

COST-MINEA Workshop, Odense  
29-30/10/2018

**THE BRUSSELS  
BUILDING STOCK  
SOURCE OF  
NEW  
MATERIALS**



**LE BATI  
BRUXELLOIS  
SOURCE DE  
NOUVEAUX  
MATERIAUX**

Jeroen Vrijders

Head of Laboratory Sustainable Development



**BELGIAN BUILDING RESEARCH INSTITUTE**

## BBRI – Belgian Building Research Institute

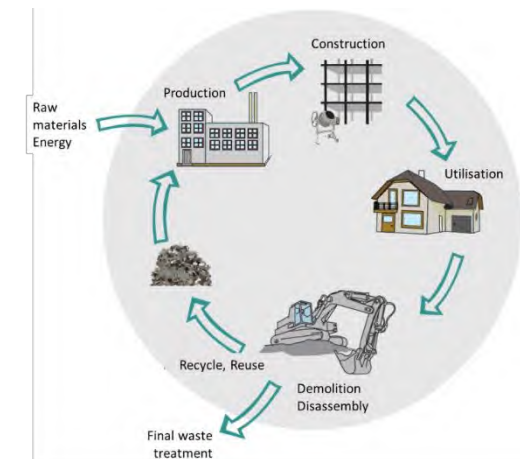
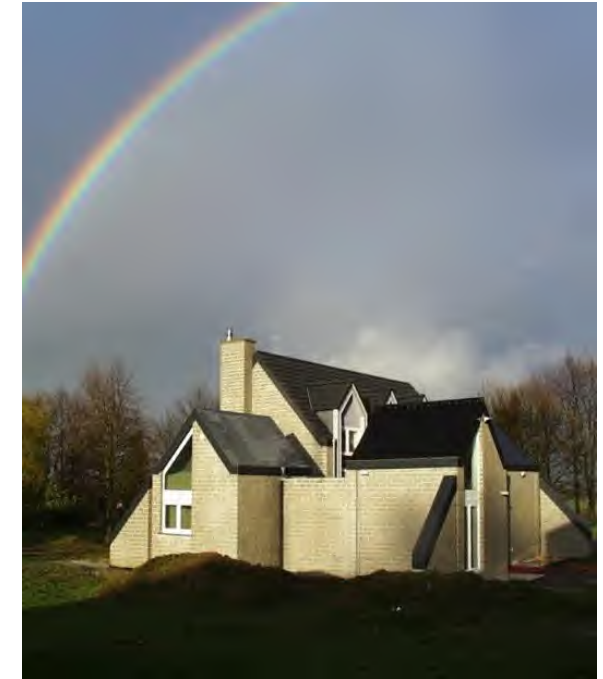
- PERFORM research
- SUPPLY information
- CONTRIBUTE to innovation

## SDR – Div. Sustainable Development and Renovation

- SUSTAINABLE BUILDINGS
- RENOVATION
- MICROBIOLOGY AND HEALTH

## SCO – Labo Sustainable Development

- BUILDING SUSTAINABILITY
- LIFE CYCLE ANALYSIS
- ACCESSIBILITY & ADAPTABILITY
- LIFE CYCLE COSTING
- DEMOLITION, RECYCLING & WASTE – Circular Economy





# BBSM - LE BÂTI BRUXELLOIS, SOURCE DE NOUVEAUX MATÉRIAUX



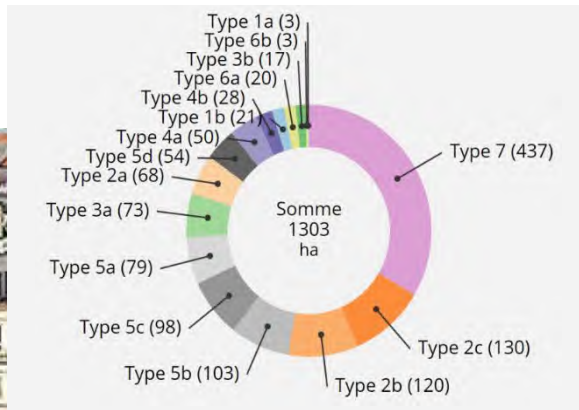
LE BATI  
BRUXELLOIS  
SOURCE DE  
NOUVEAUX  
MATÉRIAUX

## How to unlock the materials available in the Brussels Building Stock ?

### QUANTIFY THE TYPES & VOLUMES

### EXTRAPOLATION OF BUILDING PARK & CASE STUDIES

### DECISION TOOL (LCA, KM, ...)



### DEVELOPPING SOLUTIONS

### EXISTING VALUE CHAINS, NEW SOLUTIONS TO BE CREATED, ...

### STANDARDS FOR RECYCLING & REUSE



## Renovating Brussels: what is the material impact?

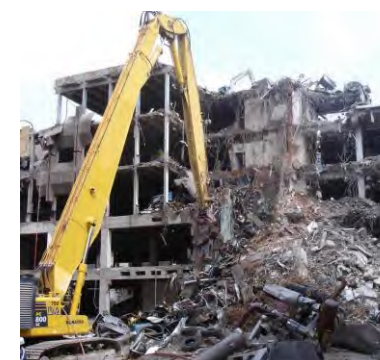
- MATERIALS in & out
- REUSED & REUSABLE materials & components
- MODEL-BASED

## Demolition & construction: key fluxes now & in the future?

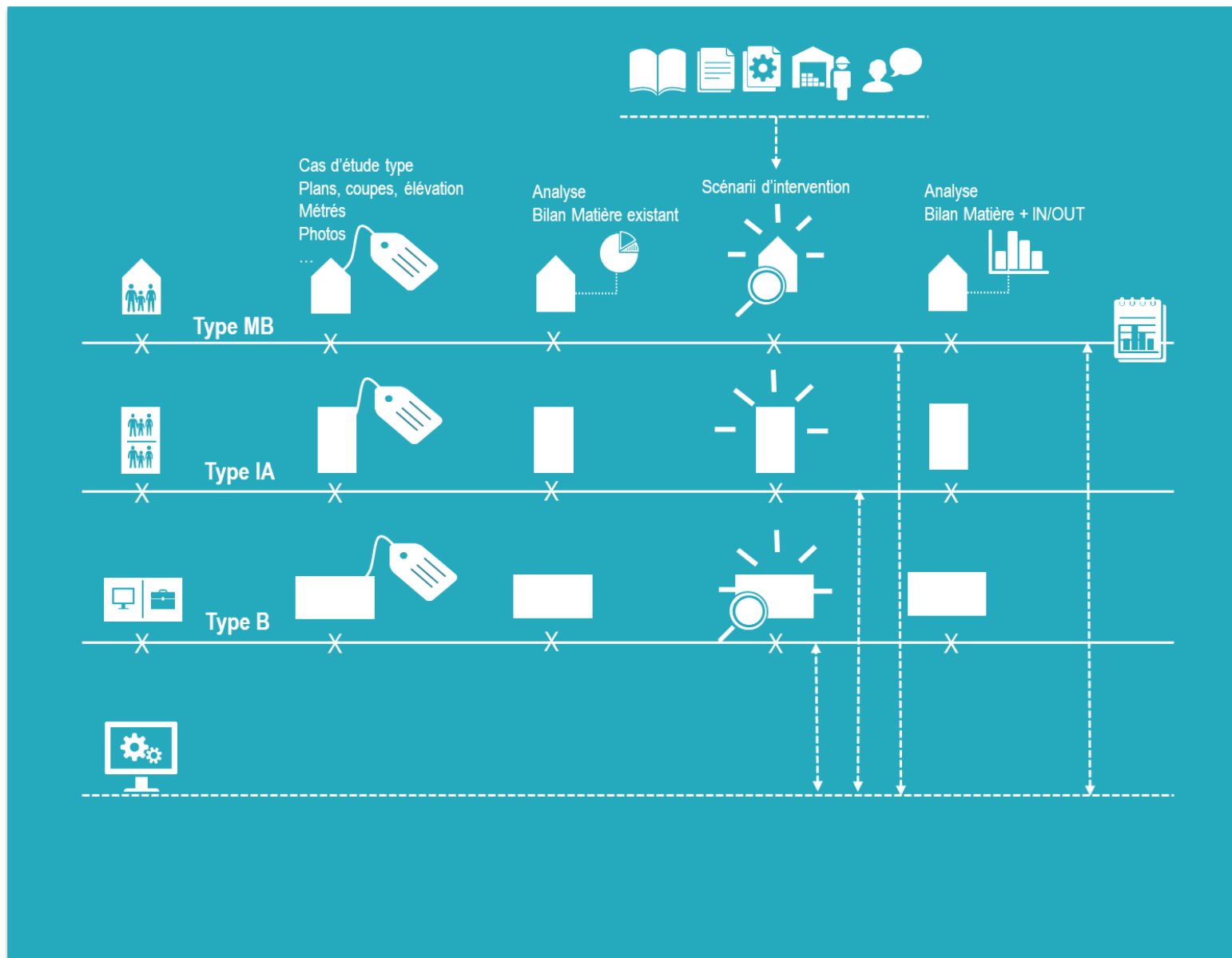
- LARGEST impact: volume, cost, potential, ...
- PRACTICAL solutions
- EXPERIENCE based

## Recycling & reuse: can knowledge on the existing help ?

- TECHNICAL framework
- EXPERIENCE & KNOWLEDGE
- Flow of INFORMATION







Compare & identify the impact of different intervention strategies in terms of material use, on different levels  
Extra aspects: environmental impact & potential for reuse (circular economy)

Building stock > Cases > Material flows

Modelling + Tool

Work by E. Gobbo, UCLouvain within BBSM WP2



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Het Gewest en Europa investeren in uw toekomst!

RÉGION DE BRUXELLES-CAPITALE  
BRUSSELS HOOFDSTEDELIJK GEWEST

Union Européenne  
Europese Unie  
European Union

Renovating Brussels: what is the material impact?

APPROACH

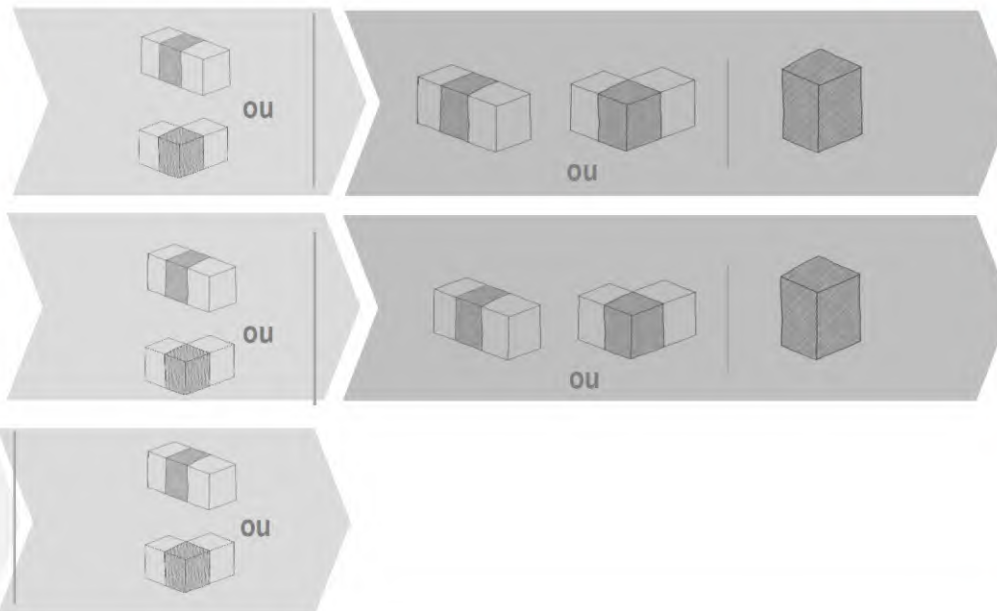


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## Analyse Typologique



~ 10 cas d'étude



- 1914

1918 - 1940

1945 - 1959

1960 - 1969

1970 - 1979

Bureaux

5%

6%

16%

19%

Logement

39%

15%

27%

26%

> 27%

48%

Σ 13.000.000 m<sup>2</sup> (2015)

Σ 194.269 bâtiments

Σ 473.216 U.hab (2008)

Source: [CERAA, 2008; SPF Economie, 2015; STAT, 2015; OdB, 2015; B3Retootool, 2015]

### Step 1 - Building Stock Analysis

Focus:

- Typologies
- Age
  - Construction period
  - Energy consumption

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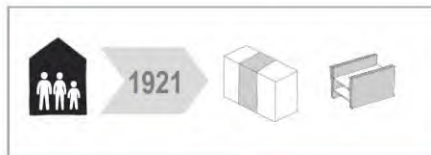
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Renovating Brussels: what is the material impact?

APPROACH

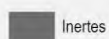
2

## Analyse Cas d'étude > Gisement



MB.2' - 1921

## Échelle Analyse



Liants minéraux



Bois



Métar



PI



10



## Step 2 – Case study compilation

PhD. Emilie Gobbo

Existing, In/out, Future stock

Work by E. Gobbo, UCLouvain within  
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## Renovating Brussels: what is the material impact?

## APPROACH





## Step 2 – Case study compilation

Renovation scenarios:

- Out (demolition)
- In (energy saving measures)

Qualification & quantification



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Renovating Brussels: what is the material impact?

APPROACH





## Step 3 – Case study results

Renovating: deep or not

Using reused/reusable materials or not

...

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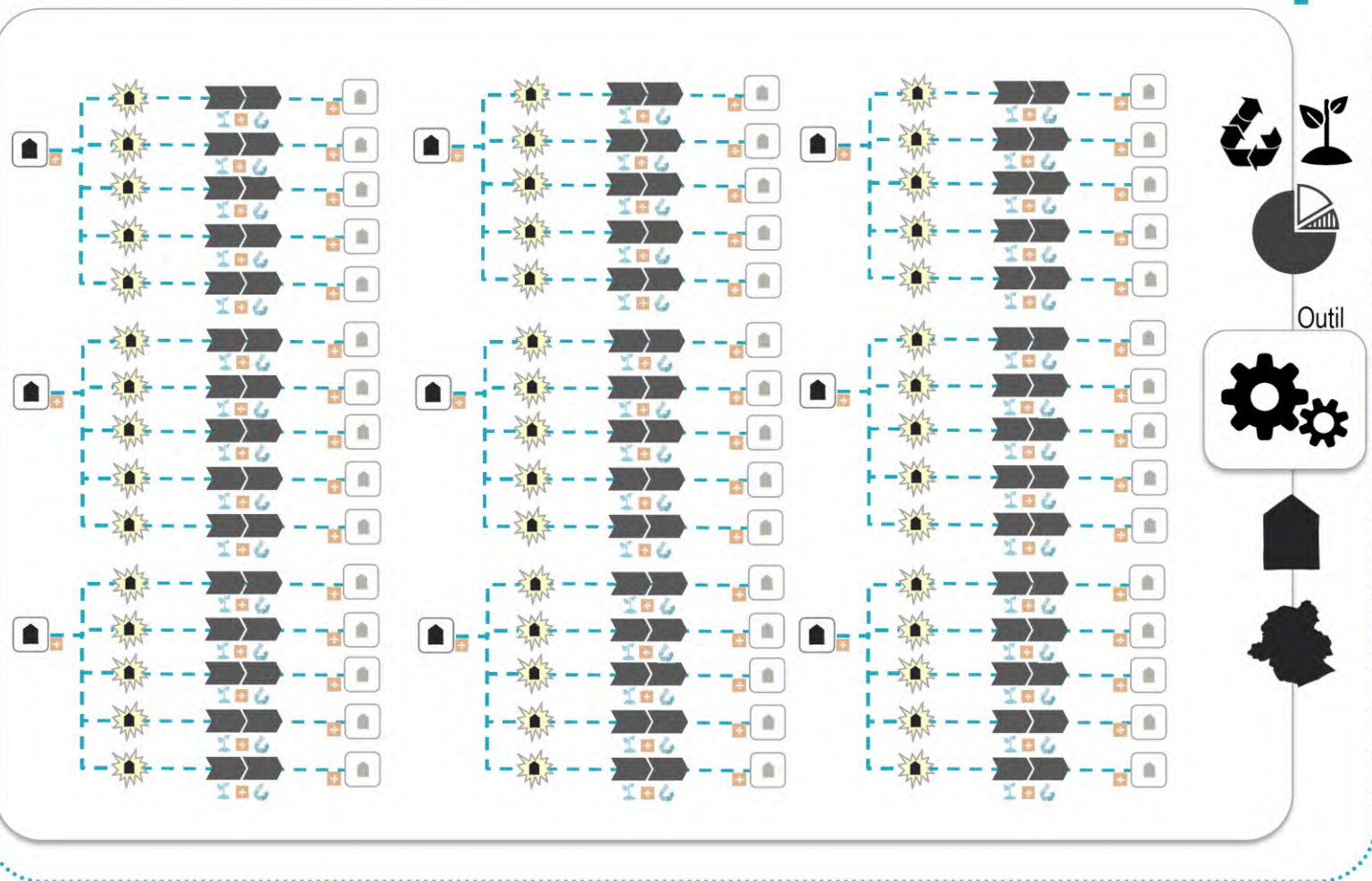


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Renovating Brussels: what is the material impact?

APPROACH



## Step 4 – “Extrapolation”

Insight in:

- Total material & waste flows
- Impact of choices on the Brussels building stock
  - Energy
  - Material (volumes & types)
  - Circularity

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Renovating Brussels: what is the material impact?

APPROACH

## Renovating Brussels: what is the material impact?

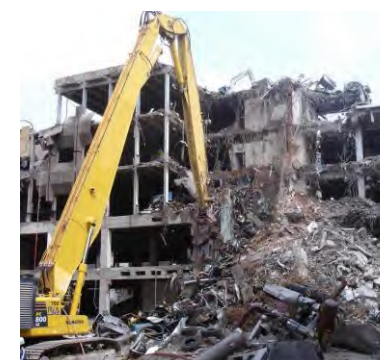
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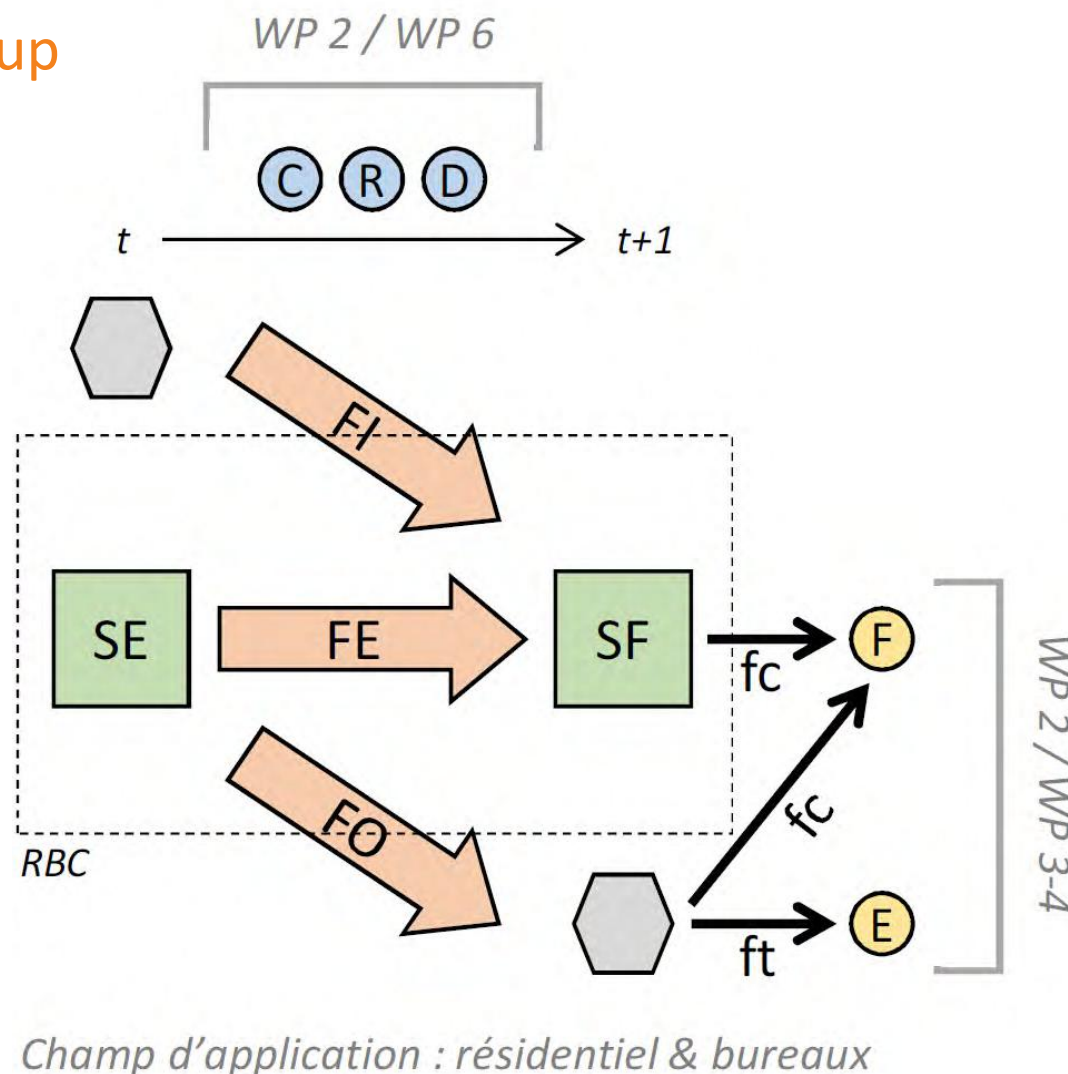
- TECHNICAL framework
- EXPERIENCE & KNOWLEDGE
- Flow of INFORMATION







## Bottom-up

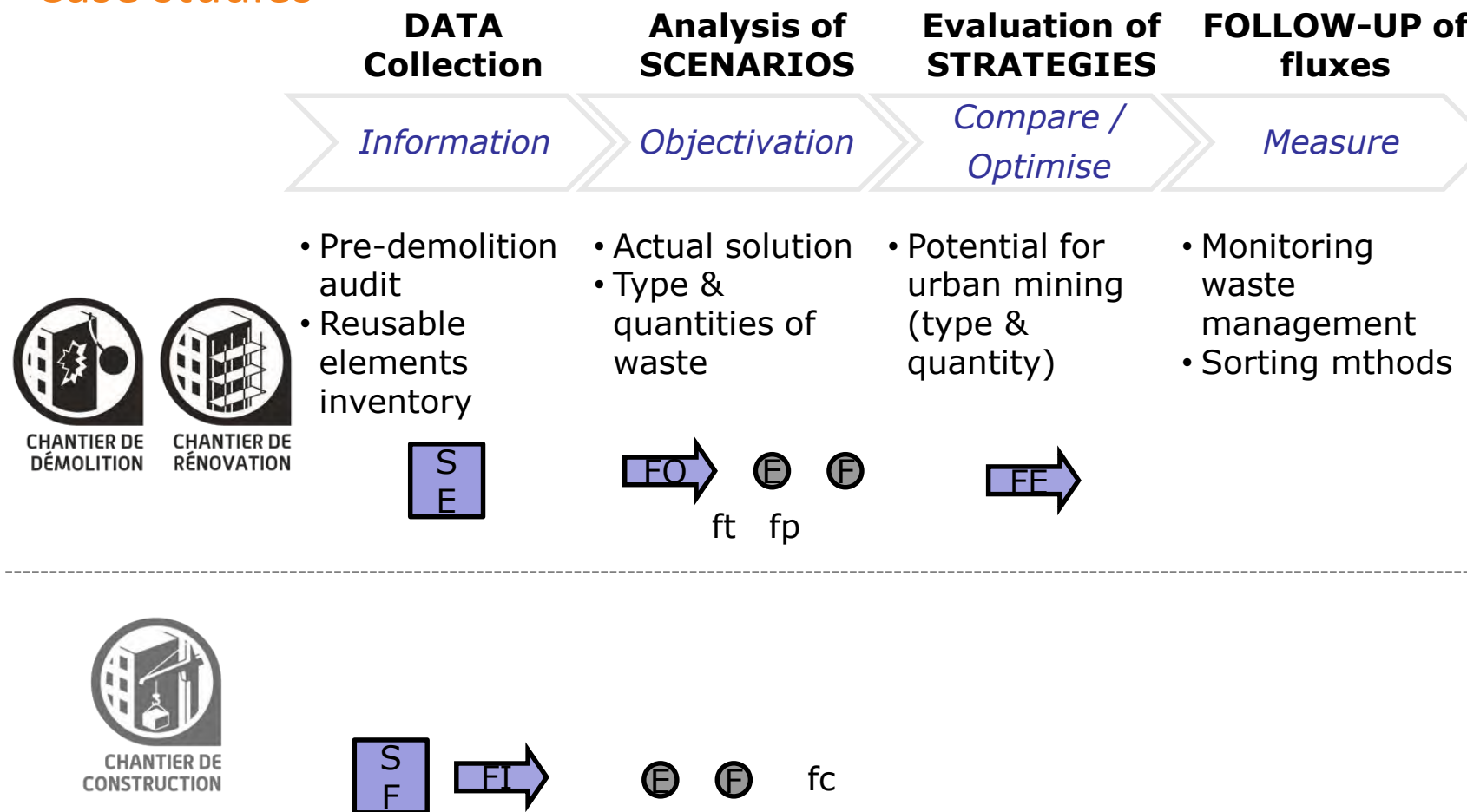


Demolition & construction: key fluxes now & in the future?

APPROACH



## Case studies



- Actual data
  - Validation UCL
  - Demolition !
- Brussels materials flows
  - Quality & quantity
  - Challenges
  - Potential for improvement
- Optimisation of resource use
  - Geographical flows
- Real life boundary conditions
  - Solutions needed for ...
  - Technical framework

\* Les étapes de collecte de données et de suivi de gestion des flux pour les chantiers de construction sont réalisées dans le cadre du projet « Chantiers pilotes de gestion innovante des déchets de construction à Bruxelles », financé par l'IBGE dans le cadre des actions du PREC.

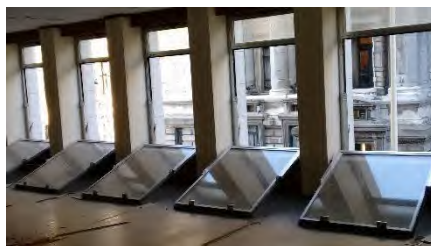
Demolition & construction: key fluxes now & in the future?

PROCESS

# Case studies



- Offices
- 1962
- 63700 m<sup>3</sup>
- 23590 m<sup>2</sup>



- Offices
- Daycare
- 1980
- 4330 m<sup>3</sup>
- 1430 m<sup>2</sup>



Demolition & construction: key fluxes now & in the future?

CASES





# Key Waste Fluxes

- Important quantities
  - Interesting for the region of Brussels
  - Waste management solution not (yet) optimised/existing
- ... now or in the future

## IDENTIFICATION →

Actual & future flows:

- $\%x \geq P_{30}$
- $\Sigma \%x \geq 70\%$
- $E3\_x \leq 70\%$

## CARACTERISATION →

Properties of waste flows

- Inert/Dangerous/EPR/...
- Treatment on site (separated, ...)
- Current solution

## EVALUATION →

Potential of this flows, based on :

- "niveau de valorisation" de la filière
- Valorisation level
- Disposal rate
- Environmental impact
- Volume in 2030 2050 2070
- Reuse potential (dismountability, sortability, ...)
- Cost compared to new

## ACTION

Creating new solutions or reinforcing existing solutions

(1) BRE, *Dealing with difficult demolition waste*

Demolition & construction: key fluxes now & in the future?

KEY WASTE FLOWS

# Case 1

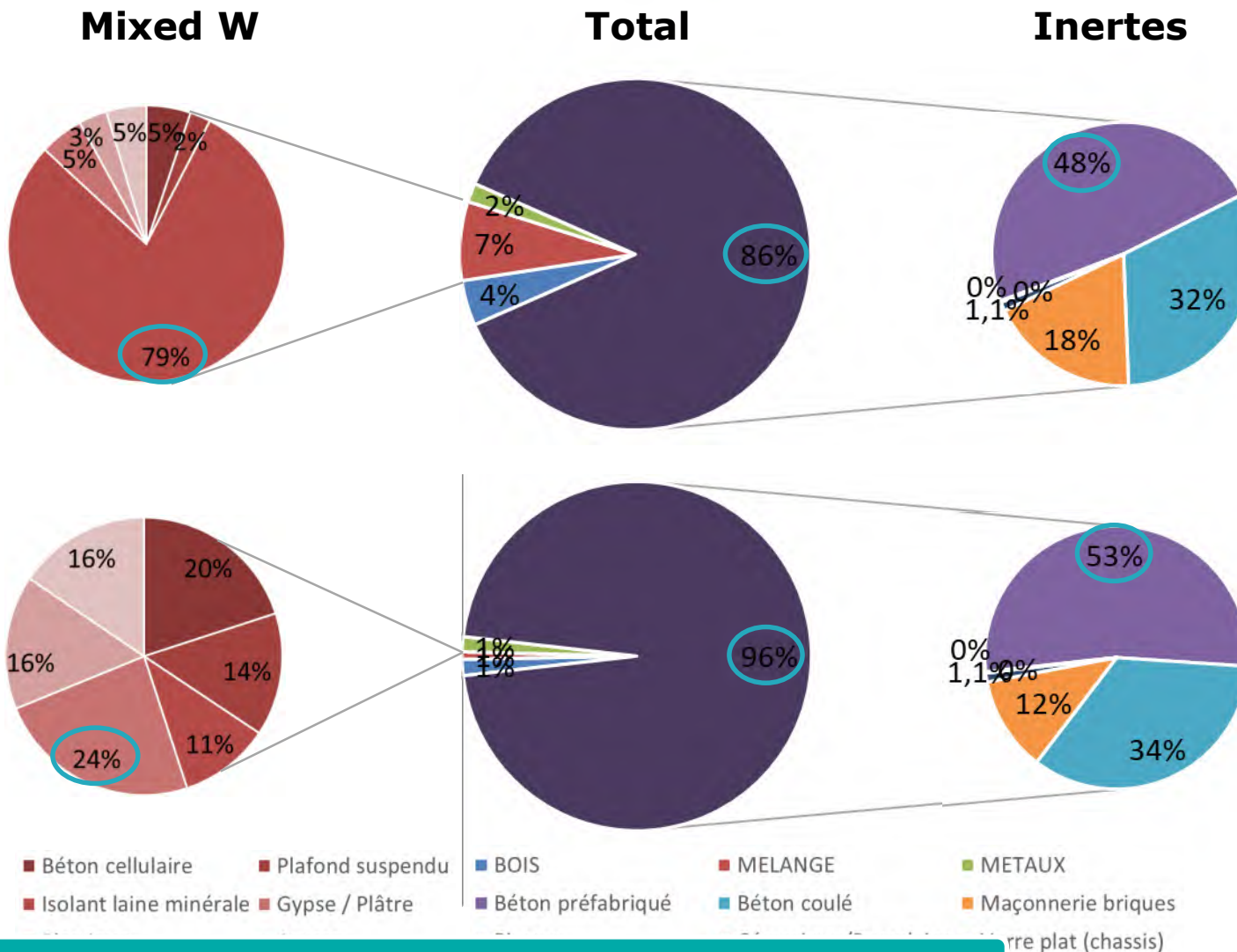
## Stock Existing

12.228 m<sup>3</sup>  
 27.565 T  
 (≈ 4% C&D W/y)  
 52 m<sup>3</sup> / 100m<sup>2</sup>  
 117 T / 100m<sup>2</sup>

% m<sup>3</sup>  
 % T

Volume

Masse



Demolition & construction: key fluxes now & in the future?

INSIGHTS

# Case 1



## Flux Out & Existing Solutions

m³ (#

T

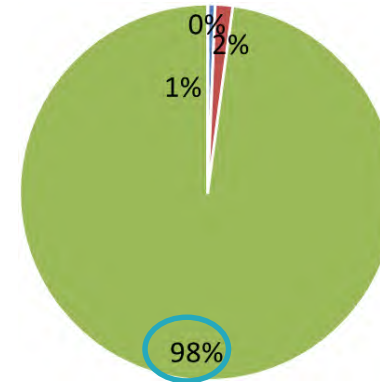
Treatment (m³)

Treatment (T)

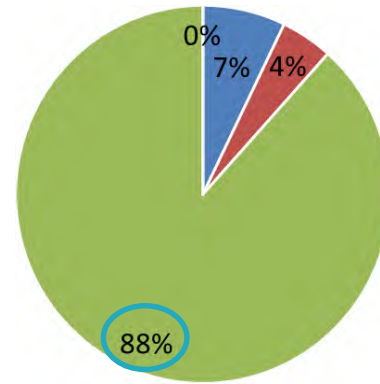
- E\_1: Décharge
- E\_2: Incinération
- E\_3: Recyclage
- E\_4: Réemploi

Indicateurs	m³ (fois)	T	E_1 (m³)	E_2 (m³)	E_3 (m³)	E_4 (m³)
<b>INERTE</b>	<b>14745</b>	<b>26489</b>	<b>5</b>	<b>0</b>	<b>14741</b>	<b>0</b>
Béton coulé	4343	9091	0	0	4343	0
Béton préfabriqué	7628	13984	0	0	7628	0
Pierre naturelle	171	253	0	0	171	0
Pierre bleue	26	37	0	0	26	0
Maçonnerie briques	2534	3082	0	0	2534	0
Céramique/Porcelaine	24	6	4	0	20	0
Verre plat (chassis)	20	37	1	0	19	0
<b>BOIS</b>	<b>875</b>	<b>413</b>	<b>0</b>	<b>711</b>	<b>163</b>	<b>0</b>
Panneaux	672	341	0	639	34	0
Autres - Bois A	166	55	0	41	124	0
Autres - Bois B	37	17	0	31	6	0
<b>MELANGE</b>	<b>1309</b>	<b>188</b>	<b>1202</b>	<b>36</b>	<b>71</b>	<b>0</b>
Béton cellulaire	68	38	48	0	20	0
Plafond suspendu	38	27	38	0	0	0
Isolant laine minérale	1049	20	1049	0	0	0
Gypse / Plâtre	54	45	43	0	11	0
Plastique	38	29	4	15	19	0
Autres	62	29	20	20	21	0
<b>METAUX</b>	<b>430</b>	<b>386</b>	<b>0</b>	<b>0</b>	<b>430</b>	<b>0</b>
Aluminium	4	5	0	0	4	0
Acier	388	244	0	0	388	0
Autres	38	137	0	0	38	0
	<b>17449</b>	<b>27568</b>	<b>1247</b>	<b>782</b>	<b>15405</b>	<b>0</b>
			7%	1%	88%	0%

Masse



Volume



Demolition & construction: key fluxes now & in the future?

INSIGHTS



# Case 1

#1 – Percentile 30  
 #2 – 70% of building  
 #3 – recycling rate ≤ 70%

ⓕ ft fc

Volume				Masse			
	#1	#2	#3		#1	#2	#3
Béton préfabriqué	41,6%	1	1	Béton préfabriqué	50,8%	1	1
Béton coulé	27,4%	1	1	Béton coulé	33,0%	1	1
Maçonnerie briques	16,0%	1		Maçonnerie briques	11,2%	1	
Isolant laine minérale	5,7%	1	1	Panneaux bois B	1,2%	1	1
Panneaux bois B	3,2%	1	1	Pierre naturelle	0,9%	1	
Acier	1,6%	1		Acier	0,9%	1	
Pierre naturelle	0,9%	1		Autres	0,5%	1	
Autres - Bois A	0,8%	1		Mélanges bitumineux	0,3%	1	
Mélanges bitumineux	0,6%	1		Autres - Bois A	0,2%	1	
Béton cellulaire	0,4%	1	1	Gypse / Plâtre	0,2%	1	1
Gypse / Plâtre	0,4%	1	1	Béton cellulaire	0,1%	1	1
Autres	0,3%	1		Pierre bleue	0,1%	1	
Plastique	0,2%	1	1	Verre plat	0,1%	1	
Plafond suspendu	0,2%	1	1	Plastique	0,1%	1	1
Autres - Bois B	0,2%	1	1	Autres	0,1%	1	
Céramique/Porcelaine	0,1%	1		Plafond suspendu	0,1%	1	1
Pierre bleue	0,1%			Isolant laine minérale	0,1%		1
Autres	0,1%			Autres - Bois B	0,1%		1
Equipements	0,1%			Amiante	0,0%		
Verre plat	0,1%			Céramique/Porcelaine	0,0%		
Amiante	0,0%			Aluminium	0,0%		
Aluminium	0,0%			Equipements	0,0%		
Ampoule et tubes fluo	0,0%			Ampoule et tubes fluo	0,0%		

fc : minimal 2 criteria  
 and no 'others'

- Prefab Concrete
- Ready Mix Concrete
- Mineral Insulation
- Wooden Pannels
- Plafond suspendu
- Aerated / Cellular Concrete
- Gypsum & plasterboard
- Plastics



Demolition & construction: key fluxes now & in the future?

INSIGHTS

## Case 2

#1 – Percentile 30  
 #2 – 70% of building  
 #3 – recycling rate  $\leq 70\%$

**F** fc

Volume					Masse				
	% (m³)	#1	#2	#3		% (T)	#1	#2	#3
Béton coulé	65,0%	1	1		Béton coulé	69,5%	1	1	
Béton préfabriqué	14,6%	1	1		Béton préfabriqué	15,6%	1		
Ciment, etc.	6,9%	1			Ciment, etc.	7,0%	1		
Autres (mélanges)	3,6%	1		1	Métal armature	3,2%	1		
Verre plat	2,4%	1			Béton bloc	2,0%	1		
Béton bloc	1,9%	1			Verre plat	0,9%	1		1
Gypse/Platre (plaque de plat	1,7%	1		1	Autres (mélanges)	0,7%	1		1
Isolant laine de verre	1,1%	1		1	Gypse/Platre (plaque de plat	0,6%	1		1
Métal armature	0,9%	1			Inertes vrac	0,6%	1		
Isolant (autres)	0,8%	1		1	Gypse/Platre (plafonnage)	0,2%	1		
Isolant PIR	0,8%	1		1	Métal aluminium	0,1%	1		
Inertes vrac	0,6%	1			Métal structurel	0,1%	1		
Isolant verre cellulaire	0,5%	1		1	Béton cellulaire (bloc)	0,1%	1		1
Béton cellulaire (bloc)	0,4%	1		1	Béton dalle	0,1%	1		
Gypse/Platre (plafonnage)	0,3%	1			Roofing bitumineux	0,1%	1		1
Isolant PUR (panneau)	0,2%	1		1	Isolant verre cellulaire	0,0%	1		1
Roofing bitumineux	0,1%	1		1	Carrelage sol	0,0%	1		
Béton dalle	0,1%	1			Carrelage mural	0,0%	1		
Panneaux bois B	0,1%	1		1	Isolant laine de verre	0,0%	1		1
Bois revêt. extérieur	0,1%		1		Plastique EPDM	0,0%			1
Plastique EPDM	0,1%		1		Bois revêt. extérieur	0,0%			1
Carrelage sol	0,0%				Panneaux bois B	0,0%			1
Carrelage mural	0,0%				Isolant (autres)	0,0%			1
Métal aluminium	0,0%				Isolant PIR	0,0%			1
Métal structurel	0,0%				Plastique PE	0,0%			1
Plastique PE	0,0%		1		Bois revêt. intérieur	0,0%			1
Bois revêt. intérieur	0,0%		1		Isolant PUR (panneau)	0,0%			1
Carrelage plinthe	0,0%				Carrelage plinthe	0,0%			

fc : minimal 2 criteria and no 'others'

- Prefabricated concrete
- Ready Mix Concrete
- Gypsum & plasterboard
- Glass wool
- PU/PIR insulation
- Cellular Glass Insulation
- Aerated concrete
- Roofing (bituminous)
- Wood
- Flat glass

**Demolition & construction: key fluxes now & in the future?**

INSIGHTS

## Renovating Brussels: what is the material impact?

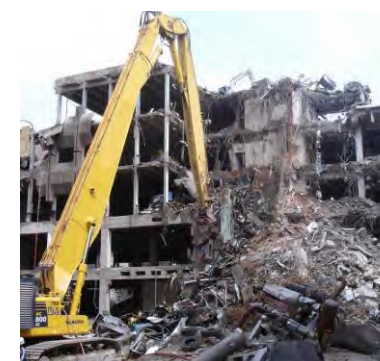
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# How to assess & guarantee (technical) quality of reused & recycled building materials & products?

## Disadvantage:

ad hoc

extra processes

## Advantage

history of use

**Recycling & reuse: can knowledge on the existing help ?**

**APPROACH**

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