

**Material
Index**

Enabling circularity in the built environment through digital twin material passports

Gemini Presentation: 20.04.2022

Material Index



Morgan Lewis, CEO

Architect, Cambridge +
Cooper Union

New Business Lead, DKA

Lead Architect, TopHat Labs



Rob Smith, MD

Mech. Engineer, Imperial +
Illinois Institute of Technology

Youngest OIM, Shell

Director, Reform Developments



Ellis Dodwell, CTO

Software Developer

Trained as Architect / Urban
Planner, Cambridge + UCL

Construction is the UK's most wasteful industry

> 50% of waste

> Over 14% of UK's GHG replacement materials

< 2% reuse rate



Large unmet demand for reclaim

Many great examples of re-use at
commercial scale particularly in Europe

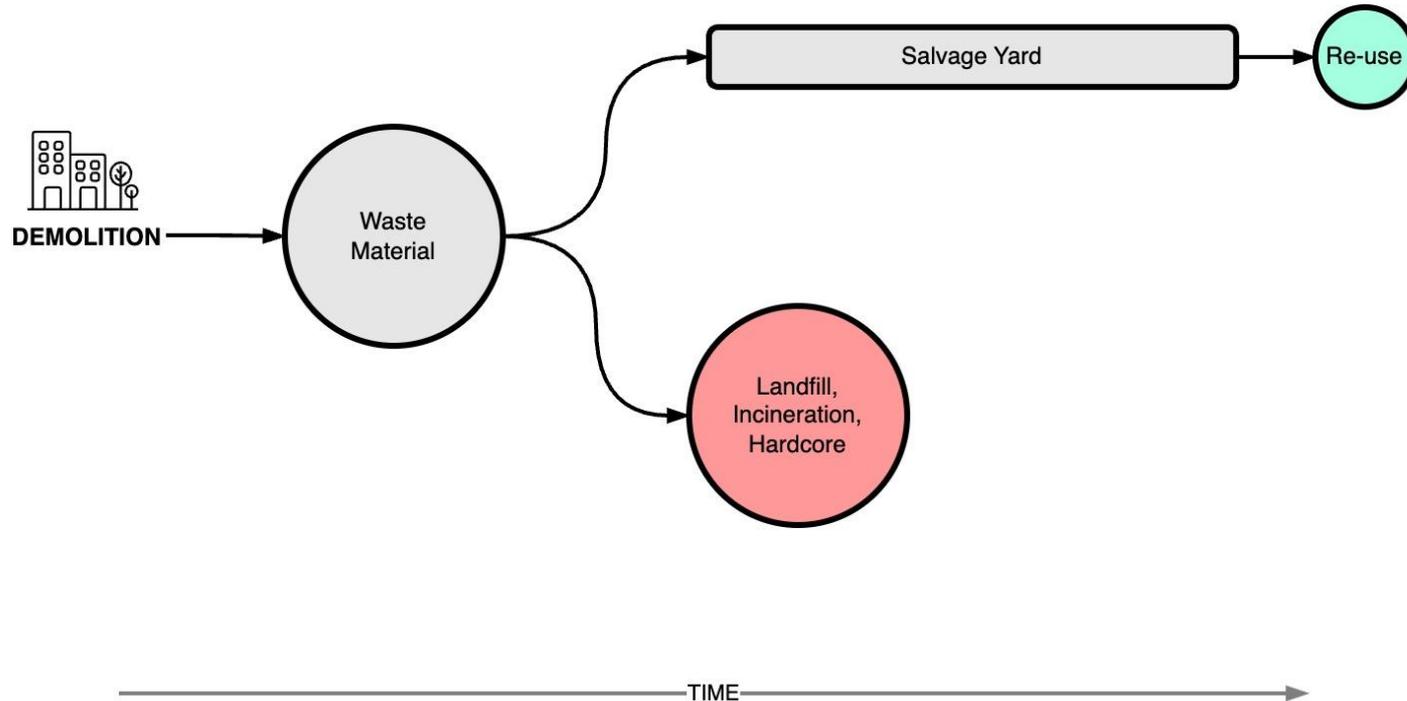


Lengdager Architects, Copenhagen

Material Process Flow

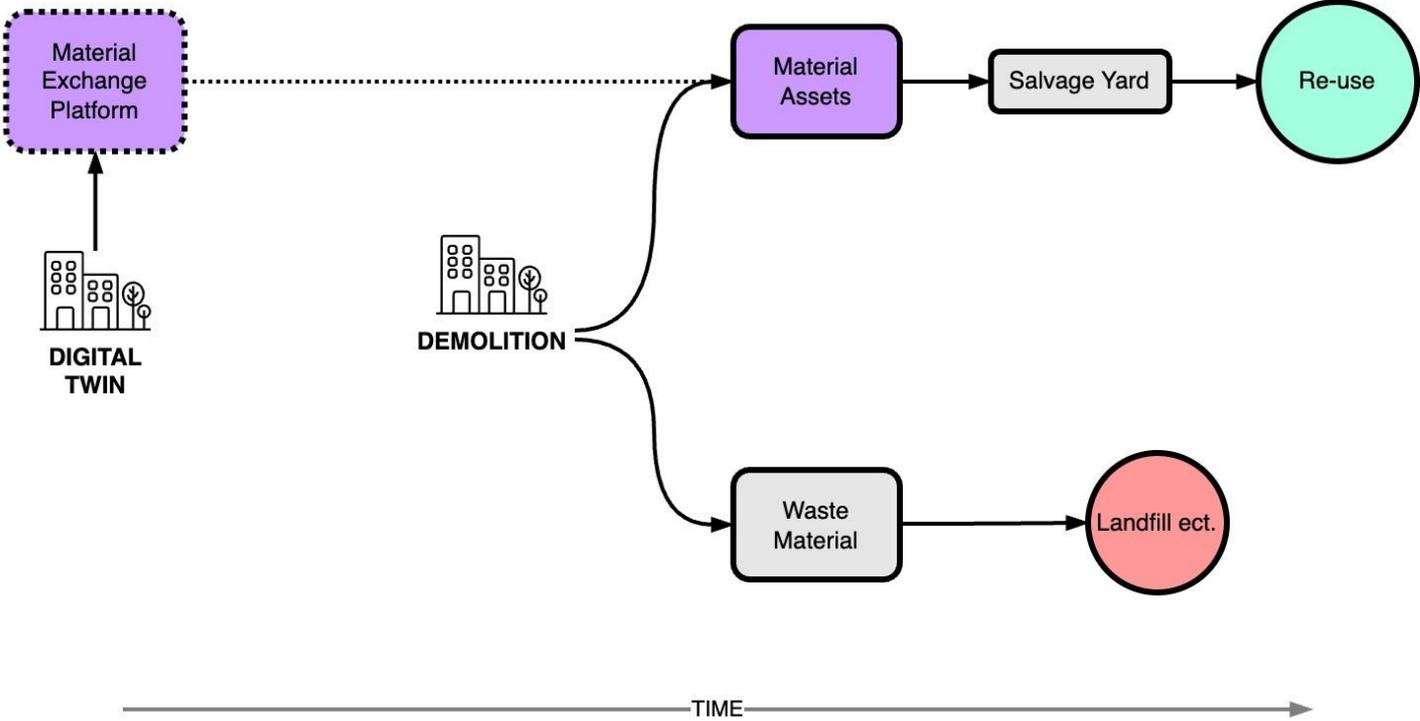
Current

The existing secondary supply chain is undigitised.



Material Process Flow

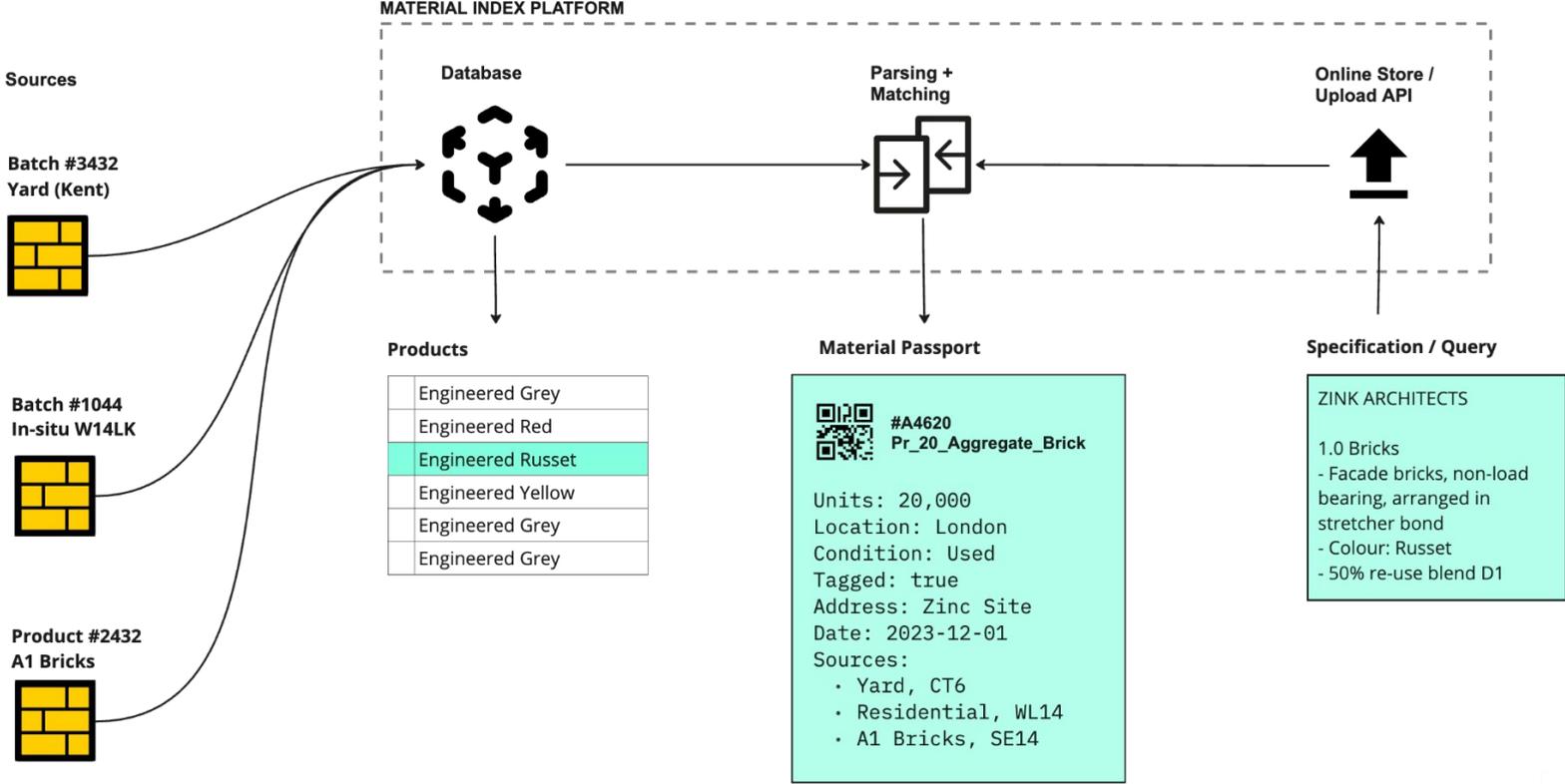
Proposed



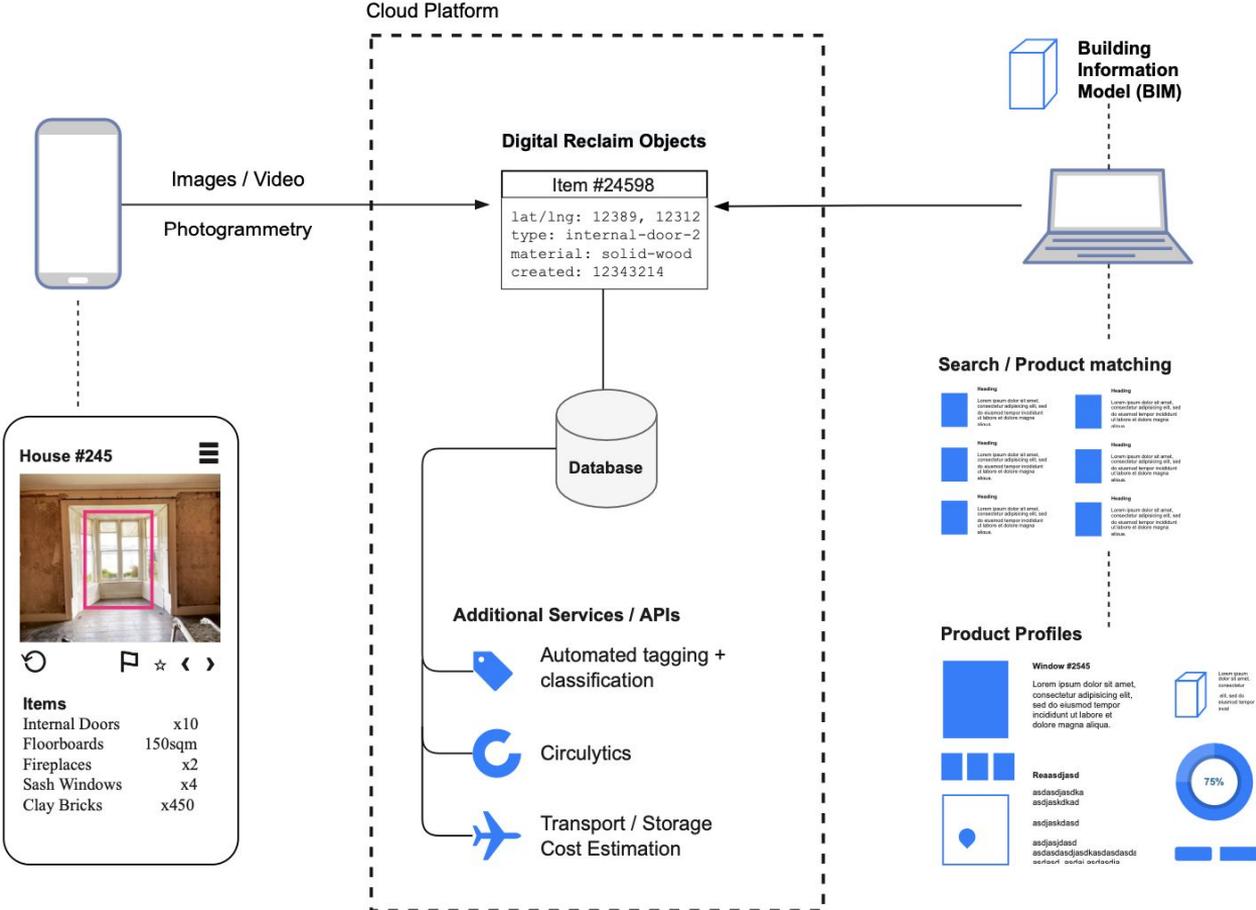
Platform Functions

Supply

Demand



Initial concept



Digital Reclaim Objects

Item #24598
 lat/lng: 12389, 12312
 type: internal-door-2
 material: solid-wood
 created: 12343214

Database

Additional Services / APIs

- Automated tagging + classification
- Circulytics
- Transport / Storage Cost Estimation

House #245



🔄 🚩 ☆ ⏪ ⏩

Items

Internal Doors	x10
Floorboards	150sqm
Fireplaces	x2
Sash Windows	x4
Clay Bricks	x450

Search / Product matching

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Heading Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.	Heading Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.
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Product Profiles

Window #2545
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Reasdjasd
 asdasdasdka asdasdkad asdasdkad asdasdkad

75%

Data Requirements

For material exchange



Classification

NBS Uniclass
IFC Entities
SKUs
Product Numbers
Text Description



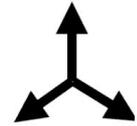
Dimensions + Quantities

Unit standardisation
pairs/sets ect.



Photographic Evidence

Quality,
resolution, lighting
ect.



Location XYZ

IFC
GPS
WiFi FTM

Approach 1

Manual BIM + Photographic Survey

BIM Survey

IFC Model

Extract

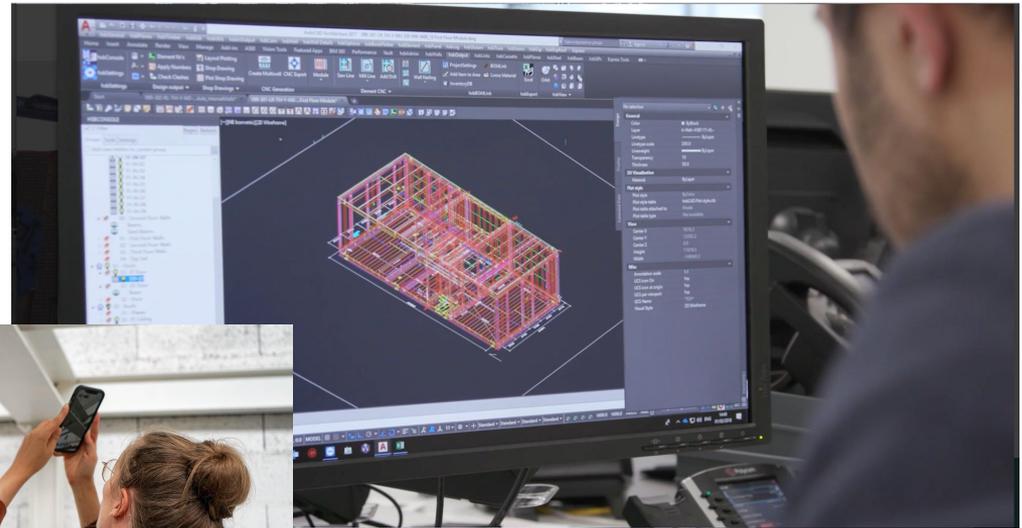
Add Photos

Flexibility in accuracy and level of detail

High technical skills required

Potentially high cost

Difficulty in scaling-up



Approach 2 LIDAR Survey



High accuracy

Requires specialist surveying equipment

Limited to surfaces

Still requires photo survey

Potential for ML Automation in classifying / calculating volumes



Approach 3

Photogrammetry Survey

Video
Survey

Mesh
Photogrammetry /
NeRF

Classification
ML / Offshore

IFC
Model

Extract

No specialist equipment required on site

Potentially noisy data, requires cleaning

Only one survey required

Recent advancements in Neural Radiance Fields (NeRF)



Approach 4

Photo survey + floor plans



No specialist equipment required on site

WiFi FTM offers 1-2m accuracy for geotagging images

Requires floor plans

No 3D model

Line #	Name	Description	Designator	Quantity	Manufacturer1	MPN1	Supplier1	SPN1	SUP1	Total Price
6	Custom one	Description of field	DefField	1						0
7	Batteries Puk 1.1 FC1, VWR1	Alkaline Battery	B11	1						0
8	BATTERY 3.7x 2000mAh	Alkaline Battery	B12	1						0
9	Battery	Alkaline Battery	B13	1	MalcoElektronika	MBROSE 103	Mouse	032-MBROSE 103		0.74
10	Battery	Alkaline Battery	B14	1	Canther Pula	BP720-BATTERY	Mouse	676-BP720-BATTERY		43.95
11	CAP 680pF 10V 0805(0402)	CAP 680pF 10V 0805 (0402) Molec	C1	1	TEK	CM020PPIABIK	Mouse	09-CM020PPIABIK		0.09
12	1uF	Polarized Capacitor (Radial)	C2	1						0
13	10uF	Polarized Capacitor (Radial)	C3	1	Yngveena ATG	TA-800X020P	Arrow	TA-800X020P-MALTI		0.42
14	CAP 2.2uF 10V 0805(0402)	CAP 2.2uF 10V 0805 (0402) Molec	C4	1	TEK	CM020GIC2PAB	DigiKey	44554274-AED		0.36
15	2.2uF	Capacitor	C5	1	Murata	GMV855C40PAC0B0	Mouse	01-GMV855C40PAC0B0		0.03
16	1uF	Polarized Capacitor (Radial)	C4, C5	2	Vishay Sprague	TRV000010C100	Newark	46811P		0.45
17	Blazer	Magnetik Transceiver Buzer	L81	1	Murata	PLCC02022000-R1	PSCComponents	7928-BB		0
18	10 1/2 10200003	10 1/2 10V 2x 2020 (0402) Molec SHD	R1	1	Cyano	PLCC00P1079-A	Mouse	02-PLCC00P1079-A		0.03
TOTAL PRICE										\$65.53



Process Flows

Comparison of stages

