

# SWIM and Horizon 2020 Support Mechanism

Working for a Sustainable Mediterranean, Caring for our Future

## Urban mining case studies

How C&D waste management may contribute to circular economy?



Day 2: Co-organised by



Presented by:

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**SWIM and Horizon 2020 SM Study visit CDW**

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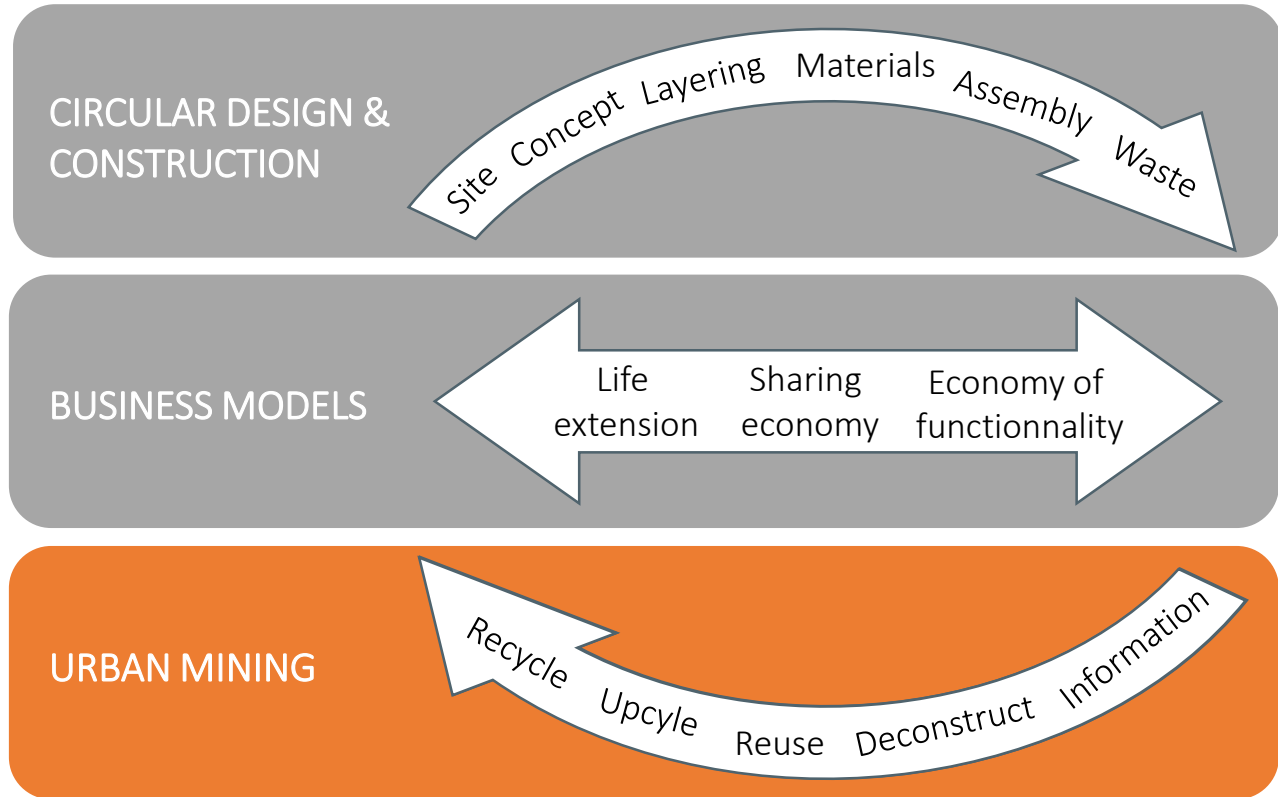
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umweltbundesamt

ATKINS

Urban mining is **“to imagine an economy in which today’s goods are tomorrow’s resources”** considering buildings as materials banks and waste as resources.



Achieving urban mining requests  
to **collect information** on  
the built elements and the materials used,  
then to carefully **deconstruct** them in order  
to optimize their treatment through  
**recycling** or **reuse**.

## Pre-demolition audit

A pre-demolition audit is a detailed record of the elements (material, quantities, dimensions, etc.) and is used for planning deconstruction

Auditing the building	Testing deconstruction	Reporting information
<ul style="list-style-type: none"><li>• Identify</li><li>• Note down</li><li>• Quantify</li></ul> <p>elements that represent a <u>potential for reuse</u> / <u>recycling</u></p>	<ul style="list-style-type: none"><li>• <u>Confirm the potential</u></li><li>• Give priority to elements easily salvageable</li><li>• Distinguish elements that could lead to loss of materials</li></ul>	<ul style="list-style-type: none"><li>• Photographic report</li><li>• Type and location</li><li>• Quantity to be recovered</li><li>• Estimate total mass</li></ul> <p><u>in a summary table</u></p>

# Reporting pre-demolition audit

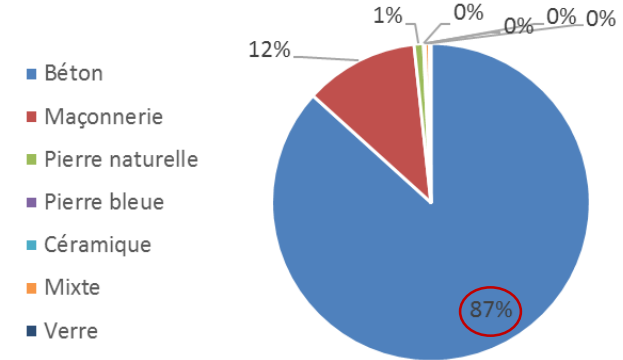
Code Eural	Matériaux	Localisation	Danger	Zone	Bâtiment / pièces	Nombre	longueur (m)	Hauteur / épaisseur (m)	Largeur / épaisseur (m)	Surface (m²)	Volume (m³)	Poids (tonnes)	Surplus de 10%
<b>17.01</b>	<b>Béton, carrelages en produits en céramiques</b>												
17.01.01	Béton											21029,521	23132,5
	Béton	hourdis			1-8	8	12,5	17	0,25		425	1062,5	
	Béton	hourdis			1-8	8	12,5	26	0,25		650	1625	
	Béton	hourdis			8	1	12,5	17	0,15		31,875	79,6875	
	Béton	hourdis			8	1	12,5	26	0,15		48,75	121,875	
	Béton	hourdis			1-9	9	47,5	20	0,25		2137,5	5343,75	
	Béton	hourdis			9	1	47,5	18	0,15		128,25	320,625	
	Béton	hourdis			9	2	7,9	5,3	0,15		12,561	31,4025	
	Béton	hourdis			9	1	3	2,3	0,15		1,035	2,5875	
	Béton	hourdis			-2 - 0	3			0,25	2200	1650	4125	
	Béton	poutres			1-8	10	47,5	0,5	0,8		190	475	
	Béton	poutres			1-8	10	77,5	0,6	1,2		558	1395	
	Béton	poutres			1-8	20	47,5	0,4	0,6		228	570	
	Béton	poutres			1-8	9	72	0,4	0,6		155,52	388,8	
	Béton	poutres			-2-0	24	48	0,7	0,5		403,2	1008	
	Béton	poutres			-2-0	6	45	0,7	1,3		245,7	614,25	
	Béton	poutres			-2-0	18	45	0,7	1		567	1417,5	

Pre-demolition audit (partial) (source : Thibaut Consultancy)

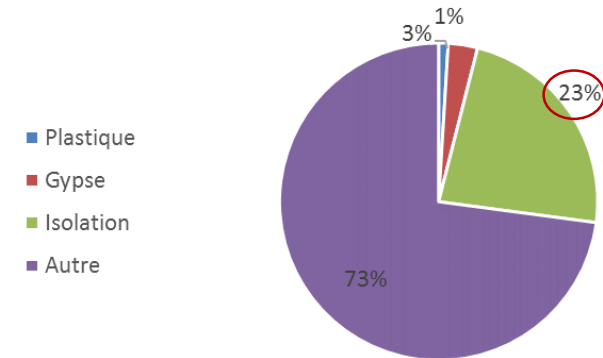
# Analysing pre-demolition audit

FLUX OUT	m³	T	%_m³	%_T		#
► <b>Inertes</b>	<b>10570</b>	<b>26609</b>	<b>74,7%</b>	<b>96,1%</b>		
Béton	8426	23074	59,5%	83,3%	Urinoirs	34
Maçonnerie	1949	3082	13,8%	11,1%	Toilettes	61
Pierre naturelle	114	253	0,8%	0,9%	Lavabos	86
Pierre bleue	17	37	0,1%	0,1%	Armoires	9
Céramique	-	6		0,0%	Fenêtres	871
Mixte	51	120	0,4%	0,4%	Portes verre	10
Verre	14	37	0,1%	0,1%	Stores alu	890
► <b>Bois</b>	<b>508</b>	<b>413</b>	<b>3,6%</b>	<b>1,5%</b>	Coffre-fort	1
Classe A	92	55	0,6%	0,2%	Chauffage (fer)	816
ClasseB	416	358	2,9%	1,3%	Armatures	2403
► <b>Mélange</b>	<b>3022</b>	<b>188</b>	<b>21,3%</b>	<b>0,7%</b>	Moteurs	10
Plastique	29	29	0,2%	0,1%	Citerne de mazout	2
Gypse	90	82	0,6%	0,3%	Chaudière	1
Isolation	699	23	4,9%	0,1%	Adoucisseur d'eau	1
Autre	2203	54	15,6%	0,2%	Tubes fluorescent	5242
► <b>Dangereux</b>	<b>19</b>	<b>93</b>	<b>0,1%</b>	<b>0,3%</b>	CFL	76
Mélanges bitumineux	-	85		0,3%	Clavier	1
Equipement dangereux	14	-	0,1%		Imprimeur	1
Amiante	5	8	0,0%	0,0%	Ordinateur	1
Ampoules et tubes fluo	-	-			serveurs	7
► <b>Métaux</b>	<b>36</b>	<b>386</b>	<b>0,3%</b>	<b>1,4%</b>	Installation ventilation	1
					ventilateurs	10
					Porte plaquée	307
					Porte à peindre	39
					Porte vitrée	161
					Porte coupe-feu	112
					Screens fenêtre	445
<b>TOTAL</b>	<b>14155</b>	<b>27688</b>				

Inerts (mass)



Mixed waste (volume)



## Reporting reusable audit

- Reusable (for sure)
- Salvageable (maybe)
- Not salvageable

10 tons expected to be reusable for sure

		Type d'élément	Quantité à récupérer	Masse (éval.)
V		Carrelage céramique 10x10 cm, damier rouge / beige moucheté	300 m <sup>2</sup>  (~400 m <sup>2</sup> en tout dans le bâtiment)	8400 kg
V		Carrelage céramique 10x10 cm, beige moucheté uni	150 m <sup>2</sup>  (~200 m <sup>2</sup> en tout dans le bâtiment)	4200 kg
V		Carrelage mural émaillé jaune	140 m <sup>2</sup>  (~190 m <sup>2</sup> en tout dans le bâtiment)	3100 kg
V		Carrelage mural blanc	20 m <sup>2</sup>  (~30 m <sup>2</sup> en tout dans le bâtiment)	450 kg

Reusable audit (partial) (source : Rotor)

## Deconstruction

Deconstruction consists in carefully extract built elements. It is achieved in order to get homogeneous waste streams or to get elements for reuse.



Tivoli, building Belgacom (picture : Rotor)



## better sorting → homogenous streams

- Pre-demolition audit
- Sorting at the source
- Optimal treatment channel



(source : Delta Partners)

## for reuse

- Economic criteria
  - Investment pro-reuse VS residual value of the material and a new equivalent material
- Technical criteria
  - Toxicity
  - Preservation of mechanical properties
  - Preservation of aesthetic properties.
  - Ability to be handled, transported and stored
  - Facility to be re-implemented.
  - Easy to dismantle
- Other criteria
  - Recurrence of elements
  - Normative changes
  - Heritage value
  - Demand

## Deconstruction and sorting on site



For REUSE  
(off site)

For treatment  
plant (50%  
incineration,  
50% landfill)

ONSS (pictures : Louis De Waele, Rotor)



# Tivoli neighborhood Renovation of Belgacom's building

Project Tivoli – BAM, Jacques Delens, CFE (Brussels, 2016)  
Source BBR

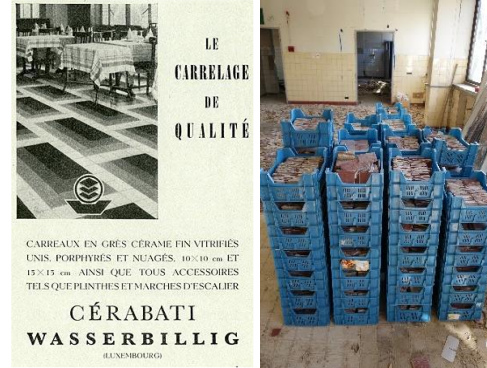






## Preparatory actions (be)for(e) reuse

(dismanteling)  
packaging  
transport  
repair  
cleaning  
documentation  
storage  
sale



Cleaning process  
(specific to materials)

- Chemical
- Mechanical
- Thermal



Source Rotor & CSTC

## Performance measurement and validation

Material storage... warehouse



## Reuse

Operation whereby non-waste products or components are used again for the same purpose for which they were designed



BEDZED (picture : BioRegional)

## Reuse of insulation



**Source** Louis De Waele & NAD

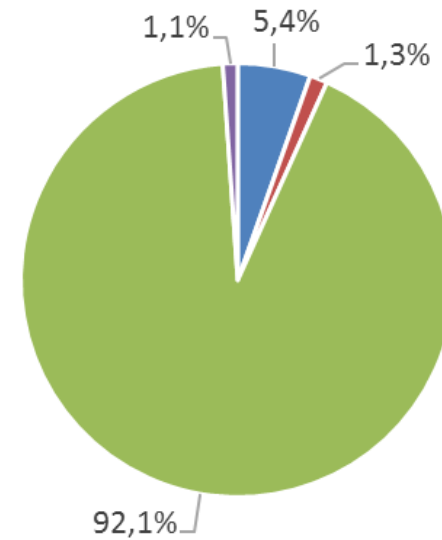


## Reuse compared to other treatment channels



	Landfill	Incinerat	Recycling	Reuse
<b>Inert</b>	1327 t	0 t	25006 t	276 t
<b>Wood</b>	0 t	331 t	59 t	23 t
<b>Mixed</b>	73 t	28 t	21 t	7 t
<b>Hazardous</b>	80 t	4 t	9 t	0 t
<b>Metal</b>	19 t	0 t	365 t	1 t
	<b>1500 t</b>	<b>364 t</b>	<b>25459 t</b>	<b>307 t</b>

- Landfill
- Incineration
- Recycling
- Reuse



Based on reusable audit and EOL scenarios

## Market value of reusable elements (theoretical)

Appellation des éléments	Pourcentage vendable	Estimation de prix en € (HTVA)
Plafond hall d'entrée	80%	605,52 €
Porte plaquée	90%	9 670,50 €
Porte à peindre	90%	1 228,50 €
Porte vitrée	90%	5 071,50 €
Porte coupe-feu	90%	6 048,00 €
Porte en verre	90%	720,00 €
Carrelage en marbre blanc	80%	2 160,00 €
Carrelage en marbre beige	80%	10 338,48 €
Parquet stratifié	90%	8 067,60 €
Lustre plafonnier	100%	750,00 €
Luminaire hall d'entrée	100%	130,00 €
Luminaire façade	100%	500,00 €

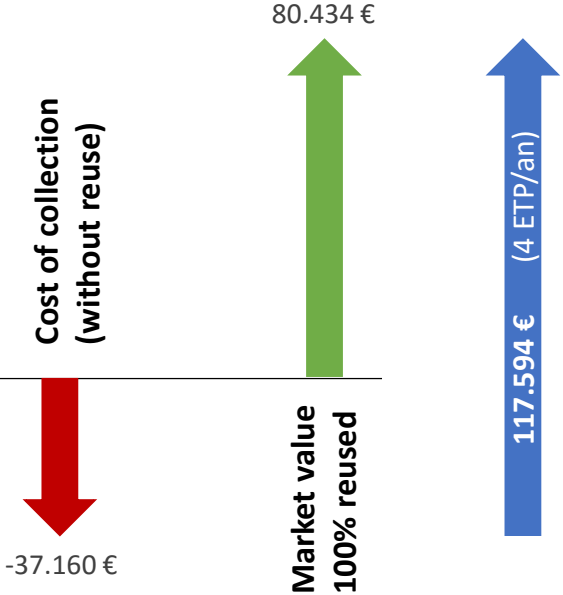
Urinoirs	90%	765,00 €
Séparateur d'urinoir	90%	432,00 €
Lavabos/vidoirs	90%	1 935,00 €
Parement mural en marbre blanc	80%	2 574,08 €
Carrelage mural sanitaires	60%	16 458,24 €
Couvre-murs en pierre bleue	90%	1 539,00 €
Couvre-murs en pierre bleue	90%	3 294,00 €
Mur en dalle de pierre bleue	90%	3 037,50 €
Blocs de béton	90%	900,00 €
Cache-radiateur en multiplex	65%	4 153,34 €
Escalier escamotable	100%	160,00 €
Horloge murale	100%	70,00 €

VALEUR TOTALE DU REEMPLOI	80 434,74 €
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Source : Rotor

# Economic added value of reuse

	Volume (m³)	# cotainers (12m³)	Cost of collection (estimated)
Inert	192,7	17	2720
Wood	82,5	8	1120
Mixed	1421,6	119	33320
Hazardous			
Metal	1	1	
	1697,8		37.160 €



## Recycle

operation whereby the waste is reprocessed into products, materials or substances for the purpose of their original function or for other purposes



Crushing plant, ABR (picture : CSTC)

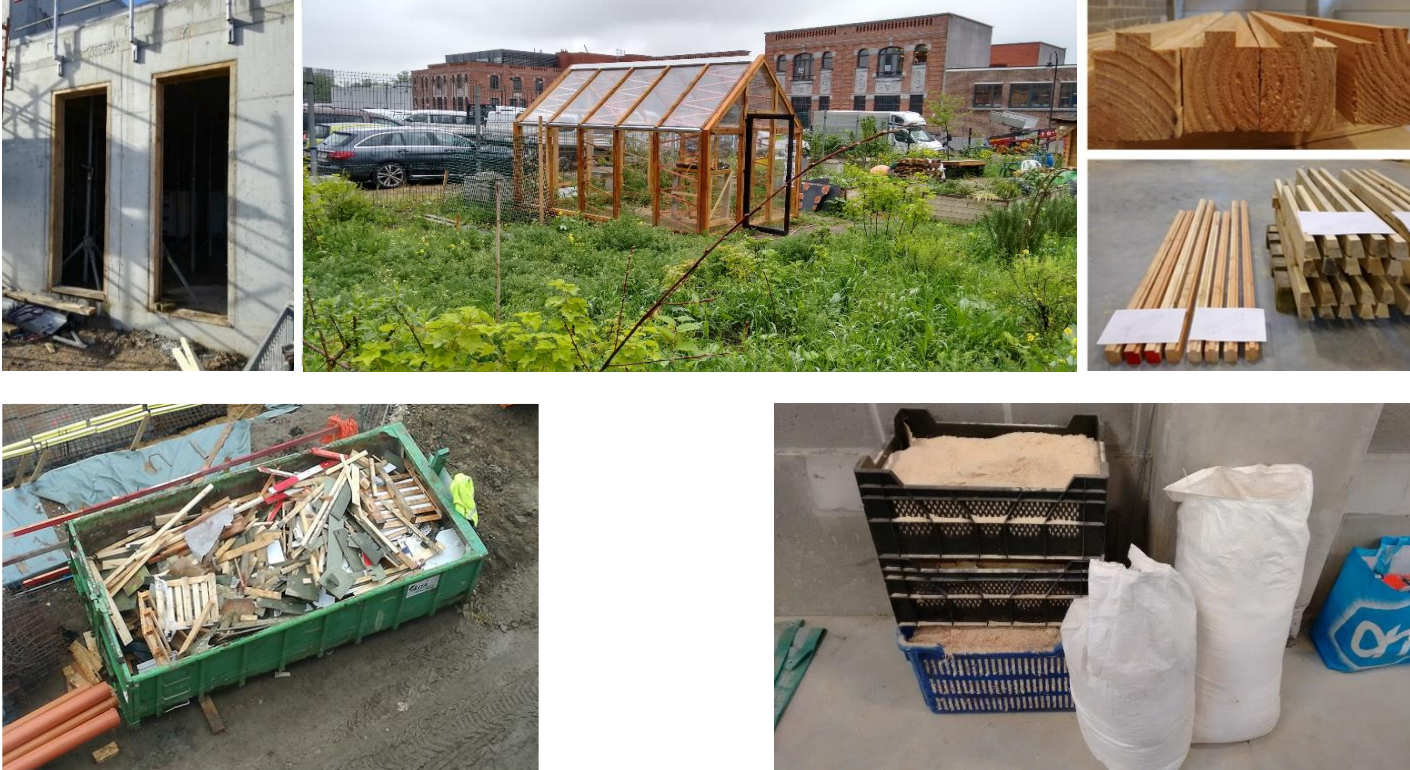
## Up-cycling / Super-use

Prototype greenhouse



Project Tomato Chili  
Source DZeroStudio

## Formwork wood waste = Resource for the creation of greenhouses



**Project** site Tivoli & Tomato Chili  
**Pictures** BBRI & DZeroStudio



# Recycling

## NATO Headquarter

- New NATO HQ in Brussels
- Demolition of >60 buildings : 200.000 t debris
- Idea : on-site aggregates valorization



© NATO

Source : IRMA project

## NATO Headquarter

### ‘Recyclability’

- Distinction in qualities of waste
- Attention for contaminants
- Distinction in different ‘types’ of elements

Concrete from roads	12 000	m <sup>3</sup>
High quality concrete (hangar floors, prefab)	19 000	m <sup>3</sup>
Concrete from building floors	8 800	m <sup>3</sup>
Mixed stony debris from buildings	27 000	m <sup>3</sup>
Asphalte debris	4 500	m <sup>3</sup>
Rubble from roads	39 800	m <sup>3</sup>
<b>TOTAL</b>	<b>111 000</b>	<b>m<sup>3</sup></b>



# NATO Headquarter

Need for clear & convincing data before decision (Differential results !)

- Constraints
  - Timeframe for execution
  - Space for storage
  - Hindrance for neighbours
- Recycling scenarios → future applications
- Calculated impacts (4)
  - 369,000 km of avoided transport
  - 2.1 Mio saved
  - New applications

	Off site	On site	On/off	No recycling
Transport [km]	400 000	31 000	42 000	800 000
Climate change [tons CO2]	350	9	20	704
Cost Estimation [€]	3.4 Mio	1.3 Mio	1.8 Mio	5.4 Mio

Source : IRMA project

## NATO Headquarter – crushing plant on site



Source : IRMA project

## NATO Headquarter – segregation of the aggregates



Source : IRMA project

# SWIM and Horizon 2020 Support Mechanism

Working for a Sustainable Mediterranean, Caring for our Future

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