

# Realizing the potential of Materials Passports for circularity and material health

What's next on the road towards a circular Real estate and construction sector?

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# Welcome

## AGENDA

- Introduction
- How Materials Passports support the vision of BAMB
- Case study
- What is next



# Circularity

## STRUCTURAL WASTE IN THE BUILT ENVIRONMENT

### CONSTRUCTION



- **10-15%** of building material wasted during construction

- **0-0.5%** productivity increase per year in most European countries 1990-2015, whereas 2% per year achieved in some countries

### UTILISATION



- **60%** of European offices are not used even in working hours

- **50%** of residential dwellers report living in too much space

### USAGE



- **20-40%** of energy in existing buildings can be profitably conserved

- Passive building standards at or near profitability for most new-build segments, but still only constitute a minority of buildings

### END OF LIFE



- **54%** of demolition materials landfilled, while some countries only landfill 6%

- Most materials unsuitable for reuse as they contain toxic elements

### URBAN PLANNING:

- **50%** of most city land dedicated to infrastructure
- **11 million households** experience severe housing deprivation
- Congestion cost **2%** of GDP in many cities

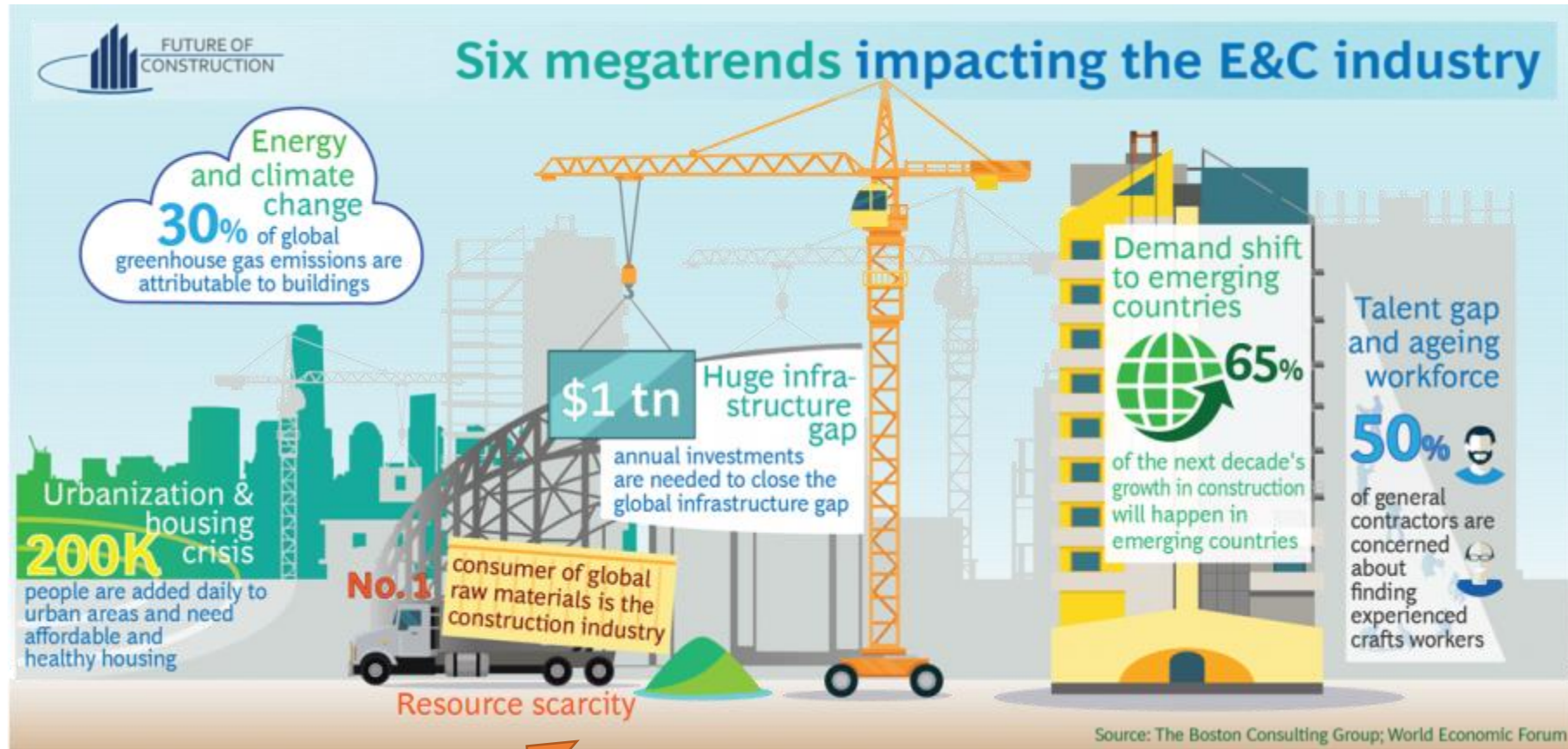
Source: Norm Miller, *Workplace Trends in Office Space: Implications for Future Office Demand*, University of San Diego, 2014; GSA Office of Governmentwide Policy, *Workspace Utilization and Allocation Benchmark*, 2011; Flexibility.co.uk, *Shrinking the office*; IEA Statistics © OECD/IEA (<http://www.iea.org/stats/index.asp>) Energy Statistics and Balances of Non-OECD Countries, Energy Statistics of OECD Countries, and United Nations, *Energy Statistics Yearbook*; European Commission, *Service contract on management of construction and demolition waste*, 2011.

Source: [https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation\\_Growth-Within\\_July15.pdf](https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_Growth-Within_July15.pdf)



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# Circularity



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# Material Health



Source: <https://s3.amazonaws.com/hbnweb.dev/uploads/images/buildings-with-orange-endpoint-icons.jpg>



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The BAMB project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

# Material Health

Cundall's new office in London focused on improved indoor air quality, including continuous monitoring of air and the use of healthy materials.

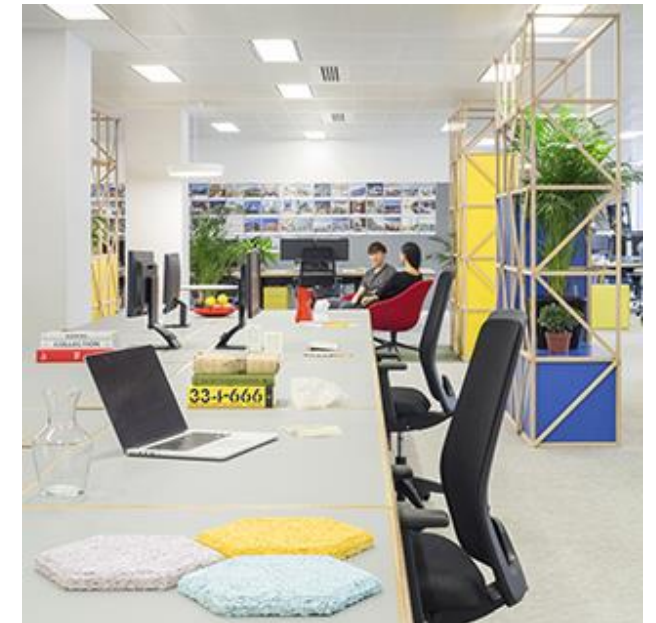
These has saved the company £200,000 due to a reduction of 4 sick days per year/employee and a 27% reduction in staff turnover.

Source: [http://www.worldgbc.org/sites/default/files/compressed\\_WorldGBC\\_Health\\_Wellbeing\\_\\_Productivity\\_Full\\_Report\\_Dbl\\_Med\\_Res\\_Feb\\_2015.pdf](http://www.worldgbc.org/sites/default/files/compressed_WorldGBC_Health_Wellbeing__Productivity_Full_Report_Dbl_Med_Res_Feb_2015.pdf)

[http://www.worldgbc.org/sites/default/files/WorldGBC%20-%20Doing%20Right%20by%20Planet%20and%20People%20-%20April%202018\\_0.pdf](http://www.worldgbc.org/sites/default/files/WorldGBC%20-%20Doing%20Right%20by%20Planet%20and%20People%20-%20April%202018_0.pdf)

[https://cundall.com/UploadedImages/04912731-4ad9-4f9b-b73b-7e6941905aed\\_\\_\\_Selected.jpg](https://cundall.com/UploadedImages/04912731-4ad9-4f9b-b73b-7e6941905aed___Selected.jpg)

## CUNDALL



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# Example (it is possible!)

Also awarded for most sustainable public procurement

## Regions make innovation happen: Värmland County wins the AER Regional Innovation Award 2014

17 April, 2014 By Alexandre Breckx



As an illustration of the strategic role that regions play in making innovation happen in Europe, our Assembly also unveiled its Regional Innovation Award (RIA) winner: Värmland County Council (SE). The region was awarded the prize following the building of a hospital in Karlstad, which aimed at monitoring and assessing an environmentally conscious choice of materials, as well as phasing out harmful chemicals in the construction of a new department for premature babies at the hospital.

The project builds on Värmland Landstinget's long established tradition in choosing the best environmentally friendly products in buildings. By controlling the selection of materials and managing the outputs, the project tries to avoid using material which will cause the structure to be in need of sanitizing or decontamination at a later stage or which might cause illness.



# Department for premature babies

What they did:

- Used products with low emissions and without (low-level) dangerous substances (criteria).
- Documented all products including content and location.
- The process was well defined, also the criteria was well known and all actors were involved.
- Instructions for maintenance were also connected to the products and places.
- SundaHus material data as a tool.





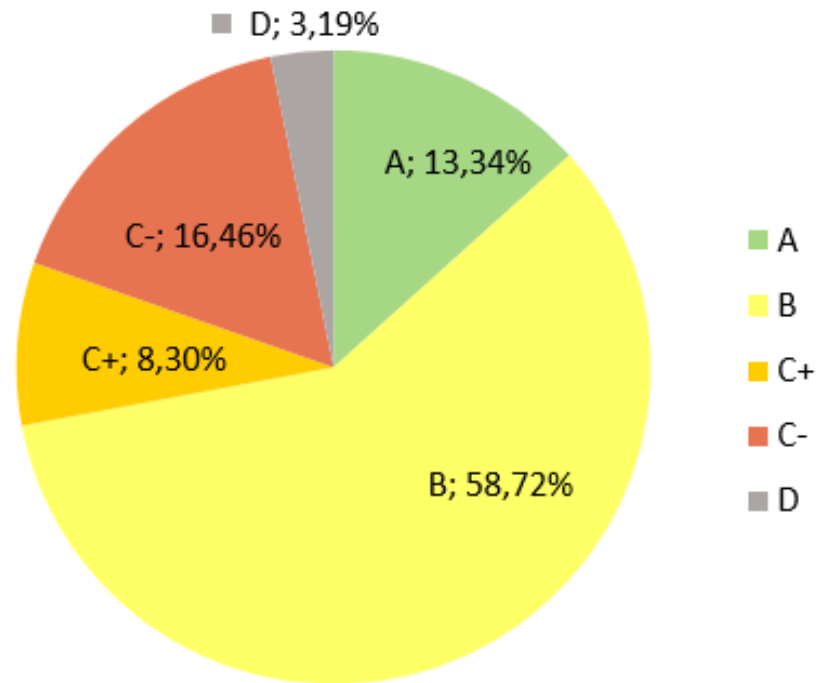
# Results

- Only flooring
  - 440 kg phthalates
  - 1,1 ton PVC
- Total reduction of:
  - 800 kg phthalates
  - 1,6 ton PVC
- The total extra cost 0,33 %.



## Distribution of products in projects 2015

(5 712 products)



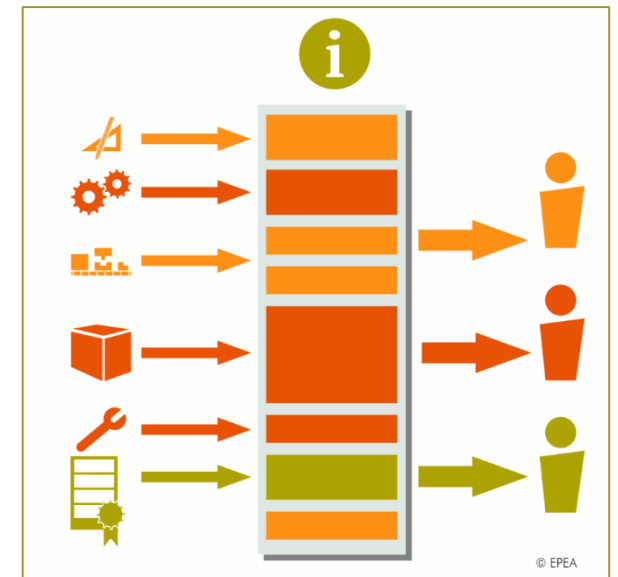
# What information do we need to reach a more circular and healthy built environment?



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# Materials Passports definition

Materials passports are (digital) sets of data describing defined characteristics of materials and components in products and systems that give them value for present use, recovery, and reuse.



# What type of information do we need to reach a more circular and healthy built environment?

What is in the product?

How to take it out of the building?

Who owns it?

Can it be reused as is?

Can it be recycled?

Can it be recovered?

Is it in bulk?

Metal	5,000 kg
Wood	5,000 kg
Glass	600 kg
Walls	250,000 kg
Ceilings	100,000 kg
Floor	30,000 kg



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# What type of information do we need to reach a more circular and healthy built environment?

- Different levels of information give different possibilities for insights...
- 5 000 ton steel:  
What type of steel is it?

**Search results** : 610 substances with 677 substance name

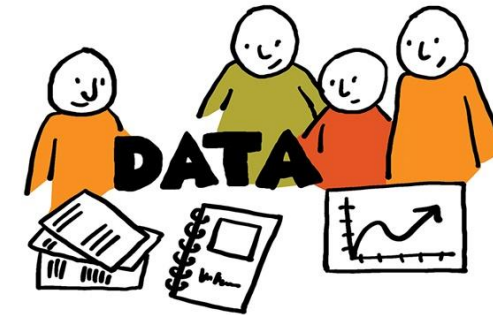
Substance name ▾
acid proof stainless steel
AISI 1020 Carbon Steel (UNS G10200)
AISI 1215 carbon steel
alloy steel
alloy steel
aluminium copper steel alloy
aluminium plated steel
aluminium zinc plated steel sheets
aluminium-zinc plated steel sheets, chromium plated
aluzinc plated steel sheets
aluzinc plated steel sheets SS1151-20 SS-EN 10 215 (1.0226)
Aluzinc steel sheets DX51D AZ150
Aluzinc steel sheets DX51D AZ185
ballast for LED - steel
black phosphated carbon steel
black steel
black steel EN 10241
black steel sheets
blue passivated steel
blue zinc passivated steel
brass and nickel plated steel
brass-plated steel
C35E/Ck35 steel
cadmium plated steel sheets
Carbofil steel

carbon steel ASTM A-526
carbon steel ASTM A715
Carbon steel C1020
carbon steel C1022
carbon steel C38D
carbon steel C76D (1.0614)
Carbon steel DC01 EN 10130
carbon steel DD11 (1.0332): EN 10111-2008
Carbon Steel EN 10132-4
carbon steel grad 4.8
Carbon steel SAE 1010
carbon steel SAE 1015
carbon steel SAE 1016L
carbon steel SAE-AISI 1022 (G10220)
carbon steel SS 1370
carbon steelI2142
carbon steelI2172
carbon steelI2391
carbon steelI520 M
carbon-manganese-steel (ASTM A449-83a) zinc plated
cermented carbide steel
chrome plated steel
chromium plated galvanized steel
chromium plated nickel plated steel
chromium plated steel
chromium plated steel 16MnCr5
chromium plated steel, 100Cr6
chromium plated steel, unspecified
chromium plated, zinc plated steel
chromium steel
chromium steel Cr/Ni 18-8
chromium(III)-plated steel
coated DX51D steel
cold rolled steel DC-05 EN 10130



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# Major systemic changes have been identified to support the BAMB vision



# HOW do Materials Passports support change in design culture?

- Circular design thinking
- Systemic and whole approach



# HOW do Materials Passports support change in value definition?

- Support more circular business models
- Public Procurement
- Calculate future costs/revenues





# HOW do Materials Passports support change in collaboration between all actors?

- Digitalization enables actors to collaborate
- Other platforms/tools for example Circular Building Assessment



# How much of an ordinary building do you think could be reused if the right information was available today?



The BAMB project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

# Case Study: Steel

- Can providing the actors with additional data help to reduce the cost of re-use?



Source: <https://www.quora.com/I-want-to-build-a-1000-sq-ft-building-How-much-stone-brick-and-cement-is-required>

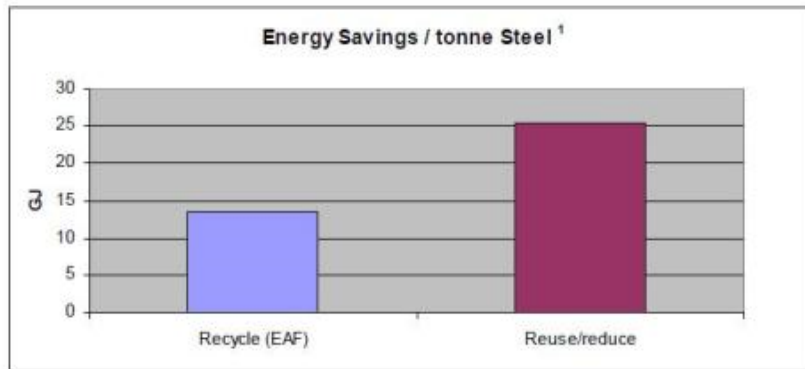
# Structural steel re-use sounds very logical



It's technically feasible

It's better for the environment

Reduce & Reuse Vs Recycle



Source: The Crucible Group - A lifecycle perspective in steel building materials. April 2006  
1 – Comparison with Basic Oxygen Furnace

BedZED London

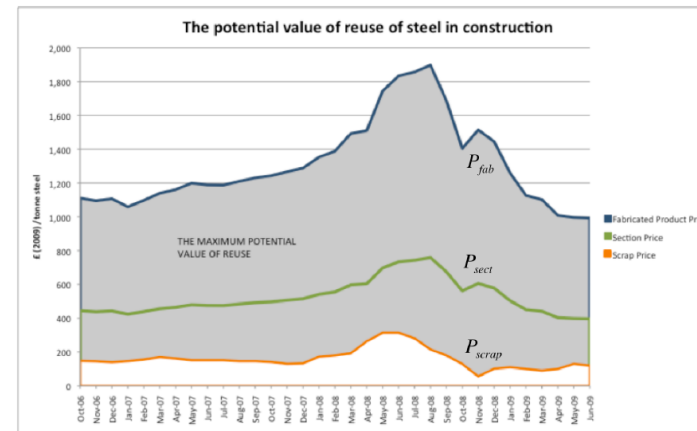


Figure 2: The maximum potential value of reuse Oct 2006 - Jun 2009

Source: Cullen & Drewniok, Univ. Cambridge (2016)

And it can be economically attractive



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## But it's not really happening yet...



Year	Author	Reuse	Recycle	Landfill	Note
2001	Steel Construction Institute	12%	93%	5%	Heavy sections
2006	Gorgolewski <i>et al.</i>	10%	90%	nil	Sections, Canada
2012	EUROFER	7%	96%	2%	Heavy sections

Source: Cullen & Drewniok, Univ. Cambridge (2016)



# Case Study



Re-use is often more expensive than new!

Cost component	New steel beam (£/t)		Re-used steel beam (£/t)		Actor
	Min	Max	Min	Max	
Striking down	0	0	120	165	Demolition contractor
<b>Steel</b>	<b>530</b>	<b>750</b>	<b>200</b>	<b>300</b>	Stockist
Std operations	110	110	110	110	
Steel cost	400	600	90	190	
Premium uncommon sections	20	40	-	-	
Testing	0	0	145	175	
<b>Reconditioning</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>200</b>	Fabricator
Shot blasting	0	0	15	55	
Removing welds	0	0	0	25	
Removing end plates	0	0	85	120	
<b>Fabrication</b>	<b>498</b>	<b>700</b>	<b>498</b>	<b>700</b>	
Administration	50	65	50	65	
Design	55	80	55	80	
Bolts/primer	25	35	25	35	
Erection	120	165	120	165	
Cuts/Welds/Drills/Shot blasting	248	355	248	355	
Transport & handling	20	25	65	75	Other
<b>TOTAL</b>	<b>1048</b>	<b>1475</b>	<b>1128</b>	<b>1615</b>	
<i>Difference</i>			<b>+80</b>	<b>+140</b>	

Table 3: Cost comparison new and re-used elements

Numbers based on: Dunant et.al., 2018



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## Can we make it cheaper and easier, by making the right data available?



- Steel grade
- Weldability
- Source mill
- Production date
- Fabrication original building
- Details original building
- Section sizes
- Beam location
- Connection geometry
- Usage history
- Loading history
- Building purposes
- Exposure to fire
- Deconstruction method
- Coatings and surface treatments used



## Material Passports can help to lower financial barriers of structural steel re-use



Use case	Customer group	Value proposition of data	Added value
Direct re-use of structures	General contractors	Sourcing advantage	Up to 1000 £/tonne
Direct re-use of elements	Fabricators	<ol style="list-style-type: none"> <li>1. Sourcing advantage</li> <li>2. Cost reductions (lower testing and reconditioning costs enabled by technical/usage data)</li> </ol>	Up to 800 £/tonne
Remanufacturing (re-fabrication)	Stockists	Cost reductions (lower testing and reconditioning costs enabled by technical/usage data)	150 -250 £/tonne



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# What is next



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*Thank you!*

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