

Material Index



Enabling circularity in the built environment through digital twin material passports

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Material Index



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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

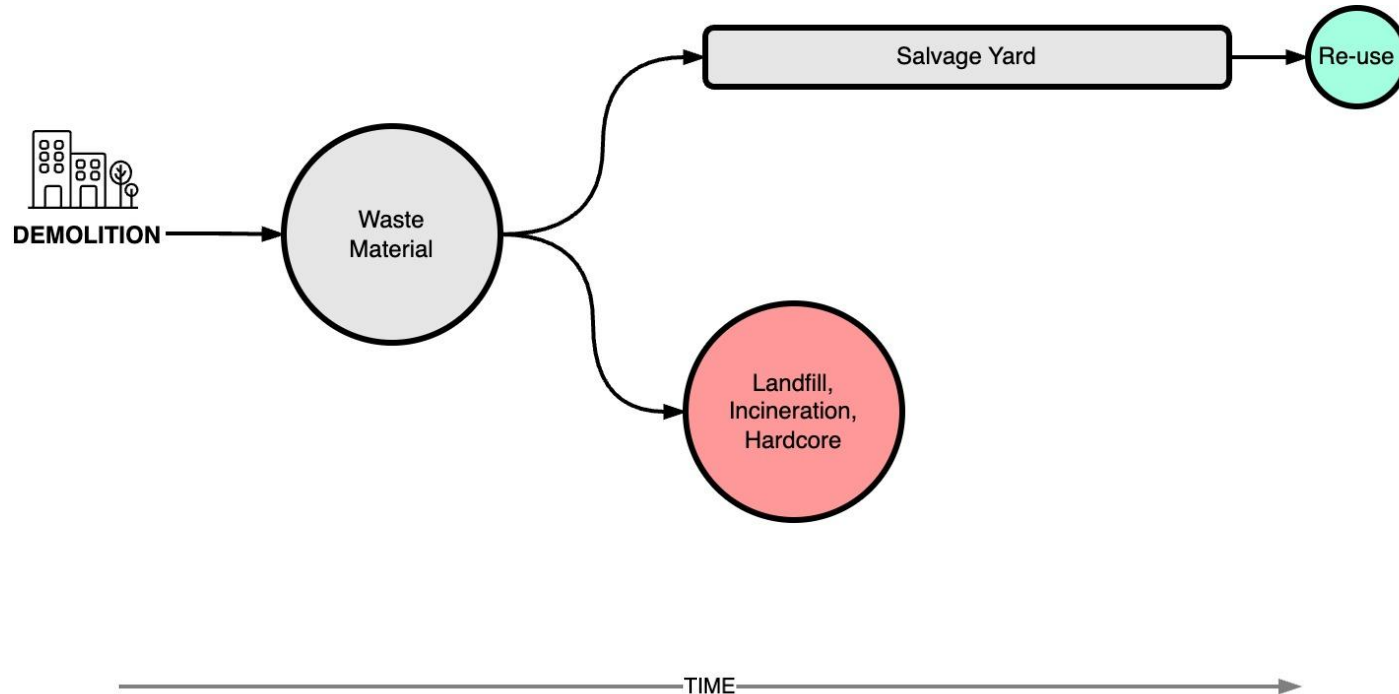
Lengdanger Architects, Copenhagen



Material Process Flow

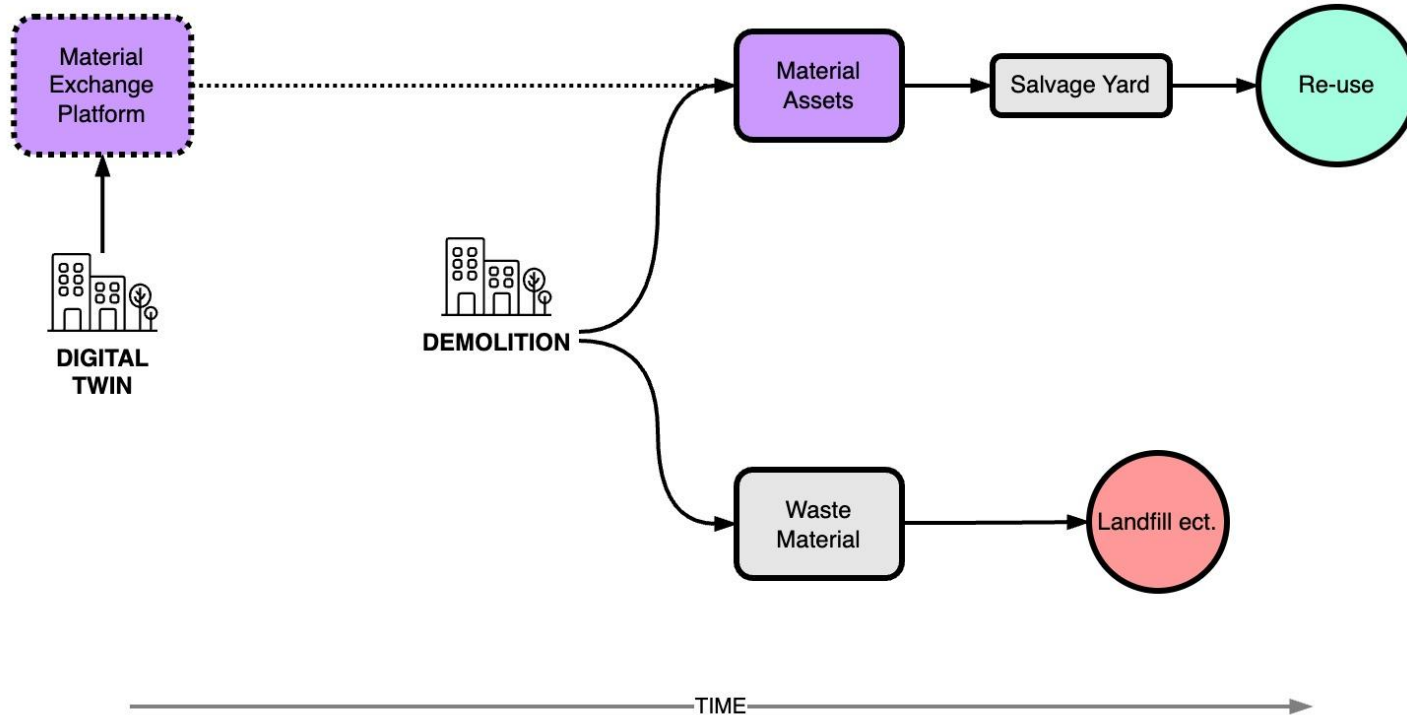
Current

The existing secondary supply chain is undigitised.



Material Process Flow

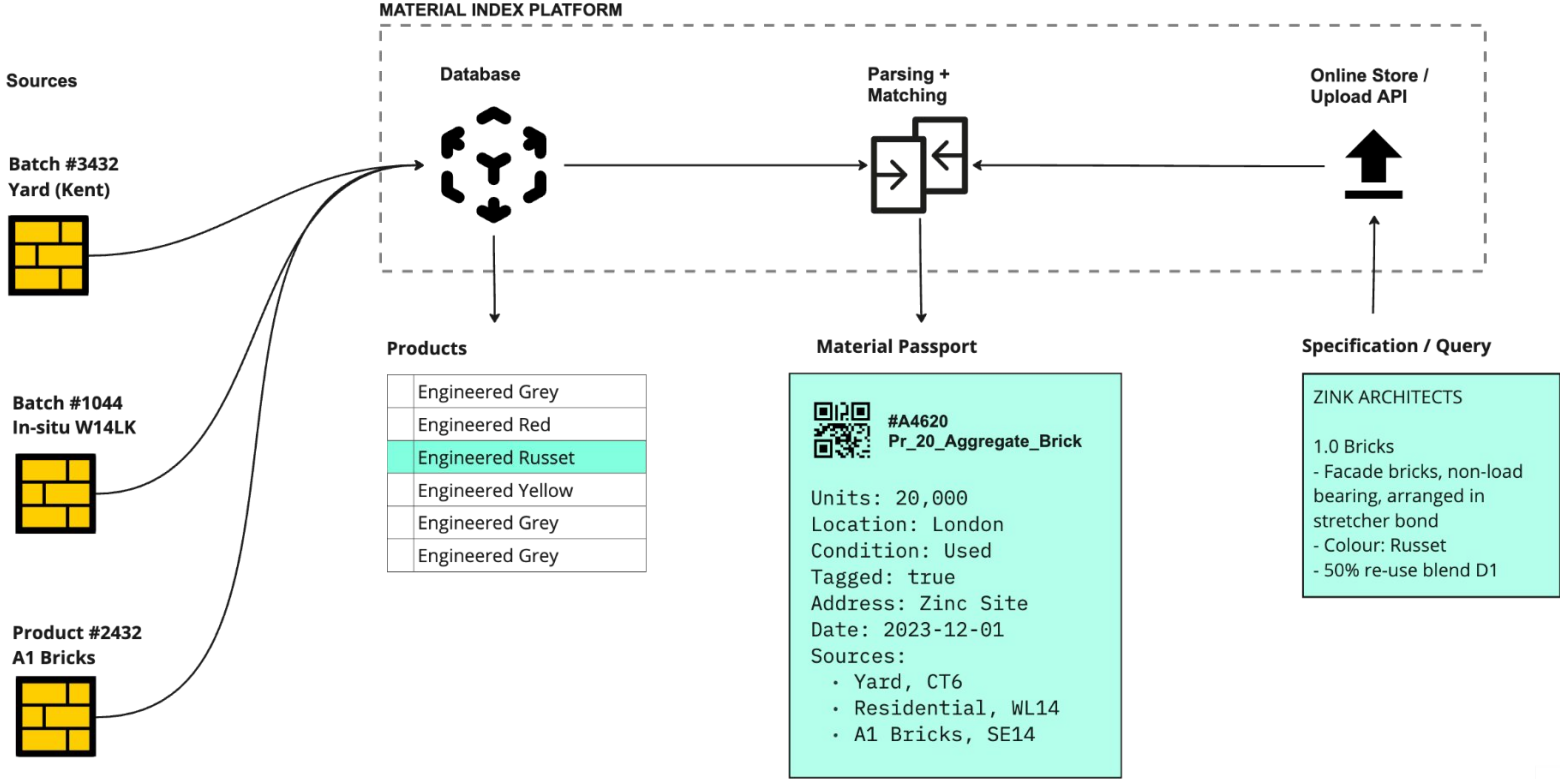
Proposed



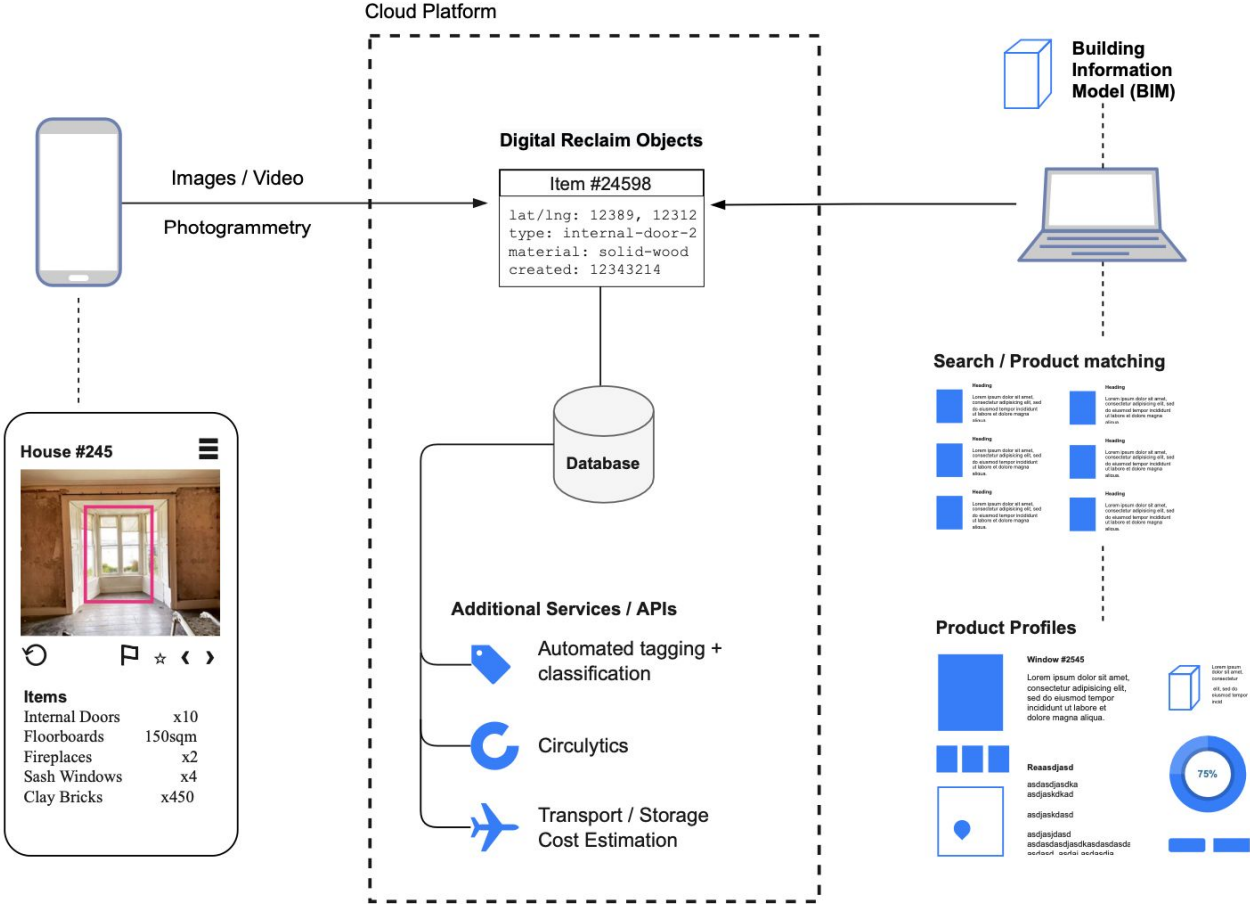
Platform Functions

Supply

Demand



Initial concept



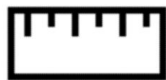
Data Requirements

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

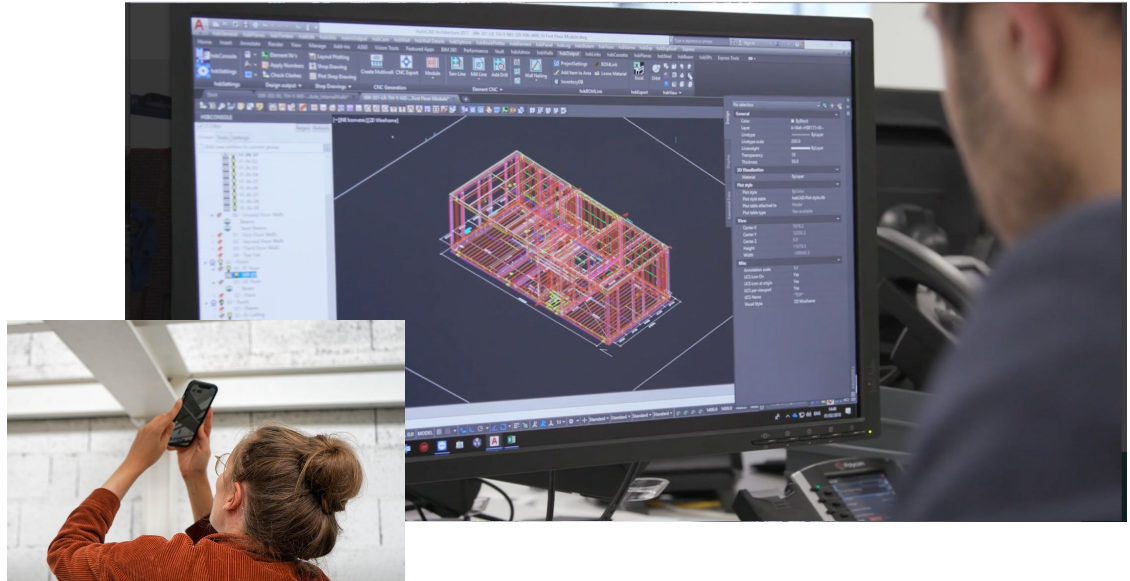
Add
Photos

Flexibility in accuracy and level of detail

High technical skills required

Potentially high cost

Difficulty in scaling-up



Approach 2

LIDAR Survey

LIDAR
Point cloud

Mesh

Classification
ML / Offshore

IFC
Model

Extract

Add
Photos

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

Photo Survey + WiFi FTM

Floor Plans

Classification
ML / Offshore

NBS
Uniclasses

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
1	Custom int.	Description of field	Def field	1						0.0
2	Battery Pack LIPO4, 700mAh	BATTERY 3.7V 2000mAh	BT1	1						0.0
3	Battery	LiPo 4000mAh	BT2	1	Micro-Battery	MBROE-100	Mouse	432-MBROE-100	0.15	0.15
4	Battery	LiPo 4000mAh	BT3	1	Canstar Plus	BP720-BATTERY	Mouse	676-BP720-BATTERY	43.95	43.95
5	CAP 100µF 16V 0805 (0402)	CAP 100µF 16V 0805 (0402) Molec	C1	1	TDK	C4020P1A60R	Mouse	89-C4020P1A60R	0.09	0.09
6	1µF	Polarized Capacitor (Radial)	C2	1						0.0
7	10µF	Polarized Capacitor (Radial)	C3	1	Yageo A101	TA8000100P	Arrow	TA8000100P/MULTI	0.42	0.42
8	CAP 1.2µF 16V 0805 (0402)	CAP 1.2µF 16V 0805 (0402) Molec	C4	1	TDK	C4020G1C2F60	Digi-Key	445-5427-0-AD	0.10	0.10
9	1.2µF	Capacitor	C5	1	Murata	GRM188RCH1R4C100	Mouse	61-GRM188RCH1R4C100	0.01	0.01
10	10µF	Polarized Capacitor (Radial)	C4, C5	2	Vishay Sprague	TRV1000V08C100	Newark	440119	0.45	0.9
11	Buzzer	Magnetic Transducer Buzzer	B1	1	Murata	PLC1612022000R1	PSComponents	7762R01	0.0	0.0
12	RS-485 (120Ω)	RS-485 120Ω (0402) Molec	R1	1	Yageo	PC100P101079AL	Mouse	602-PC100P101079AL	0.01	0.01
TOTAL PRICE										\$65.53



Process Flows

Comparison of stages

