



RESOURCE EFFICIENCY

Urban Mining / Material Passport

Concept Overview:

sustainability and circular economy



Urban Mining

the **systematic recovering** and **reusing** of **anthropogenic materials** such as concrete, bricks, steel reinforcements etc. from urban areas

Buildings as material banks?

Material Passport

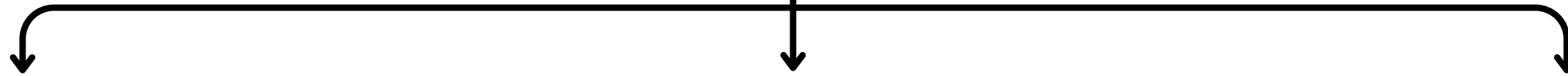
digital documents that provide detailed information about the composition and lifecycle of building materials **informing recovery opportunities**

Allowing specific components to be identified within a database and later utilised?

Resource Efficiency:¹
Definition



involving



#1 Dematerialisation

reducing material and energy use

#2 Re-materialisation

remanufacturing and recycling

#3 Infrastructure Transitions

with sustainable urbanisations



to achieve

**lowering the amount of resources required and the
negative environmental impacts associated with use**

1 [International Resource Panel]. (2021, February 18). What is Resource Efficiency? - Resource Efficiency Dictionary [Video]. Youtube. <https://www.youtube.com/watch?v=NA3SwyP8ROk>

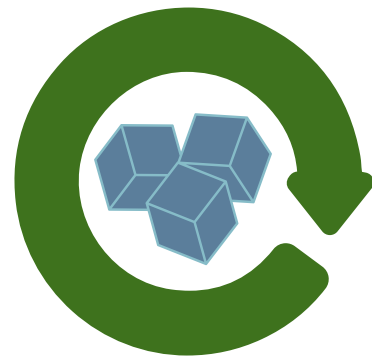
Urban Mining: Interpretations



the **systematic recovering** and **reusing** of **anthropogenic materials** such as concrete, bricks, steel reinforcements etc. from urban areas

comprehensive / paul brunner⁴

generic / material bank



Rematerialisation Remanufacturing & Recycling²

utilising anthropogenic stocks rather than geological to meet demands of manufacturing



Direct Reuse³

using and preserving a product as close to its finished state as possible, **to preserve its existing value**



Goal-orientated knowledge base

preserving information from production through recovery
→ **Material Passports**



Locate recycling facilities within service-oriented cities

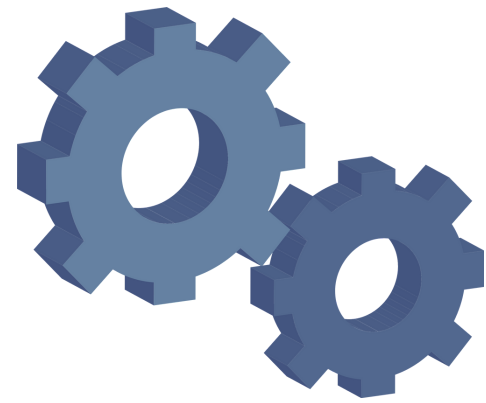
to develop the concept into a new strategy to increase the sustainability of the urban metabolism

² rts (2021, September 21). What is urban mining? <https://www.rts.com/blog/what-is-urban-mining/>

³ Blok, M. (2021, February 2). Urban mining and circular construction-what, why and how it works. <https://www.metabolic.nl/news/urban-mining-and-circular-construction/>

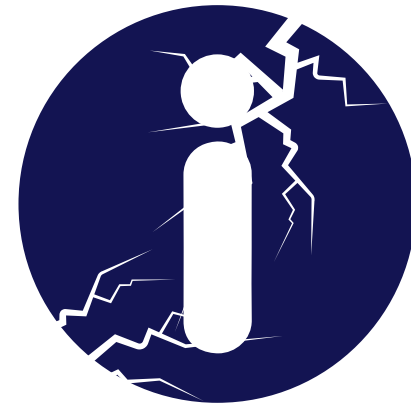
⁴ Paul H. Brunner, 2011. "Urban Mining A Contribution to Reindustrializing the City," *Journal of Industrial Ecology*, Yale University, vol. 15(3), pages 339-341, June.

Urban Mining: Challenges



#1 Industry Preparedness⁵

the construction sector is not yet geared to use secondary materials for constructing



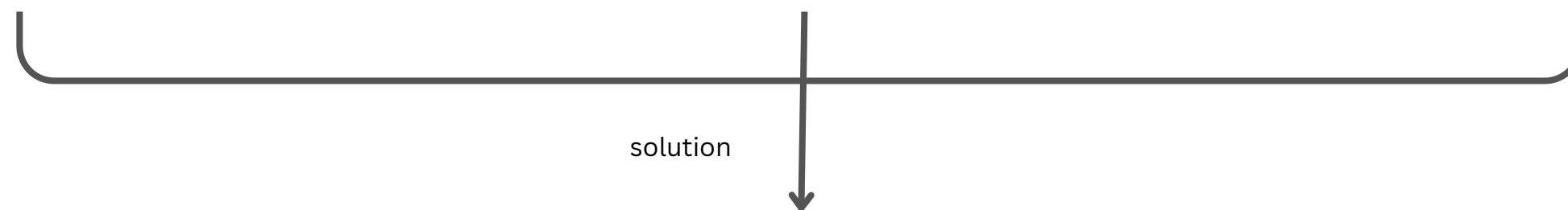
#2 Information Failure⁶

lack of information on what harvestable materials are present and what their value could be



#3 Potential Insecurity⁷

which potentials of secondary resources promise an economic benefit or even marginal negative assets



Material Passports

5, 6 Blok, M. (2021, February 2). Urban mining and circular construction-what, why and how it works. <https://www.metabolic.nl/news/urban-mining-and-circular-construction/>
7 Paul H. Brunner, 2011. "Urban Mining A Contribution to Reindustrializing the City," *Journal of Industrial Ecology*, Yale University, vol. 15(3), pages 339-341, June.

Material Passport: Examples



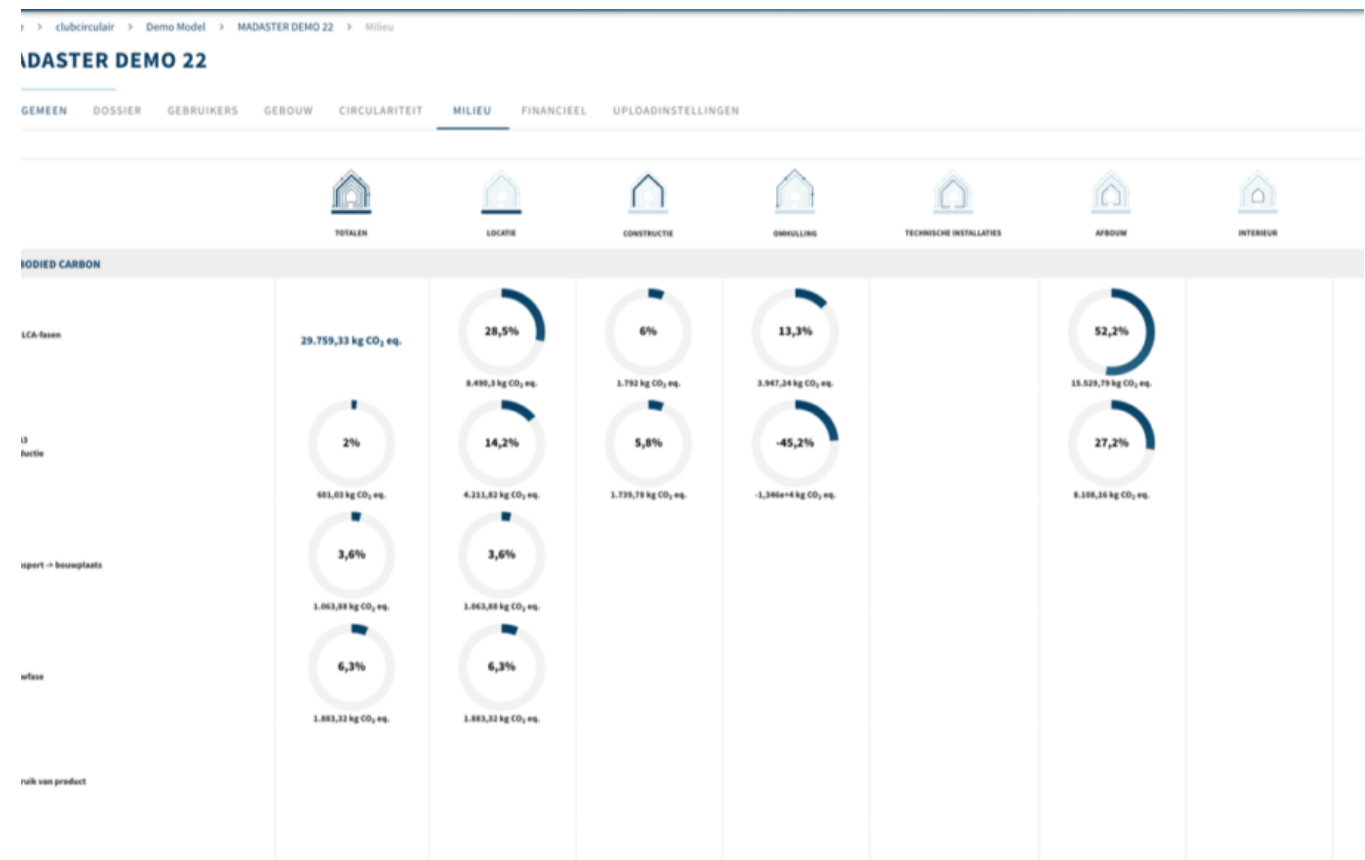
digital documents that provide detailed information about the composition and lifecycle of building materials **informing recovery opportunities**

A MATERIAL PASSPORT FOR A HOME:

	MATERIAL	QUANTITY	REUSE/RECYCLE/DOWNCYCLE	SUSTAINABILITY
FOUNDATION	Concrete piles	60,000 kg		
	Concrete foundation	14,000 kg		
FACADE	Stained glass	15 kg		
	Glass	1,500 kg		
	Meranti window frames	350 kg		
	Barn wood	2,000 kg		
FLOORING	Concrete ground floor	21,000 kg		
	Concrete system floor	105,000 kg		
ROOFING	Wooden roof structure and facade	2,500 kg		
	Roof tiles	4,000 kg		
INTERIOR WALLS	Sand-lime brick	56,000 kg		

Simplified Passport

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Material Passport by Madaster

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8 Block, M., Schouten, N., & Dasnois, M. (2020, August 12). On the journey to a circular economy, don't forget your materials passport. Block, M., Schouten, N., & Dasnois, M.

9 (2020, August 12). On the journey to a circular economy, don't forget your materials passport.

Madastar (n.d.). Madaster. Madaster. <https://madaster.no/en/platform/>



#1 Lack of unified approach

different passports have differing standards that need translation. **Losing key information and advantages.**

Such as a unified maintenance schedule or knowing the life-cycle of a component



#2 Keeping up to date

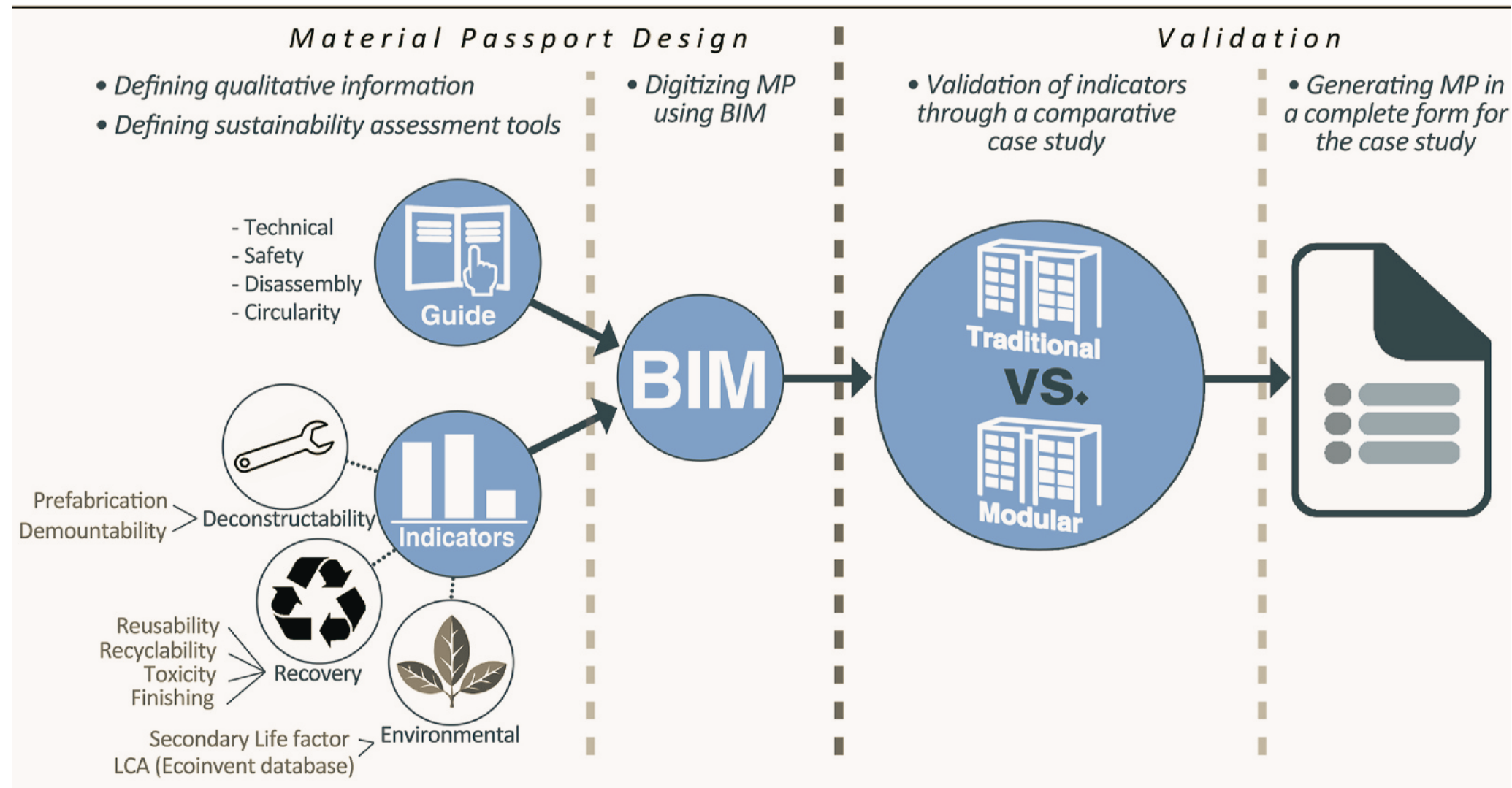
Properties with high turnovers like rental, or owned by big corporations, make **maintaining high levels of details difficult over time**



#3 Privacy and Security

Ensuring the **trustworthiness** and clear sharing guidelines of the passports can be difficult in a digital world. Requiring investments in an independent agent or a system like blockchain

Material Passport: ¹¹ Integration with BIM



Proposed framework of developing a digital material passport with BIM

#1 Obtaining Information

solves the problem of insufficient information by including quantitative and qualitative information, covering all lifecycle stages of the building

#2 Automation

Automated calculations for sustainability indicators, **reducing calculation time and errors**

#3 Information Preservation

BIM tools have information preservation features, allowing for storing technical information.

Case Studies:

Build Reversible in Conception

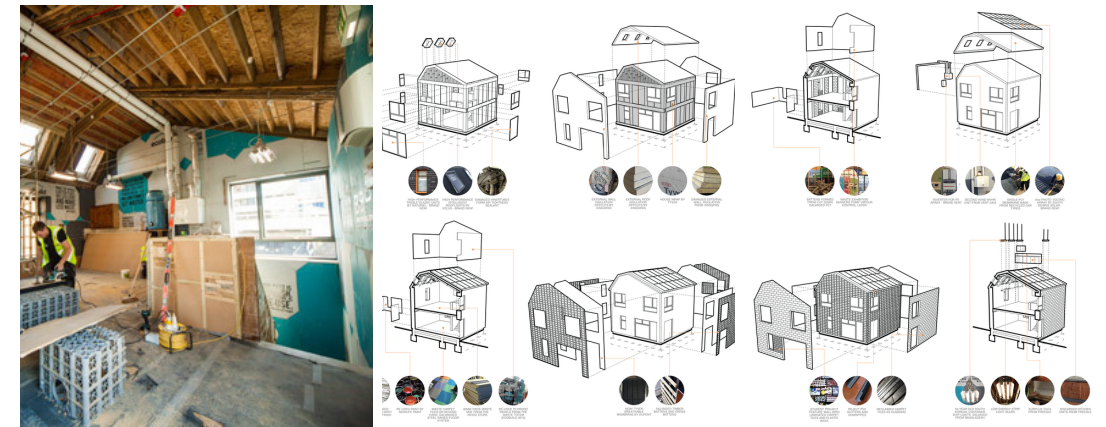
by Building As Material Bank (BAMB)



Designed to be a material bank, the BRIC building was built and dismantled multiple times, each time to fulfill a different purpose. From an office (2018) to a shop (2019) and eventually an acoustic laboratory (2020) for training EFP students.

Waste House

by BBM



Testing the longevity and permanence of waste mixed materials. The building used ground-granulated blast-furnace slag for foundation and salvaged plywood beams, columns and timber joists rescued from a nearby demolished house.

12 (n.d.).(2020) Build Reversible in Conception (B.R.I.C). BAMB. <https://www.bamb2020.eu/topics/pilot-cases-in-bamb/bric/>

13 Griffiths, A. (2014, June 19). Waste House by BBM is "UK's first permanent building made from rubbish". Dezeen. <https://www.dezeen.com/2014/06/19/waste-house-by-bbm-architects-is-uks-first-permanent-building-made-from-rubbish/>