Baz.

Bahbak Hashemi-Nezhad & Rafael el Baz “Sweet Terrain”

Sweet Terrain (2025) repurposes London Clay excavated during HS2 railway construction in West London into a system of wall tiles proposed for Old Oak Common Station. The project reimagines this overlooked material as a new architectural language rooted in the area’s cultural and industrial heritage.

Products — Design

Image by Olivia Aspinall.

HG Matthews “STROCKS™”

STROCKS™ are unfired earth building blocks for structural and insulating internal walls. The Tribeca development in King’s Cross, London, pioneered the use of STROCKS™ using the excavated clay direct from site, combined with sand and straw. These blocks are used in the development’s basement, serving as a direct, lower-carbon alternative to traditional concrete blocks.

Products — Building Materials Manufacture

Image by Cinzia Romanin and Thomas Noceto.

Local Works Studio “Gent Brick”

In spring 2021, Local Works Studio designed a prototype white brick, made from construction waste, that could form the external walls of a new extension to the Design Museum Gent, in Belgium. Working alongside project architects Carmody Groarke in the UK and ATAMA in Belgium, Local Works Studio developed a low-carbon material and fabrication strategy allowing for a simple and clean making process that enables on-site and urban fabrication, drastically reducing material movements.

Products — Building Materials Manufacture

Image by Jeremy Morris.

BC Materials

BC Materials transforms excavated earth from urban construction sites into circular, local clay building materials, such as compressed earth bricks, clay plasters, and rammed earth. These materials are CO_2-neutral, provide a healthy indoor climate, and are characterised by a highly energy-efficient and local production process. After use, they can be returned to the soil or transformed again into building materials in an infinite circular process.

Products — Building Materials Manufacture

Image by HS2.

Skanska Costain STRABAG joint venture “Excavation Waste London Clay Utilisation in Concrete Applications”

The project converts excavated London Clay into calcined clay, a low-carbon Supplementary Cementitious Material used to partially replace Portland cement in concrete. Funded by Innovate UK’s Decarbonising Concrete programme, the initiative demonstrates how spoil clay can reduce embodied carbon of concrete, while meeting the durability and placement requirements of a major infrastructure project. Developed by the Skanska Costain STRABAG joint venture in partnership with HS2, Arup, Tarmac, University of Leeds, University of Bath, Sika UK, Expedition Engineering and MPA.

Engineering / Material Innovation

Image by Thomas Noceto.

BC Studies

BC Studies is a nonprofit research and education laboratory that explores our material environment through the lenses of construction and production. BC Studies operates as a platform for critical inquiry, hands-on experimentation, and knowledge sharing, which is manifested through teaching, educational programmes, workshops, and published research.

Social Practice

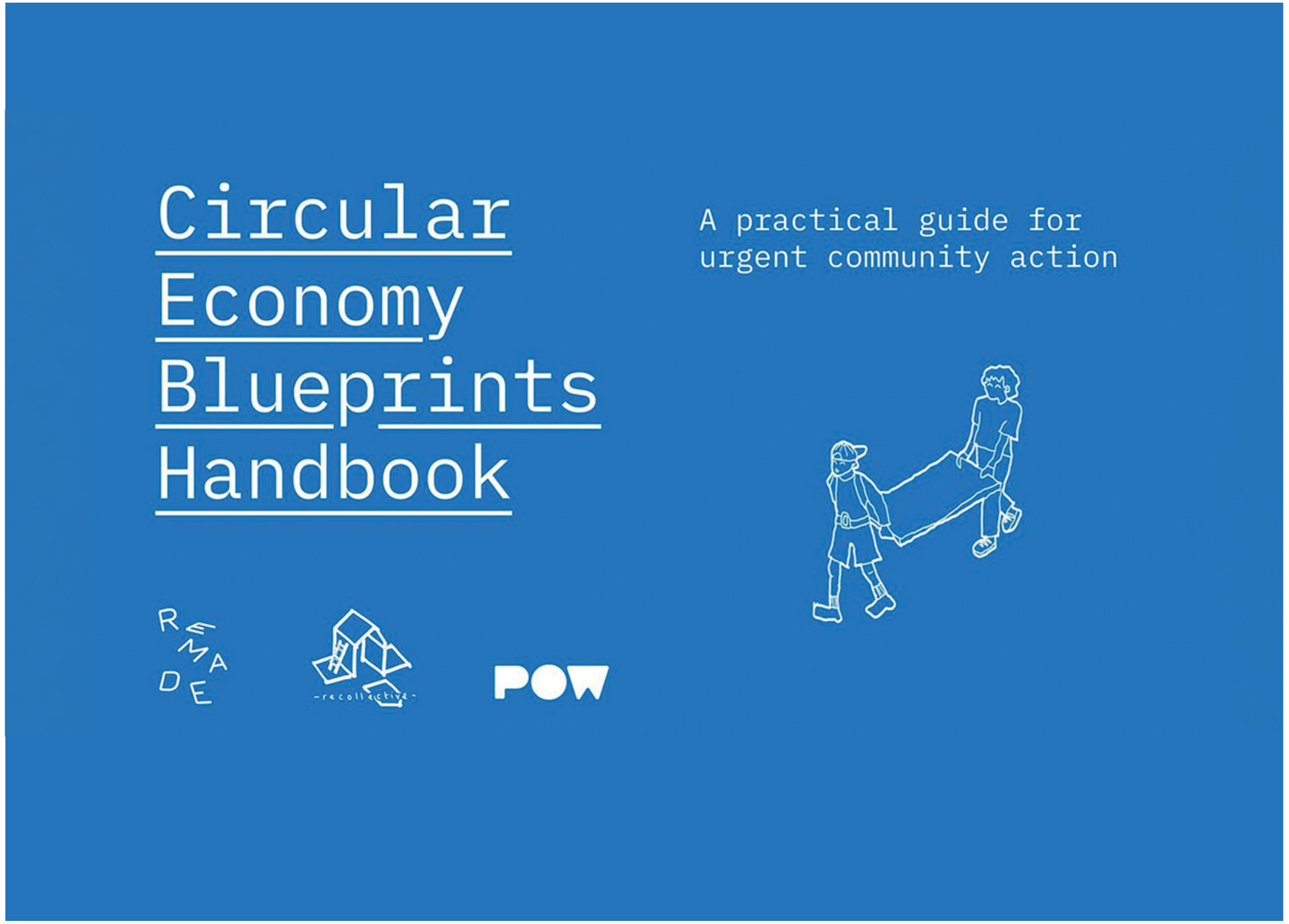


Image by ReCollective.

Re-Made in Park Royal and ReCollective “Circular Economy Blueprints Handbook”

The Circular Economy Blueprints Handbook charts a course from a linear to a circular economy. Led by Re-Made in Park Royal and ReCollective, they investigate five waste streams to find innovative ways to divert surplus materials from traditional waste channels while generating social value. These findings are published in this handbook to inspire and enable other circular economy organisations, community groups, and businesses to implement similar approaches in their communities.

Social Practice

Secondary Material Systems

Image by Rescued Clay.

Rescued Clay

Rescued Clay is a group of ceramicists aiming to utilise clay from London construction sites to foster innovation and build communities. They process clay that would typically be sent to landfill, making it available for their own use and others, alongside hosting workshops and classes from their North London studio.

Social Practice

Secondary Material Systems

Resources & References

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Best Practice Guidance

CIRIA
Construction Industry Research and Information Association
CL:AIRE
Contaminated Land: Applications in Real Environments
Soils in Planning and Construction Taskforce

Built Environment

ACAN
Architects Climate Action Network
Arup
The Alliance for Sustainable Building Products
Assemble
Bauhaus Earth
Carmody Groarke
Civic Square
CRAterre
Ebuki
Earth Building UK & Ireland
ElliottWood
Material Cultures
Morris + Company
OPDC
Old Oak and Park Royal Development Corporation
RIOT
Rotor
Supply Chain Sustainability School
UK Green Building Council
World Green Building Council

Case Studies

Bahbak Hashemi-Nezhad & Rafael el Baz
BC Architects/Materials/Studies
British Ceramics Biennial
Golden Earth Studio
HG Matthews
Local Works Studio
ReCollective
Re-Made in Park Royal
Rescued Clay
Samsoum Studio
Sarah Fraser
Skanska Costain STRABAG joint venture
Tuckey Design Studio
University of Staffordshire
WoodCast Designs

Ceramics

British Ceramics Biennial
Ceramic Material Atlas
Ceramics UK
Darwin Terracotta
Dreadnought Tiles
Forterra
Furlong Mills
Granby Workshop
H&E Smith
Ibstock Brick
Ketley Brick
Lucideon
Potclays
The Brick Development Association
The Firing Line
Valentine Clays
Weinerberger
Welby & Wright
York Handmade Brick

Podcasts

Architects Journal Climate Champions
Breaking Ground
Building Sustainability Podcast
Clay Commons
The Mater Podcast

Organisations

Policy

Circular Economy Task Force
Defra
  Department for Environment, Food and Rural Affairs
Environment Agency

Secondary Material Supply Chain

Enviromate
ReCollective
Renee Materials
The Rebuild Site
Tipping Point East

Systems, Strategy & Circular Economy

Dark Matter Labs
Ellen MacArthur Foundation
Green Alliance
LETI
  Low Energy Transformation Initiative
Reusefully
The UKRI Interdisciplinary Circular Economy Centre for Mineral-Based Construction Materials
WRAP
Zero Waste Scotland

The Earth

British Society of Soil Science
IOM3
  Institute of Materials, Minerals & Mining
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The Soil Association

Waste Management

Mone Bros
Nexus ReGen
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Department for Environment, Food and Rural Affairs

Institute of Materials, Minerals and Mining

The Ellen MacArthur Foundation

Soils in Planning and Construction Taskforce

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Gent Brick Production, Local Works Studio/BC Materials. Image by Design Museum Gent.

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Scan for further information and conference recording, or go to:

britishceramicsbiennial.com/about/research

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