



Fire Station, Straubenhardt, Germany



Moringa, Hamburg, Germany



The Cradle, Dusseldorf, Germany



Office Building, Essen, Germany Sustainability and Engineering Consulting



Multi Tower, Brussels, Belgium



SCHÜCO-Office, Bielefeld, Germany



LIVING, Brussels, Belgium



Renovation of WTC-Towers, Brussels, Belgium



///// OUR MISSION WITH EPEA Co-developer of the Cradle to Cradle[®] design concept



2019



///// WHAT WE OFFER Key Services – Engineering and Sustainability Consulting





///// ENGINEERING AND SUSTAINABILITY CONSULTING Key Services

CIRCULAR ECONOMY

- STRATEGY AND CORPORATE
- DEVELOPMENT
- Circular Economy Guidelines and Strategies
 - Procurement Strategies
 - Life Cycle Carbon Assessments
 - C2C Industrial Product Passports
 - Material / Product Consulting
 - Building Circularity Passport[®]

OPERATION

Urban Mining





Measures for continuous optimization CIRCULAR ECONOMY CHALLENGES

Life Cycle Assessment

Ensure detailed documentation of all materials procured from different **suppliers and locations** through a third-party certified EPD.

Separability

Facilitate **connection techniques** adopted between different layers that require frequent replacements.

Dismountability

Design for disassembly by focusing on **interchangeability and adaptability** of individual functional units.

Material Health

Pollutant-free design can be implemented directly during design stages and lessons learned can be used across different projects.

Material Sourcing

Ensure a **locally sustainable supply** of resources with the focus on secondary materials.

Material Recovery

Intelligently **planned materials** can be recovered in a high-quality manner, thus increasing the residual value.



///// STEP I - METHODOLOGY - URBAN MINING – INVENTORY (BUILDING LEVEL)

1.	2.	3.	4.	5.	6.
Determination of the installed materials	Assessment of the material quality and potential problematic substances (Based on the C2C pollutant report)	Initial assessment of potential recycling routes and potentials of reusable and recoverable components and materials	Rough estimate of the monetary material values and recycling costs or revenues as well as the environmental pollution	Creation of material flow analysis (variants)	Creation of recommendations for the dismantling specification and implementation
Quick Scop of the structure	Detailed Scap of most		Circular stakeholders	Material flow chart is created	Decumentation is prepared for
envelope and fit-out on global	interesting materials	Circular stakeholders commitment on materials and	commitment on materials and	based on	the demolition project, as
Weight		valorization technology	valorization LOI	manufacturers/Contractors commitment	appendix to the tender file
	Visual shaek, desumentation				
Identification of the most	analysis, destructive analysis,		Disassembly mode, packaging,		Evaluation Grid, Specification
building element	laboratory controls, manufacturer tests, demolition	Materials/products are	transport, location, destination, parties involved	Client commitment on goals,	Bill of Quantities, List of
	tests, evacuation route and on	preserve, upcycling, recycling,		recycling percentage and identified materials	buyers (commitments)
List of actions	regulations, local stakeholders	thermal recovery, landfill	Signature of LOL		
			Signature of Lor		Contractor award



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///// OUTPUT : INVENTORY

IVENT	ORY	Localisa	ation						Qu	antiti	es			R	lecycl ooten	ling tial				He disass marke	alth – sembly t inter	y− rest
		↑																	י			
DREES &							-												-			
SOMMER																					Date	04.01.202
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	Vurs extérieurs élément vertical	Bélon.	Niveau 2-6		0.12	60			2,500		149.494	1.9%			149.494					•		
	Mura extérieuro la paroi intérieure de la cavité Mura extérieuro assement fation	Magoniteria et isolation Bellon	November D		3,3	9	-	-	1.690		34.648	0.2%			12.951	13.189	1.465					<u> </u>
	Murs extérieurs- parement Bétan, parapet (sal et plafond)	Béton.	Niveau D		50			m ²	2.500		34.982	0,2%			14 932							
	Murs exbinieurs- parament bitton, parapet (sol et plafond) autres	Belton.	NVMM 0		0,12	1		n°	2.500		8.124	105			3.174				-			
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09	Murs entitrieurs: façade brigues	Terre Cuite	Nyess 1-9	626	0.05	31			1.800		56.324	0,4%		56.324						•		
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	Garage - porte	Menuiseries mitalliques	Nivers 0	-			1	R.		500	800	1.0%			800							
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	Wers interieurs	Digres.	Teut	405				-	50		24.045	4,2%				24.043						
Interior Hour Finishes	faction	Carrelage of ramique	Nyany 0.4	1.154					17		20 712	1.15				29,722						
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	finition	Vingl	Teut	5.609				m²	3		25.828	0.2%				15.145	1.663					- · ·
and a contract of the second s	PP data	care de lides	Tevales	26					382		4.275	0.74		4.275								
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24	Laminates TL Recomment Collina	Mature down	Test Notes 2	-																		
19	Wireirs (130cm x 60cm)	Vene	Teut				20	<u>×</u>	18		360	0.0%		350						•	•	
18	Constitues Witt (Miscon) Constants (Miscon & Blicon)	Céramique Céramique	Teat	-			31	*	20		1.022	100		1.027								+ :-
17	Séparateurs Uninoirs (78cm x 8cm)	Céramique	Tout				28	pc.	10		180	0,0%		280						•	•	•
18	Lavation double variaue (130cm x 30cm) Radiateurs	Vertilia-convertieurs	Teat	-			20	*	15		800	0,0%		900						· · ·		+ •
31	Dévidoirs d'incendie (30m)	Mital	Teut				30	9K				0,0%										•
22 Outdoor Facilities (myreta)	Chevelletes + divers	Nesi .	Teat																			
and a second second	Munit extérieur	Magonnerie	Nyess 0	1	29			m ³	1.000		54,218	0,45				48.796	5.422					
	Muret extérieur	Return.	Niveau 3	1	29			- m ²	2.900		56.408	0,0%				50,767	3.643					



///// OUTPUT : TECHNICAL SHEET

SOMMER	2			SUMME	
Projet	Arlon 77		07 Réf Fiche	Projet	Arlon 77
Matériau				Matériau	
identifié				identifié	
	Matérieu	Laine de roche			
	Emploi actuel - type	Isolation des cloisons démontables			Em
	Localisation	Niv. +1 et +9.			
	Quantité disponible estimée	1251 m2			Quantité di
	Poids total estimé	3.128 kg			P
	Mode d'assemblage	Pose entre panneaux sans fixations			Mo
	Dimensions				
	Etat	Bon état			
	BIM - Code BBsfB				
	Article CDC	Cf cdc AR curage (art. 12.07.05, à vérifier)			
				12	
		-			
nstes de reemplo	by reuthisation			Pistes de réen	ploi/ réutilisation
	Valorisation proposée	Réemploi ex situ			Valor
	Vérifications nécessaires	Etat de l'isolation avant dépose sur palette: panneaux e demi panneaux accepté sur 10% d'une palette!	ntiers jusquà		Vérificat
	Préconisation démantellement	Démontage solgneux et dépose de l'isolation après cont sur palette (25 - 28 couches) + film plastique de protect	rôle qualité		Préconisation
mages référence				Images référe	nce

Projet	Arlon 77		10 Réf Fic
Matériau			
identifié	Matériau	Boir , boir paint	
	Emploi actual - tuna	Boster intérieurer	2.2
	Localization	Nbr +0 à +9	122
	Quantité disponible estimés	462 m3	
	Poids total estimé	12 722 kg	
	Mode d'assemblare	44.7A6.76	
	Dimensions	Diverses	
	Etat	Etat variable	1
	BIM - Code BBsfB		
	Article CDC		-
	Article CDC		
Distan da rá			
Pistes de réemp	ploy reutilisation		
	Valorisation proposée	Réemploi ex situ	
	Vérifications nécessaires	Intérêt marché réemploi avant démontage	
		Démontaite solitineux et dépose propre sur palette avec protection	
	Préconisation démantellement	entre feuilles de portes.	
Images référen	ce		



///// OUTPUT : URBAN MINING STRATEGY





///// OUTPUT : URBAN MINING PASSPORT

Bâtiment existant



Projet



PROJECT

Reference	Area Total Weight of New buildin	g & Weight of New building	
66.295	m² 125,516,243 kg	100%	

Total Building New Weight Distribution



_OBJECTIVES & RESULTS

The reconstruction process integrates all potential re-used materials for five material families: New, Re-used, Recycled, Renewable, and Bio-sourced materials. The following visual tracks the current progress for the percentage of materials that have been re-used on site.





URBAN MINING – ZIN/WTC



CIRCULARITY AS AN ENGINE FOR INNOVATION

Circularity is a very important aspect of the ZIN project. The existing building will be kept to a maximum. The underground floors and traffic cores will be preserved. The elements that will be demolished will be given a new life. Overall, more than 95% of all existing materials and equipment will be recovered or recycled.

Circular thinking is not only based on recovery and certification, it is also based on a very long-term perspective for the building. ZIN is therefore not only focused on today's needs, but can also be adapted in the future to meet tomorrow's needs.

Main topics

- Urban Mining with C2C Mindset
- Upcycling
- Material Passport
- Build for Disassembly Design



/////

ZIN – FLEXIBILITY & ADAPTABILITY



Physical Flexibility : building elements can be adapted.



Functionnal Flexibility : space can be adapted.





/////

ZIN - URBAN MINING STRATEGY

Industrial approach





///// REFURBISHMENT

1972

2020



Moeroppervlak: 170 000 m² Gewicht : 275 000 T

 Nieuw:
 275 000 T

 Grond:
 400 000 T

 Afval:
 41 000 T



Behouden:193 000 TGerecycleerd ter plaatse:15 000 TGerecycleerd elders:52 000 TAfval:15 000 T

Geen vernietiging van groene ruimte



Vioeroppervlak: 170 000 m² Gewicht : 315 000 T

Nieuw:	107 000 T
Behouden delen:	193 000 T
Gerecycleerd ter	plaatse:15 000 T
Afval:	7 512 T
Grond :	OT



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///// ZIN – MATERIAL FLOWS

The Institute Cradle to Cradle Certified®

CRADLE TO CRADLE

Resource

INNOVATION INSTITUT<u>E</u>

News





///// URBAN MINING - ZIN





///// URBAN MINING - ZIN

Uclycled materials and reused materials (insulation, concrete, partitions, stones, raised floors)



Isolation



Carreaux de tapis



Partitions



Fibre minérale



Pierre naturelle



Carreaux de terrasse



Faux planchers



Panneaux de bois



Vitrages



Aménagements intérieurs



///// **URBAN MINING - ZIN**





























///// STEP II - METHODOLOGY - URBAN MINING - IMPLEMENTATION (BUILDING LEVEL)

	1.	2.	3.	4.	5.	6.
1	Site preparation with the awarded Contractor	Identification and organization of the process (LCM)	Planification and Site Management	Storage & Reverse Logistic	Monitoring of the quantities and stakeholders	Financial streams
	Process, evacuation routes, stairs, lifts, façade access, storage, trucks delivery, crane	Feasibility study per material category (glass, partitions, insulation, etc) : technical and financial	Planification of works, material flows, responsibilities, qualities, timing	A storage manager has to be identified, with forklifts and packaging materials, according to buyers' conditions.	Daily monitoring of quantities and buyers, workload for the Contractor, trucks, pallets, qualities.	Identification of costs included in Contractor contract, external costs, transport, cleaning, lab tests, consultant, etc
	Contractor analysis for site installation, verification and risk assessment	Agreement on quantities, planning and process.	Circular Manager (Contractor or consultant) is responsible for the implementation plan.	Coordination of the materials from desassembly to storage, from storage to trucks or	Coordination of the confirmation of the use of materials (reuse, recycled)	Monthly financial report with savings, entries and non foreseen costs
			Deadlines and packaging	vehicules.		
	Action plan	Localisations and quantities per material	under his responsability.		Photo reportage of the	Einal financial report
				Excess materials are recycled	materials use and destination	



SOMMER

///// INDUSTRIAL TAKE BACK LOOPS : MANUFACTURER IS KEY

Sorting properly demolition waste on site, in order to define the right recycling loop and process

Industry requirement for remanufacturing process

Recycling rules since 2000 as production date.



Metal and bricks are sorted, mixed material are used for landscaping or fundation soil. Existing tiles made of mineral wool are difficult to be reused after several years of use, they are perfect for upcycling, when they have been fabricated no later than 2000, because they are biosoluble.

New products are fabricated out of raw materials, with the industrial performance and the Manufacturer guaranty. Compliance with regulation and environmental performance will always confirmed.









INDUSTRIAL TAKE BACK LOOPS

Glass out of demolition waste is recycled for bottles purpose.

Reuse the glass in interior or upcycle it into a new glass can be a challenge.



High quality glass is then converted into bottle glass, then green glass and brown (beer bottles).



Reusing pure float glass waste (not polluted) generates savings in carbon, energy and raw materials. Industrial process is cheaper and environmental more efficient.

Façade elements and glass panels performance are changing quickly, and usually are tailor made for a project. Reuse those materials are not possible, unless it has been designed in such a way.









///// INDUSTRIAL TAKE BACK LOOPS

Sorting properly demolition waste on site, in order to be able and ensure highquality recycling

Concrete Upcycling to be reused as structural material in future buildings



Recycled concrete aggregates are typically used for low-quality applications (road constructions). Using it for structural purpose is not common and need several audits and test to have bank insurance today.

High-Quality concrete with high recycled content is locally produced and reused on site, controlled and safe for the next use.











///// INDUSTRIAL TAKE BACK LOOPS

Material re-use instead of thermal treatment of wooden elements

Dismantling of structural components, treatment and remanufacturing

Health concern for composting, reuse products before incineration in a safe project.



Local authorities help circular projects by reusing products in fair and furniture



Reuse of High-quality materials have hidden costs difficult to resolve for a long-term project : storage, transport, mock-up, technical and financial studies, quality control, guaranties, controls, contractor risk.





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///// STEP III - METHODOLOGY - URBAN MINING - REPORTING (BUILDING LEVEL)



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///// URBAN MINING AND EMBODIED CARBON PASSPORT











///// LIFE CYCLE ANALYSIS – CARBON FOOTPRINT OF A BUILDING

Whole life carbon Circular economy **Embodied carbon** In-use Construction End of life Product Beyond building stage stage stage life cycle D **Benefits & Loads** nufacturin **Iransport** Iranspor Reuse Recovery Recycling **Operational carbon Operational energy B6 Operational water**

Carbon Footprint = embodied carbon + operational carbon

Comparaison distribution of carbon footprint for an office building.



Better buildings fabrics for the building envelope reduces the operational carbon and increases the impact of embodied carbon of the overall building. To comply to our climate targets the overall carbon footprint of the building stock needs to be reduced. Material re-use and recovery has an important impact and helps to achieve this goal.

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///// URBAN MINING - MARAIS



- Writing the urban mining note
- Monitoring of on-site operations
- Outgoing flow assessment : monitoring of quantities of demolition and construction waste
- Reuse of materials from demolition



///// URBAN MINING - MARAIS Desassembly and storage of on-site materials















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///// URBAN MINING - MARAIS

Non-separable materials are waste













///// URBAN MINING - U-SQUARE : MISSION



- Writing the urban mining note
- Monitoring of on-site operations
- Outgoing flow assessment : monitoring of quantities of demolition and construction waste
- Reuse of materials from demolition
- EFRO reporting (fiches, CO², waste, etc)



///// URBAN MINING - U-SQUARE

Reused materials

- Briks
- Windows
- Tiles
- Floor
- Door
- Stones
- Toilets
- Stairs
- Radiators
- Etc..









///// URBAN MINING - U-SQUARE Destination of the reused materials



Bricks



Outdoo glass used for indoor glass



Blue stones as indoor stones









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