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Sustainability: Environmental Product Declarations for road restraint systems

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Introduction

- Transportation and Construction sectors consume large amounts of energy and produce high levels of CO_2-equivalent emissions.
- For the assessment of the sustainable use of resources and of the impact of construction works on the environment Environmental Product Declarations (EPD) should be used when available. (CPR, (56))
- It is fundamental to consider sustainability when designing new solutions for road infrastructures and for construction of road networks.
- In the future CPR will require construction products to sustainably use natural resources.(CPR, (55))

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What's an EPD

- An EPD is an independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products.
- An EPD is created and verified in accordance with the ISO 14025.
- The EN15804 provides core product category rules for all construction products and services.
- EPD, already used for buildings, will be more & more required in Green Public Procurement process for infrastructure.
- EPD is valid for 5 years.

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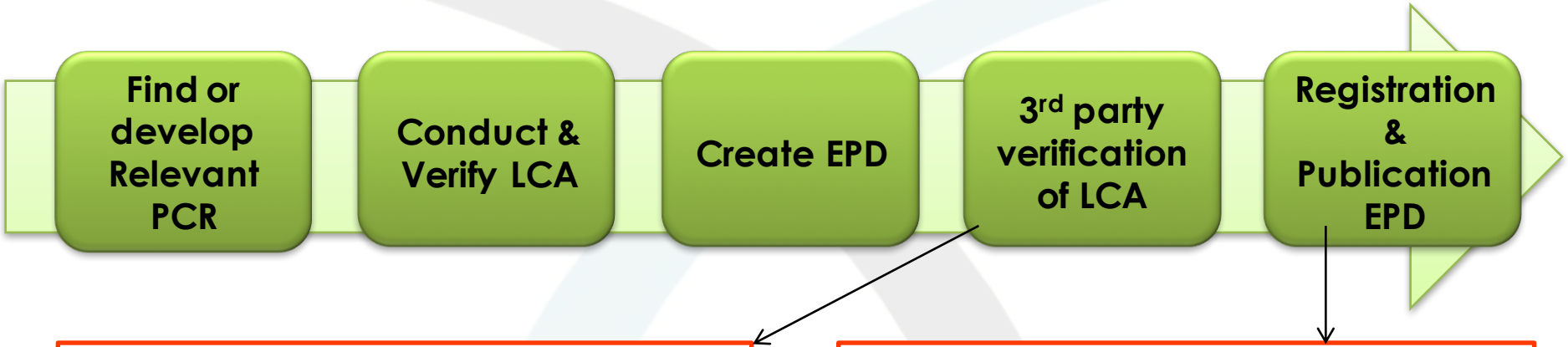
EPD process

- Five steps to create an EPD:



Data and modeling

Quality ensured by the German Institute of Building and Environment (IBU)

Visibility and international recognition

Eco-platform hosts EPD and ensures mutual recognition across system operators

THIRD-PARTY VERIFIED EPD ISO 14025 and EN 15804 — Institut Bauen und Umwelt e.V.

ECO PLATFORM

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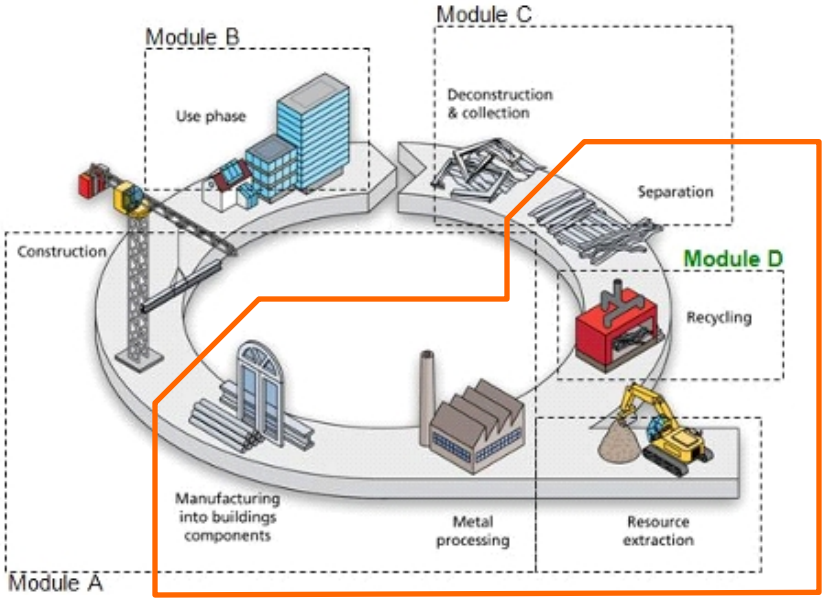
EPD in a glance

- Contains all relevant info (technical features of the products, modelling approach and assumptions, data sources)
- System boundaries:



5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 ton of reinforcing steel in bars

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	1.23E+3	4.28E+0	-1.78E+1
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	2.00E-8	1.24E-9	7.93E-11
Acidification potential of land and water	[kg SO_2-Eq.]	8.43E+0	1.98E-2	-6.81E-2
Eutrophication potential	[kg $(PO_4)^3$-Eq.]	4.18E-1	2.53E-3	-5.37E-3
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	5.73E-1	1.80E-3	-9.96E-3
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	4.33E-3	1.40E-6	1.46E-6
Abiotic depletion potential for fossil resources	[MJ]	1.23E+3	4.28E+0	-1.78E+1

RESULTS OF THE LCA - RESOURCE USE: 1 ton of reinforcing steel in bars

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	8.37E+2	1.22E+1	8.71E+0
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	8.37E+2	1.22E+1	8.71E+0
Non-renewable primary energy as energy carrier	[MJ]	1.34E+4	6.44E+1	-1.59E+2
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	1.34E+4	6.44E+1	-1.59E+2
Use of secondary material	[kg]	8.39E+2	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	3.21E+0	1.97E-2	-1.17E-2

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 ton of reinforcing steel in bars

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	9.61E-6	1.03E-6	-2.25E-7
Non-hazardous waste disposed	[kg]	8.31E+0	1.50E+2	-2.52E-1
Radioactive waste disposed	[kg]	1.40E-1	4.97E-3	2.87E-3
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	8.50E+2	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0

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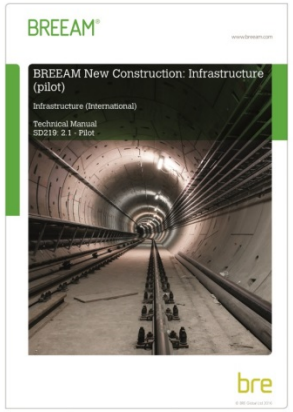
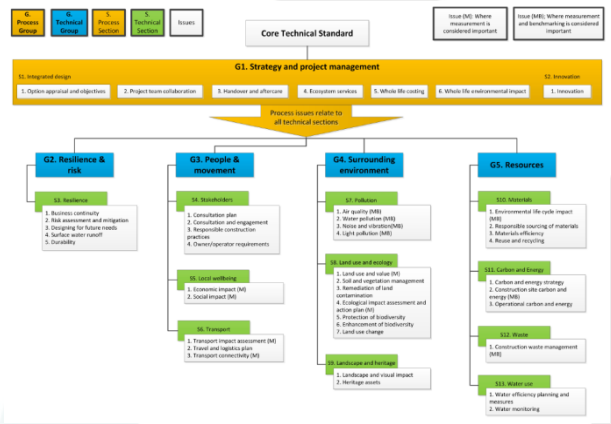
EPDs rating

- First sustainability rating schemes have been developed for construction works.





BREEAM rating	% score
Outstanding	≥ 85
Excellent	≥ 70
Very good	≥ 55
Good	≥ 45
Pass	≥ 30
Unclassified	< 30

- Software using EPDs within Integrated Design to calculate LCA at each construction stage.
- EPDs contribute up to 7 credits.

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EPD for VRS

- ArcelorMittal has published recently 3 EPDs for Single-sided safety barriers and MPS.
- Manufacturing:

  High strength steels & Magnelis®

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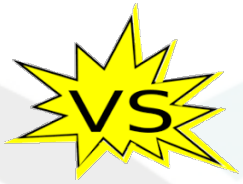
EPDs comparison

Barrier A
H1 W3 A side barrier
High strength steels & Magnelis® (100%)



Barrier B
H1 W5 A side barrier
Commodity steels & Batch galva (89%) + HDG Z600 (11%)

- Functional Unit: 1m of road steel barrier
- Same End of Life (EoL) scenario (99% RR)

Barrier	Weight [kg/m]	GWP* [kg CO2-eq./m]		
		A1-3	D	A1-3+D
Barrier A	20.3	50.7	-33.6	17.1
Barrier B	24.4	58.4	-24.4	34.0

*Preliminary results

Innovative steel products represent a strong improvement toward sustainability, contributing to:

- **17% Weight reduction**
- **50% GHG reduction**

*Greenhouse gas (GHG)

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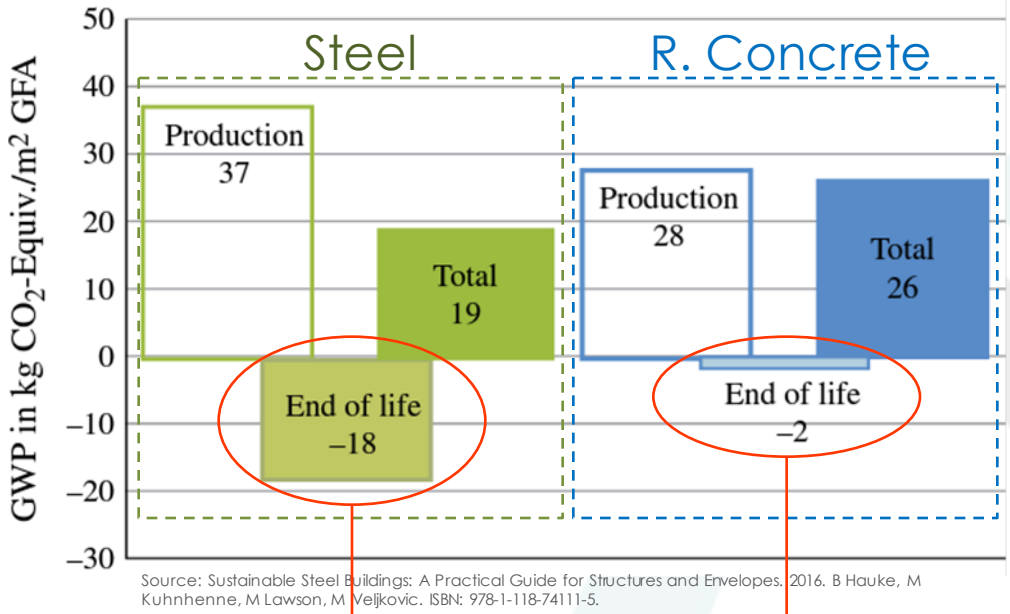
Recycling potential



Source: Sustainable Steel Buildings: A Practical Guide for Structures and Envelopes. 2016. B Hauke, M Kuhnhenne, M Lawson, M Veljkovic. ISBN: 978-1-118-74111-5.

Global warming potential (GWP) in kg CO2-eq. per m2 Gross Floor Area (GFA)

EoL includes Reuse - Recovery - Recycling potential

Steel benefits @ EoL:
- **~89% GWP reduction**

End-of-life practice is key:
- Steel: reuse/recycling into new steel products
- Concrete: downcycling (use as aggregate or filling material)

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Conclusions

- EPDs will enable to compare environmental performance of functionally equivalent products.
- Published EPDs demonstrate that high strength steels and new coatings decrease the use of natural resources, increase the lifespan of solutions and are 100% recyclable (and recycled) at the end-of-life.

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Conclusions

- EPDs are a strong asset in considering benefits of recycling at the end-life as part of the products environmental performance.
- Safety improvements & Sustainability approach are rocking road infrastructure engineering enabling further innovations.

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For more info:

http://constructalia.arcelormittal.com/en/tools/epd

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