ENVIRONMENTAL IMPACT OF STEEL CONSTRUCTION

prof. ir. arch. Wim HOECKMAN

Victor Buyck Steel Construction (Eeklo - B)
Vrije Universiteit Brussel (B)

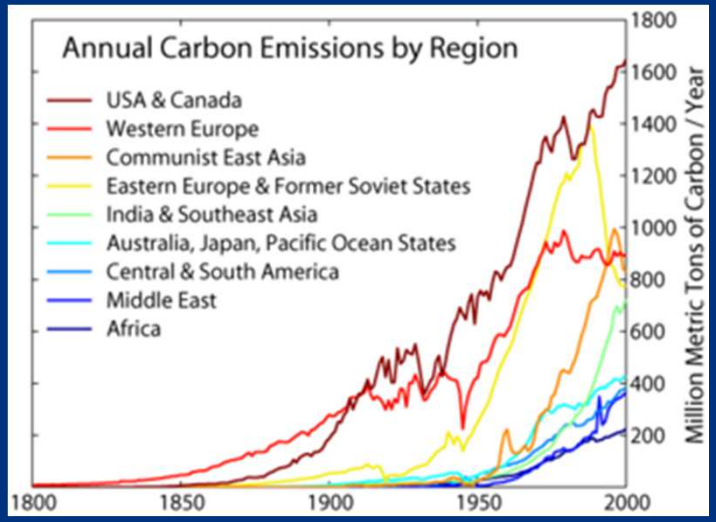
STEEL AT WORK

VICTOR BUYCK STEEL CONSTRUCTION

Vrije Universiteit Brussel

Vlaamse partijen scharen zich achter 30% CO2-reductie

In het Vlaams Parlement tekent zich een consensus af over de ondersteuning van de Europese doelstelling om de uitstoot van broeikasgassen tegen 2020 met 30 procent te verminderen. Meerderheid en oppositie hebben daarover een voorstel van resolutie klaar. De Vlaamse partijen vinden wel dat de reductiedoelstelling de Vlaamse concurrentiepositie niet mag aantasten.



The Telegraph

Chinese airlines refuse to pay EU carbon tax

China's biggest airlines warned on Thursday they will refuse to pay a new EU tax aimed at cutting carbon emissions.

European Union: Every airline will have to compensate their CO2 emissions

VICTOR BUYCK STEEL CONSTRUCTION

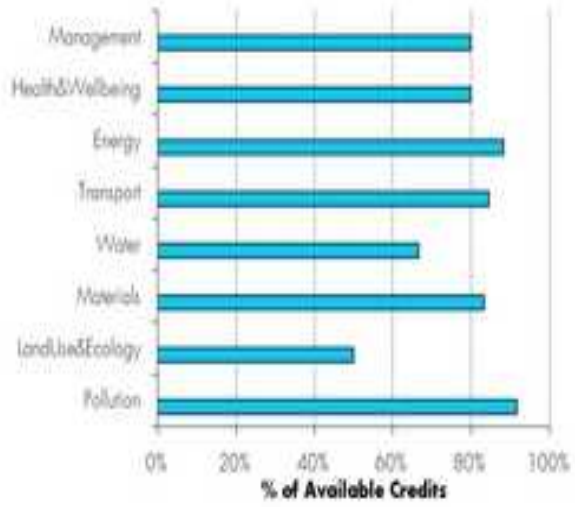
Vrije Universiteit Brussel

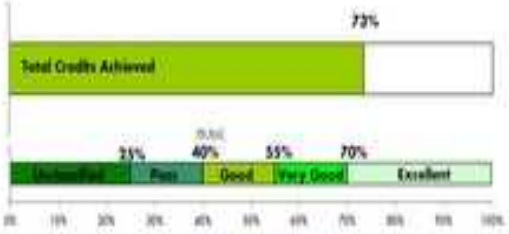
1. PROJECTS WILL BE EXAMINED ON THEIR SUSTAINABILITY PERFORMANCE

TODAY: ALREADY REALITY

1. PROJECTS WILL BE EXAMINED ON THEIR SUSTAINABILITY PERFORMANCE

BREEAM





Max Fordham Consulting Engineers

BREEAM In-Use

breeam
The Code For A Sustainable Built Environment

Baseline Score*
Oude Houtlei 140
Gent, 9000, Belgium

Has been assessed to BES 5058 Part 1 (Asset Rating) to a UK baseline and achieved a score of 73.76 %

Acceptable | Pass | Good | Very Good | Excellent | Outstanding

How this Asset is Scored

Category	What is covered in the category	Percentage of Category Score attained (0 10 20 30 40 50 60 70 80 90 100)
Materials	Condition of asset, security features and systems, fire alarm systems	77.8
Transport	Access to public transport, proximity of local amenities, provision of cyclists	100
Waste	Waste storage and sorting facilities	100
Water	Water meters, sanitary fittings, grey-water/rainwater use, leak detection/prevention measures	59.3
Health and Wellbeing	Occupancy control, internal air quality, legionella, amenity provision	60
Pollution	Waterair pollution, flood risk/mitigation, SuDs, nitrous oxide emissions, refrigerant leaks	78.9
Energy	Energy Performance Certificate rating or predicted energy score, energy submetering	61.7
Land Use and Ecology	Make up of site, species enhancement measures, ecological features	87.5

*The performance shown on this report is based on the UK Building Regulations codes of practice, UK climatic conditions and energy methodology. The specific criteria and assumptions used can be obtained from BRE Global on request.

Company Name: GG05

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www.breeam.org

2. ENVIRONMENTAL IMPACT OF CONSTRUCTION WILL BE **DECISIVE** IN TENDER REVIEWS

EXAMPLE 1

EXAMPLE 2

Ontwerp KB
Projet d'AR

Tot vaststelling van minimumeisen voor milieuboodschappen over bouwproducten // versie **juli 2012** // status ontwerp

Fixant les exigences minimales de l'affichage environnemental des produits de construction // version **juillet 2012** // statut projet

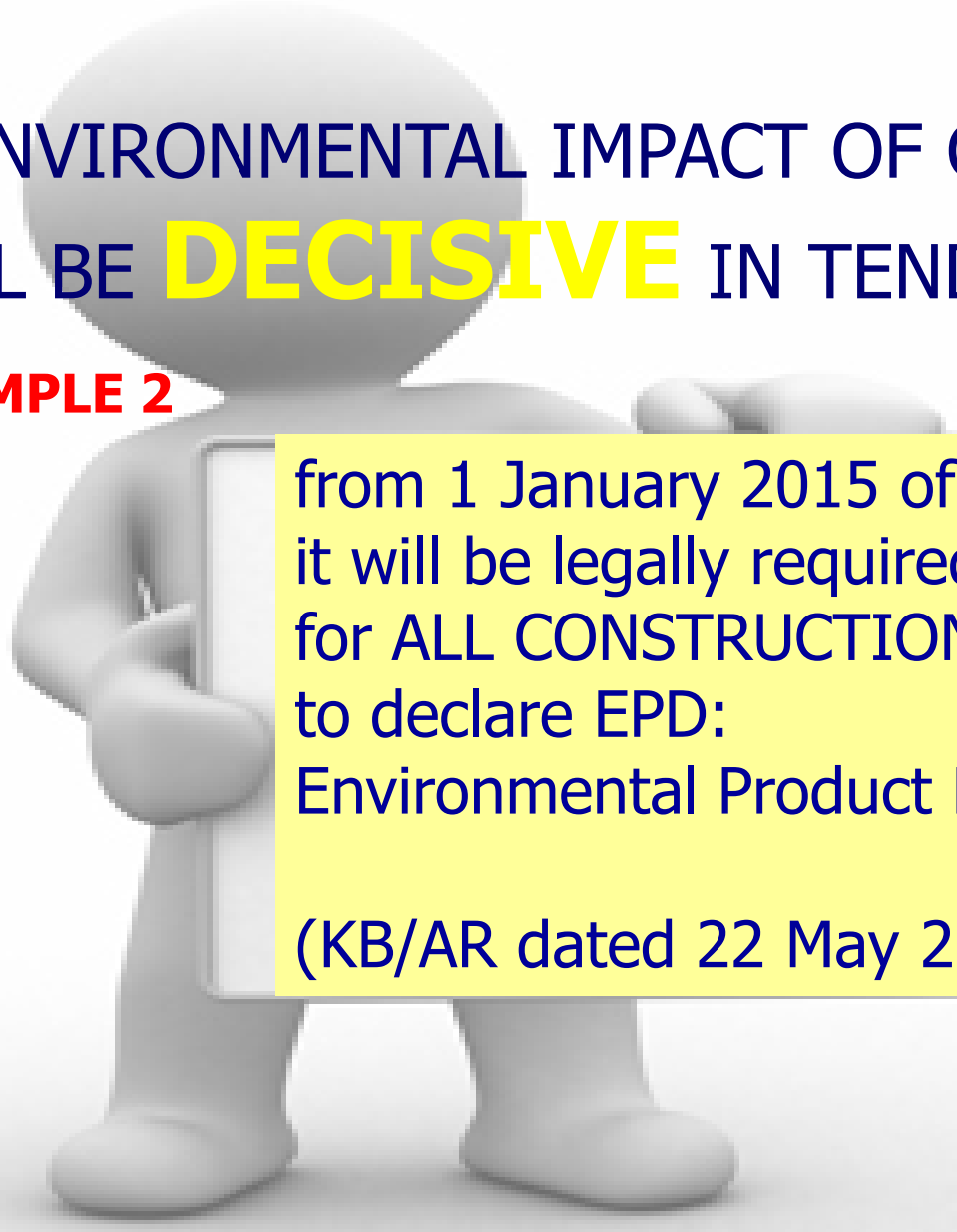
FOD Volksgezondheid – DG5 Leefmilieu – dienst Productbeleid

SPF Santé publique - DG5 Environnement - Service Politique des produits

Dieter De Lathauwer

2. ENVIRONMENTAL IMPACT OF CONSTRUCTION WILL BE **DECISIVE** IN TENDER REVIEWS

EXAMPLE 2



from 1 January 2015 of 2016 onwards,
it will be legally required
for ALL CONSTRUCTION PRODUCTS
to declare EPD:
Environmental Product Declaration

(KB/AR dated 22 May 2014)

2. ENVIRONMENTAL IMPACT OF CONSTRUCTION WILL BE **DECISIVE** IN TENDER REVIEWS

EXAMPLE 1

CRITERIA:

A. Insight (into own carbon footprint)
B. CO2 reduction (recorded ambition)
C. Transparency
   (internal and external communication)
D. Participation in initiatives
   (with colleague companies in the field of CO2 reduction)

2. ENVIRONMENTAL IMPACT OF CONSTRUCTION WILL BE **DECISIVE** IN TENDER REVIEWS

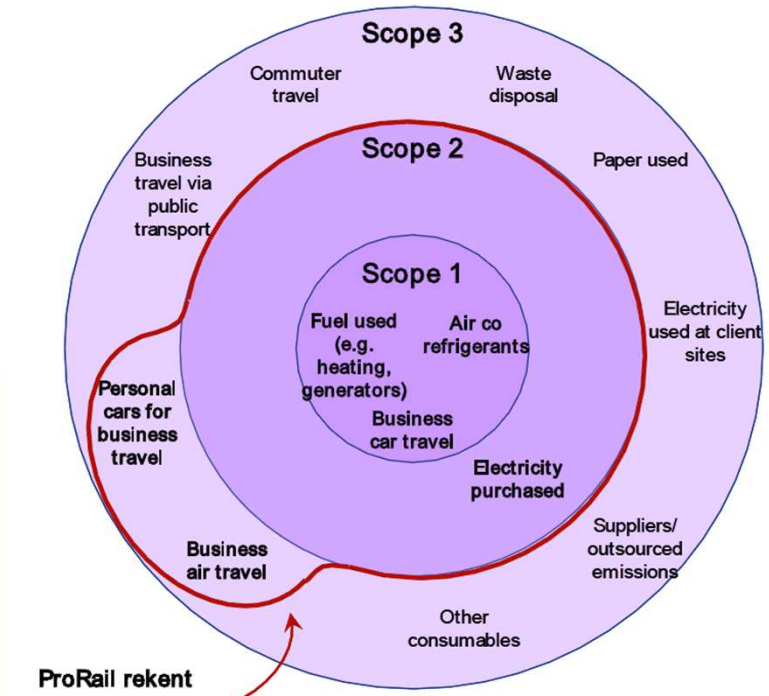
EXAMPLE 1

CO_2-PERFORMANCELADDER©

Samen zorgen voor minder CO_2

CRITERIA LEVEL 3:

- report CO2 emissions scope 1 & 2
- objectives for reduction
- communicate internally + externally
- active role in (sector) initiatives

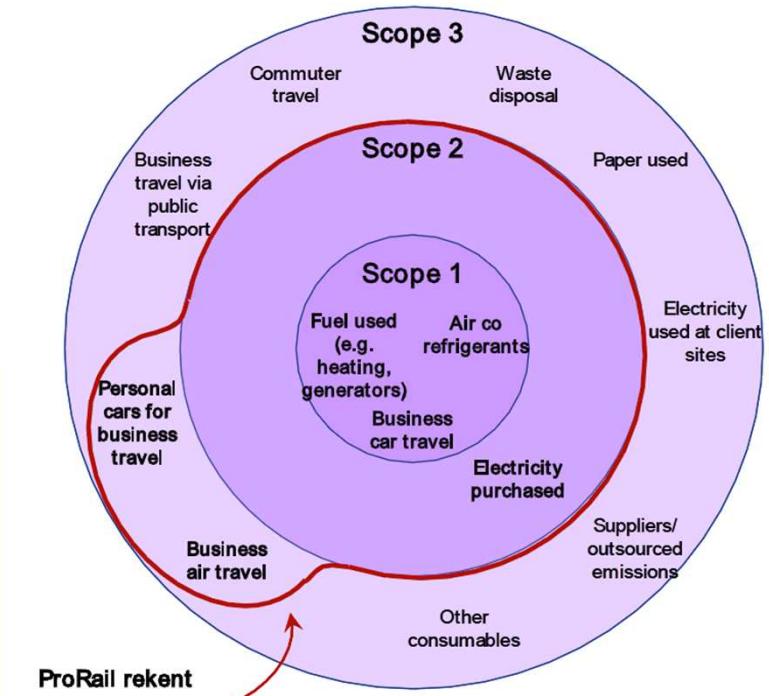


2. ENVIRONMENTAL IMPACT OF CONSTRUCTION WILL BE DECISIVE IN TENDER REVIEWS

EXAMPLE 1

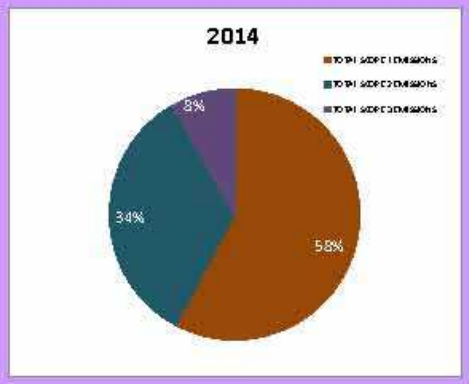
CRITERIA LEVEL 5:

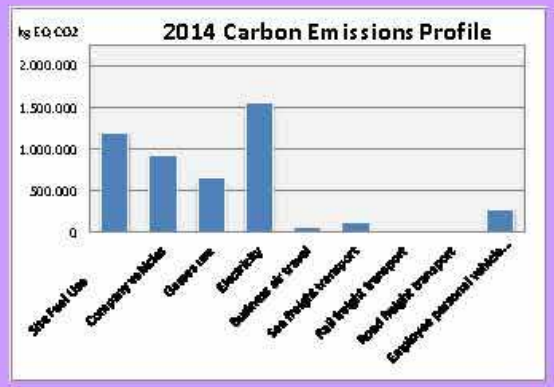
- report CO2 emissions scope 1 & 2 (including A suppliers)
- objectives for reduction fully incorporated + publically committed
- communicate internally + externally
- participate in and initiate (sector) initiatives

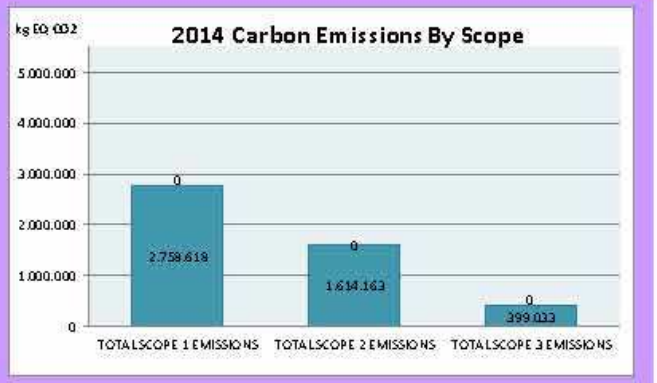


2. ENVIRONMENTAL IMPACT OF CONSTRUCTION WILL BE DECISIVE IN TENDER REVIEWS

EXAMPLE 1







	Tonne t CO2 2009	Tonne t CO2 2010	Tonne t CO2 2011	Tonne t CO2 2012	Tonne t CO2 2013	Tonne t CO2 2014
TOTAL SCOPE 1 EMISSIONS	2660,73	3215,52	2522,07	2764,56	3906,90	2758,62
TOTAL SCOPE 2 EMISSIONS	3226,76	3039,53	2375,61	1559,32	1053,74	1614,16
TOTAL SCOPE 3 EMISSIONS	66,79	582,57	147,76	359,35	373,45	399,03
TOTAL GHG ANNUAL EMISSIONS	5954,28	6837,73	5045,44	4684,05	5334,10	4771,81
EVOLUTION REF YEAR 2009	100,0%	114,8%	84,7%	78,7%	89,6%	80,1%

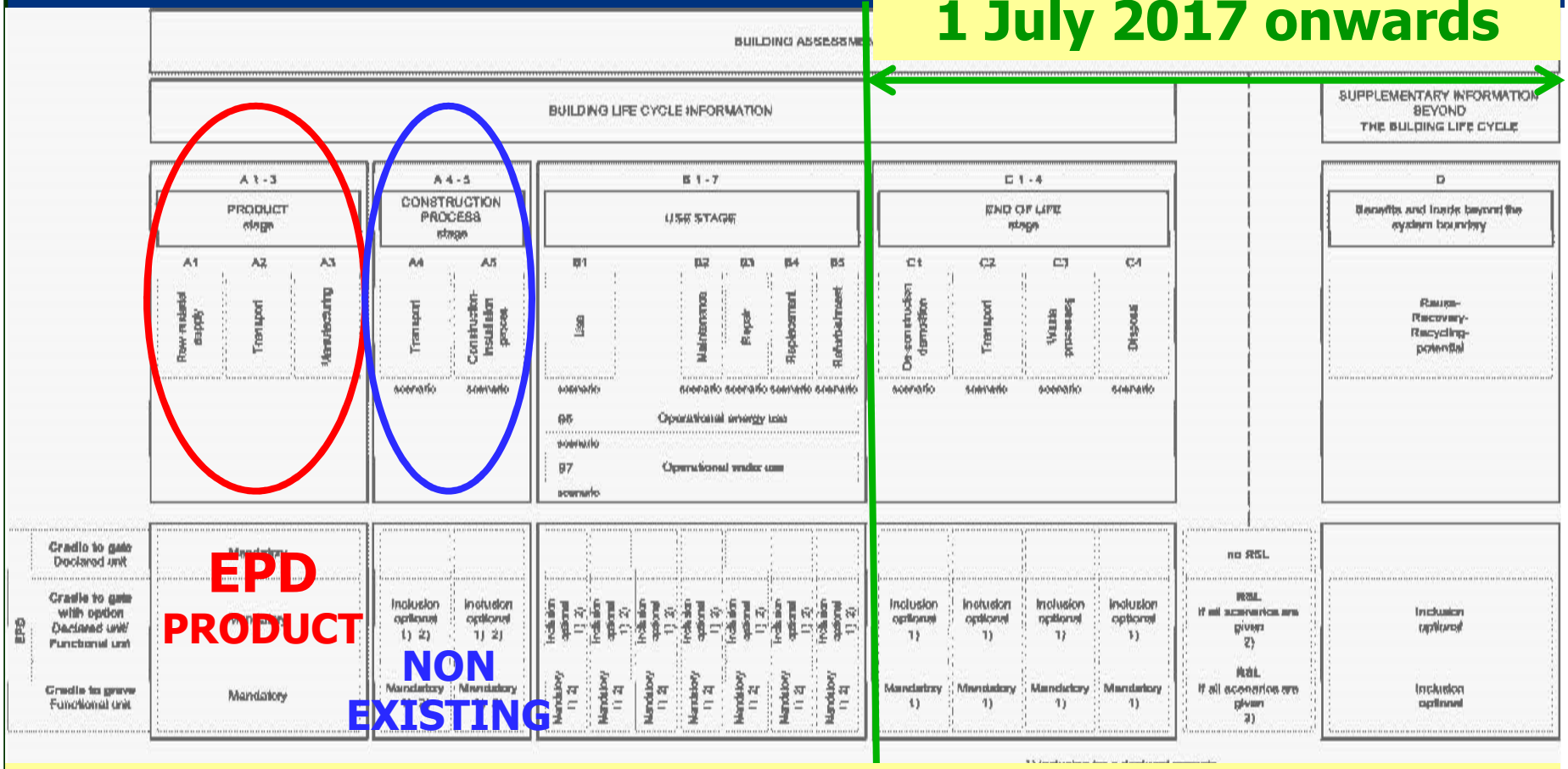
	Effratio 2009	Effratio 2010	Effratio 2011	Effratio2 2012	Effratio 2013	Effratio 2014
Annual total man hours	730.479	724.366	703.045	673.950	670.475	782.703
TOTAL SCOPE 1 EMISSIONS	3,64	4,44	3,60	4,10	4,03	3,52
TOTAL SCOPE 2 EMISSIONS	4,42	4,20	3,38	2,31	1,05	2,06
TOTAL SCOPE 3 EMISSIONS	0,09	0,80	0,21	0,53	0,38	0,51
TOTAL GHG ANNUAL EMISSIONS	8,15	9,44	7,19	6,95	5,50	6,10
EVOLUTION REF YEAR 2009	100,0%	115,8%	88,2%	85,3%	67,4%	74,8%
TARGET	100,0%	0,98	0,96	0,94	0,92	0,90

CONCLUSION

SOONER or LATER
the environmental impact of
all human actions & activities
will be required to be determined
and will be required to be reduced,
thus also for
the steel construction industry

EN 15804 (EPD)

1 July 2017 onwards



1 January 2016 onwards: transport component to be included !

CHALLENGE FOR STEELWORK CONTRACTORS

STEEL AT WORK

CHALLENGE:

DEVELOP A METHOD TO DETERMINE YOUR ENVIRONMENTAL FOOTPRINT

CHALLENGE:

DEVELOP A METHOD TO DETERMINE YOUR ENVIRONMENTAL FOOTPRINT

ANALYSE THE PROCESS
+ APPLY ON REAL CASES
+ DETERMINE IMPROVEMENTS
= SET THE STANDARD

STEEL AT WORK

CHALLENGE:

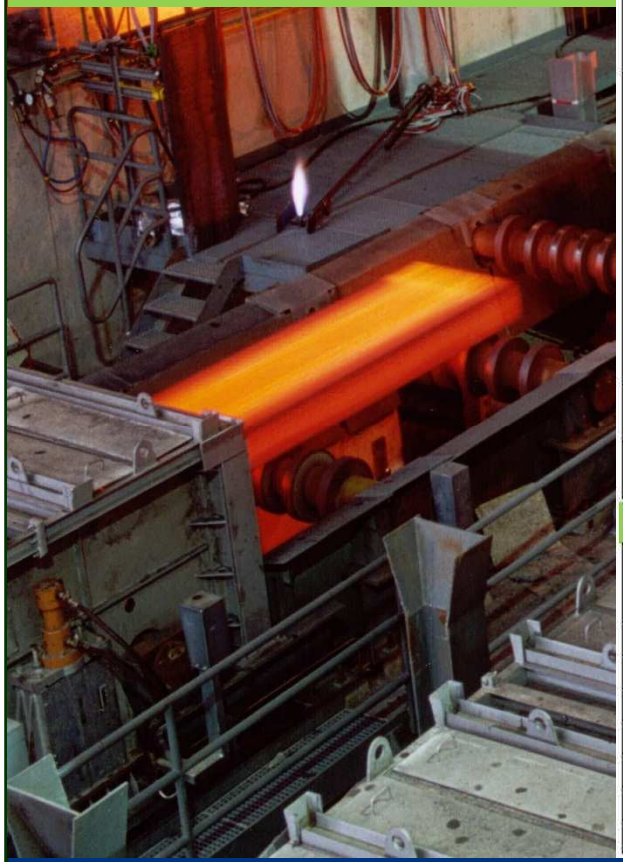
SET THE STANDARD

PRODUCT STAGE (A1, A2, A3):

ENVIRONMENTAL PRODUCT DECLARATION
as per ISO 14025 and EN 15804

Owner of the Declaration	bauforumstahl e.V.
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-BFS-20130094-IBG1-EN
Issue date	25.10.2013
Valid to	24.10.2018

Structural Steel: Sections and Plates
bauforumstahl e.V.



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 BOUNDARYS
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement[1)]	Refurbishment[1)]	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	MND	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 tonne structural steel

Parameter	Unit	A1 - A3	D
Global warming potential	[kg CO_2-Eq.]	1735	-959
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	1.39E-7	6.29E-9
Acidification potential of land and water	[kg SO_2-Eq.]	3.52	-1.32
Eutrophication potential	[kg $(PO_4)^{3-}$- Eq.]	3.7E-1	-1.26E-1
Formation potential of tropospheric ozone photochemical oxidants	[kg Ethen Eq.]	6.98E-1	-4.14E-1
Abiotic depletion potential for non fossil resources	[kg Sb Eq.]	2.85E-4	-1.11E-4
Abiotic depletion potential for fossil resources	[MJ]	17000	-7450

PRODUCT STAGE (A1, A2, A3):

MRPI
milieu relevante product informatie

COMPANY INFORMATION

bouwen met staal

Bouwen met Staal
Postbus 190
2700 AD ZOETERMEER

tel.: +31 (0)79 353 1277
fax.: +31 (0)79 353 1278

FOR
Steel construction products

MRPI code
9.2.00011.004

DATE OF ISSUE
January 8, 2013

END OF VALIDITY
January 8, 2018

FUNCTIONAL UNIT
1 ton of steel for:
- Heavy construction products (beams, columns)

ENVIRONMENTAL PROFILE 1 ton

Theme	(equivalents) Unit	Production	Transport to building site	Construction	demolition, dismantling	Waste processing
Abiotic depletion, non fuel	kg Sb eq	-1.34E-04	5.54E-05	2.78E-06	4.53E-06	9.55E-05
Abiotic depletion, fuel	Kg Sb eq	5.21E+00	1.45E-01	1.14E-01	2.56E-01	-2.72E+00
Global warming (GWP100)	kg CO_2 eq	9.08E+02	1.96E+01	1.70E+01	4.03E+01	-5.12E+02
Ozone layer depletion (ODP)	kg CFC-11 eq	1.55E-05	3.24E-06	2.04E-06	6.01E-06	-3.72E-06
Photochemical oxidation	kg C_2H_4	3.30E-01	1.68E-02	9.37E-03	2.71E-02	-1.84E-01
Acidification	kg SO_2 eq	3.38E+00	1.03E-01	9.34E-02	2.32E-01	-1.51E+00
Eutrophication	kg PO_4--- eq	3.74E-01	2.34E-02	1.93E-02	5.49E-02	-1.53E-01
Human toxicity	kg 1,4-DB eq	3.33E+01	5.64E+00	3.00E+00	7.27E+00	-8.85E+00
Aquatic ecotoxicity, fresh water	kg 1,4-DB eq	3.02E+00	2.55E-01	1.75E-01	4.58E-01	-1.87E+00
Aquatic ecotoxcity, marine water	kg 1,4-DB eq	6.34E+03	9.83E+02	8.29E+02	1.95E+03	-1.78E+03
Terrestrial ecotoxicity	kg 1,4-DB eq	4.68E-01	4.54E-02	3.36E-02	4.03E-02	-1.40E-01

CONSTRUCTION STAGE (A4, A5):

1. FABRICATION
2. TRANSPORT
3. ERECTION
4. OVERHEAD

CONSTRUCTION PHASE:

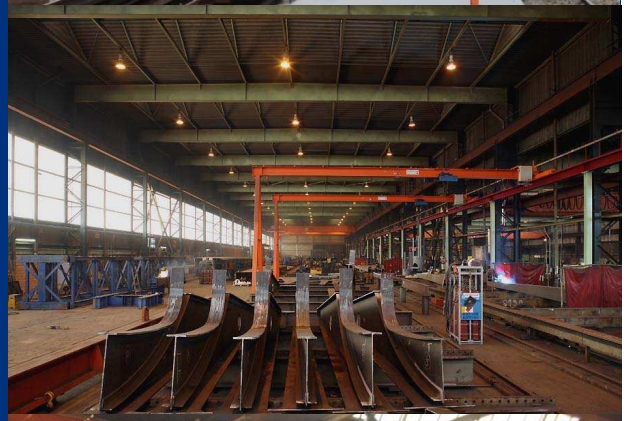
1. FABRICATION
2. TRANSPORT
3. ERECTION
4. OVERHEAD

TOTAL No. OF ACTIVITIES: 80
TOTAL No. OF INDIVIDUAL FACTORS: 180

CONSTRUCTION PHASE:

1. FABRICATION

- grit-blasting
- cutting (plates and sections)
- drilling, punching, etc.
- welding
- manipulation
- diesel for various machines
- compressors



2. TRANSPORT
3. ERECTION
4. OVERHEAD

CONSTRUCTION PHASE

1. FABRICATION

2. TRANSPORT

- ° from rolling mill to factory
- ° internal transport factory
- ° from factory to construction site

3. ERECTION
4. OVERHEAD

CONSTRUCTION PHASE

1. FABRICATION
2. TRANSPORT

3. ERECTION

- ° welding
- ° gases
- ° cranes, etc. : diesel

4. OVERHEAD

CONSTRUCTION PHASE:

1. FABRICATION
2. TRANSPORT
3. ERECTION

4. OVERHEAD (not project related)

- electricity offices
- heating
- ventilation
- lighting

VICTOR BUYCK STEEL CONSTRUCTION

Vrije Universiteit Brussel

CONVERSION FACTORS

Machines and tools (electricity)

$$E = n \varphi \lambda P \text{ [kWh]} = 3.6\ n \varphi \lambda P \text{ [MJ]}$$

P	declared power of the machine [kW];
n	total number of working hours reported by the operator [h];
λ	load factor: percentage of full capacity that has been used [%];
φ	effectivity: effective working time of the machine divided by reported working time of the operator [%].

GWP = 0.615 n φ λ P [kgCO2eq] (grey - 2012)
GWP = 0.526 n φ λ P [kgCO2eq] (grey - 2015-NL)
GWP = 0.213 n φ λ P [kgCO2eq] (grey - 2015-B)
GWP = 0.000 n φ λ P [kgCO2eq] (solar - 2015-NL)
GWP = 0.050 n φ λ P [kgCO2eq] (solar - 2015-B)

CONVERSION FACTORS

Machines and tools (electricity)

$$E = n \varphi \lambda P \text{ [kWh]} = 3.6\, n \varphi \lambda P \text{ [MJ]}$$

	Load factor λ	Effectivity φ
Cranes (workshop)	10%	65%
Compressor (workshop)	30%	100%
Ventilation (workshop)	100%	100%
Plate cutting machine (workshop)	40%	50%
Drilling, punching, sawing (workshop)	90%	70%
Welding in workshop half automatically	68%	35%
Welding in workshop full automatically	35%	70%

CONVERSION FACTORS

Consumables

- propane
- natural gas
- acetylene
- diesel
- thinners
- zinc metal spray

Example: diesel

$E = 3.6\ c_{die}\ v_{die}$ [MJ]
$GWP = 3.135\ v_{die}$ [kgCO2eq]

calorific value : c_{die} = 11,61 kWh/l
volume v_{die} [l]

CONVERSION FACTORS

Handbook CO2 performance ladder; edition 3.0 (10 June 2015)

co2emissiefactoren.nl

100 pages

CONVERSION FACTORS

List emission factors via co2emissiefactoren.nl

Elektriciteit	Eenheid	Kg CO2/eenheid Totaal	Kg CO2/eenheid Conversie	Kg CO2/eenheid Productie
STROOMETIKET			VARIABEL	0,054
Grijze stroom	kWh	0,526	0,464	0,062
Stroom (onbekend)	kWh	0,355	0,301	0,054
Windkracht	kWh	0,000	0,000	0,000
Waterkracht	kWh	0,000	0,000	0,000
Zonne-energie	kWh	0,000	0,000	0,000
Biomassa	kWh	0,189	"0"	0,189

STEEL AT WORK

CONVERSION FACTORS

List emission factors via GABI - data base

Environmental impact	Abbr.	Unity	Electricity				Natural gas	Gasoline	Transport					Shadow cost
				Green		Gray			Truck	Car		Vessel		SKB-method
			Hydro	Wind	PV				Diesel	Diesel	Gasoline	Inland	Sea	
			1 kWh				1 kWh	1 l	1 t,km	1 km	1 km	1 t,km	1 t,km	EUR/unity
Global warming potential	GWP	kg CO_2eq	6,99E-03	7,67E-03	5,03E-02	2,13E-01	2,21E-01	3,22E+00	5,15E-02	1,47E-01	1,75E-01	1,97E-02	3,93E-02	0,05
Ozone depletion potential	ODP	kg CFC-11eq	4,00E-14	5,00E-13	1,29E-11	1,03E-09	1,61E-12	0	0	0	0	8,09E-14	0	30
Acidification potential	AP	kg SO_2eq	5,96E-06	2,16E-05	2,31E-04	4,22E-04	1,27E-04	1,25E-02	2,00E-04	3,38E-04	1,11E-04	1,38E-04	3,69E-04	4
Eutrophication potential	EP	kg $(PO_3)^{3-}$eq	7,87E-07	2,45E-06	1,86E-05	6,08E-05	2,58E-05	3,28E-03	5,24E-05	8,93E-05	2,61E-05	3,50E-05	9,23E-05	9
Photochemical oxidants formation potential	POCP	kg C_2H_4eq	2,64E-07	1,82E-06	3,20E-05	5,95E-05	2,26E-05	5,71E-03	9,14E-05	-1,02E-04	1,75E-07	2,05E-05	3,44E-05	2
Abiotic depletion potential (non fossil)	ADP_e	kg SBeq	1,27E-07	5,77E-08	3,44E-06	5,77E-08	2,82E-09	0	0	0	0	7,70E-10	0	0,16
Abiotic depletion potential (fossil)	ADP_f	kg SBeq	7,65E-06	4,31E-05	3,11E-01	1,39E-03	1,84E-03	0	0	0	0	1,30E-04	0	0,16
Human toxicity	HTP	kg 1,4-DBeq	-2,07E-04	3,26E-04	7,61E-02	1,16E-02	2,11E-03	9,63E-03	1,54E-04	6,19E-04	2,22E-03	9,38E-04	8,73E-04	0,09
Terrestrial ecotoxicity potential	TETP	kg 1,4-DBeq	1,93E-06	2,24E-05	2,91E-04	2,42E-04	1,57E-05	8,89E-07	1,42E-08	5,18E-08	4,64E-08	1,46E-04	1,77E-07	0,06
Freshwater aquatic ecotoxicity potential	FAETP	kg 1,4-DBeq	9,37E-06	3,57E-05	5,35E-04	1,07E-03	5,54E-05	7,77E-06	1,24E-07	4,55E-07	4,07E-07	1,38E-04	1,55E-06	0,03
Marine aquatic ecotoxicity potential	MAETP	kg 1,4-DBeq	1,32E-01	8,94E-01	3,31E+01	3,76E+01	3,33E-01	1,55E-06	2,49E-08	9,07E-08	8,41E-08	2,70E-01	3,08E-07	0,0001

RESULTS

24 STEEL PROJECTS, all recently completed

STEEL AT WORK

RESULTS

24 STEEL PROJECTS, all recently completed

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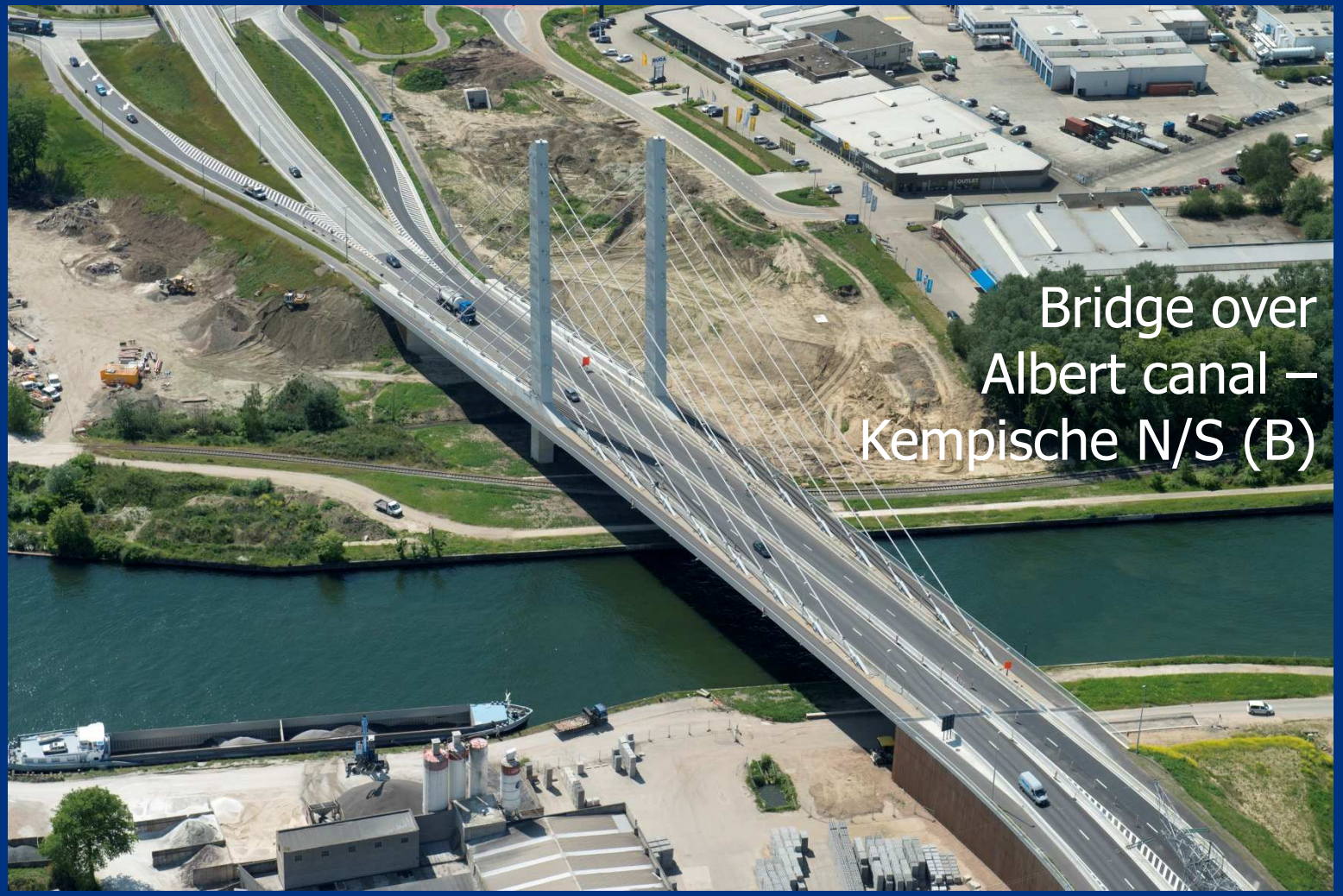


STEEL AT WORK

RESULTS

24 STEEL PROJECTS, all recently completed

JTI Headquarters – Genève (CH)

RESULTS

24 STEEL PROJECTS, all recently completed

VAC
office building
- Gent (B)

STEEL AT WORK

RESULTS

24 STEEL PROJECTS, all recently completed

BASF –
Black Diamond –
Antwerpen (B)

STEEL AT WORK

RESULTS

24 STEEL PROJECTS, all recently completed

Footbridge Kennedylaan – Gent (B)

STEEL AT WORK

RESULTS

24 STEEL PROJECTS, all recently completed

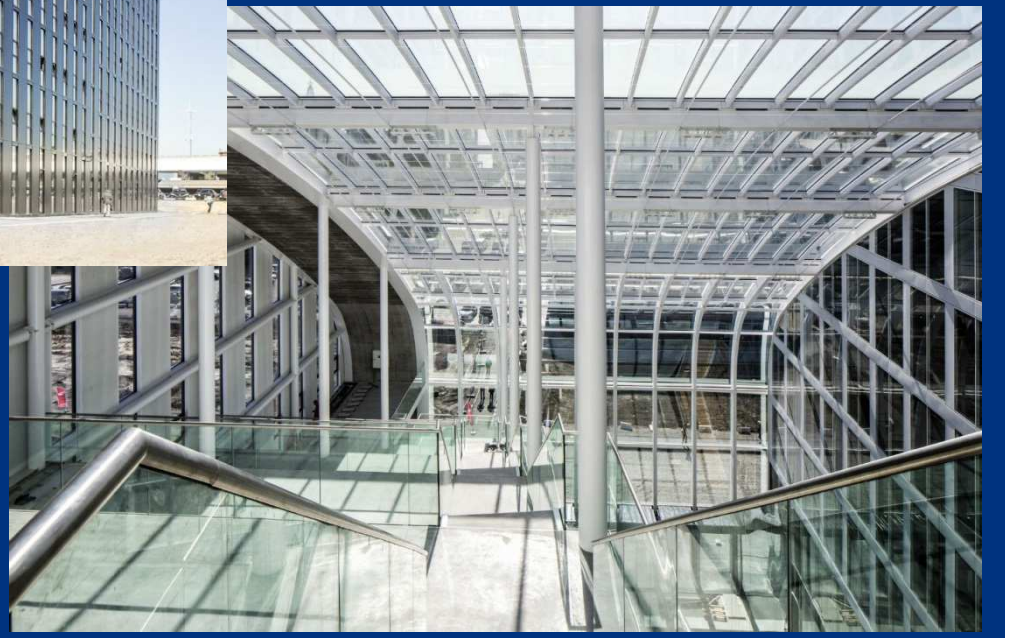
Airport Eindhoven (NL)

STEEL AT WORK

RESULTS

24 STEEL PROJECTS, all recently completed

Building BIM – Brussels (B)



RESULTS

24 STEEL PROJECTS, all recently completed

Aldi – Cuincy (F)

RESULTS

STEEL AT WORK

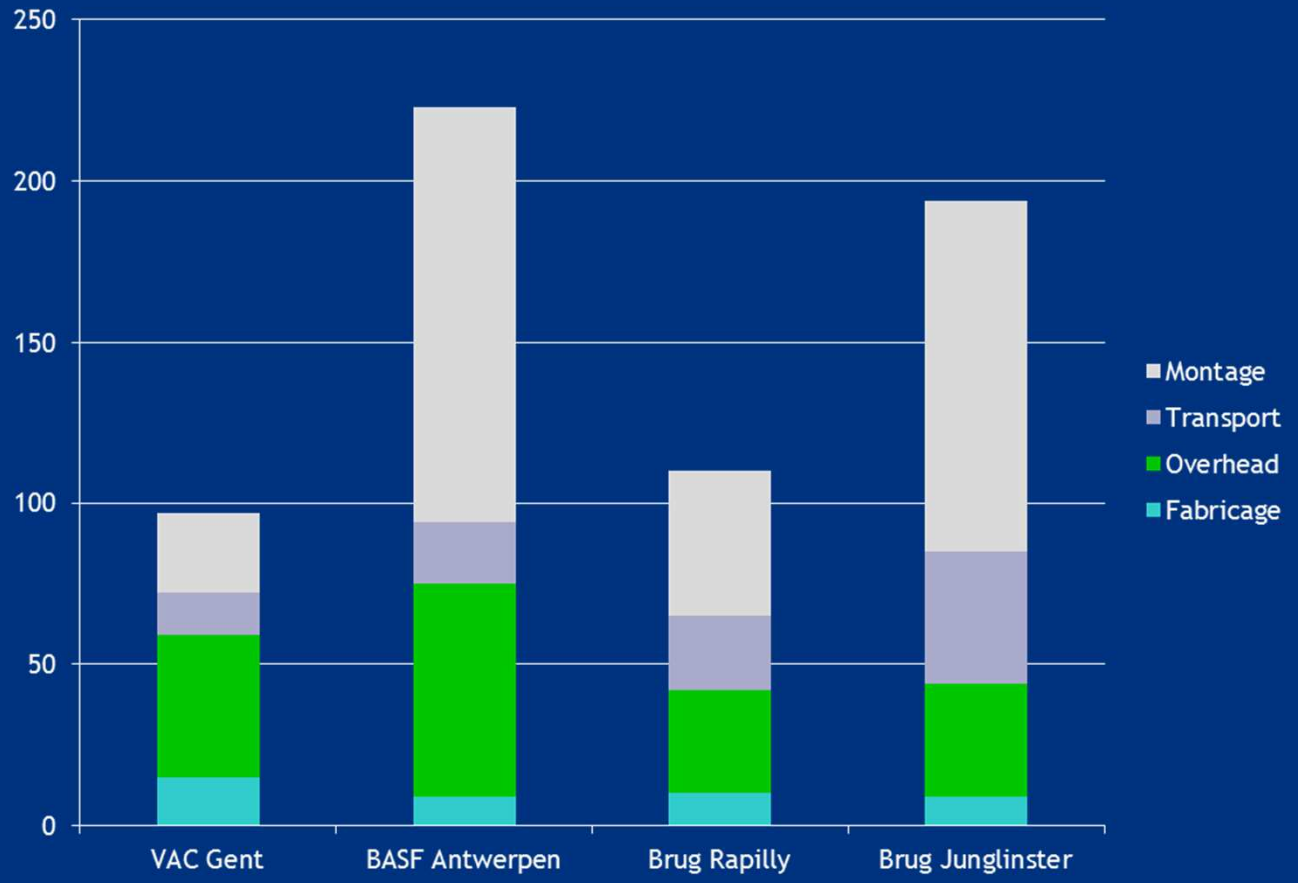
Environmental impact	Abbr.	Unity	Temp. bridge	Truss bridge	Arc bridge	Cable stay bridge	Office building	Office building	Industrial building	Foot bridge	Building	Office building	Industrial building
			Pont Adolphe	Junglinster	Rapilly	Kempische NZ	JTI	VAC	Black Diamond	Kennedylaan	Luchthaven	BIM - IBGE	Aldi
			Luxemburg	Luxemburg	Hauconcourt (F)	Westerlo (B)	Genève (CH)	Gent (B)	Antwerpen (B)	Gent (B)	Eindhoven (NL)	Brussel (B)	Cuincy (F)
			1415 t	2548 t	1705 t	1631 t	3033 t	1302 t	1140 t	403 t	481 t	859 t	498 t
Global warming potential	GWP	kg CO_2eq	163	110	194	154	140	96,4	223	173	177	91,1	122
Ozone depletion potential	ODP	kg CFC-11eq	<<	<<	<<	<<	<<	<<	<<	<<	<<	<<	<<
Acidification potential	AP	kg SO_2eq	0,405	0,320	0,620	0,399	0,423	0,209	0,632	0,361	0,422	0,211	0,291
Eutrophication potential	EP	kg $(PO_3)^{3-}$eq	0,103	0,082	0,160	0,100	0,106	0,051	0,161	0,084	0,103	0,051	0,071
Photochemical oxidants formation potential	POCP	kg C_2H_4eq	0,116	0,101	0,226	0,113	0,139	0,059	0,26	0,107	0,157	0,068	0,088
Abiotic depletion potential (non fossil)	ADP_e	kg SBeq	<<	<<	<<	<<	<<	<<	<<	<<	<<	<<	<<
Abiotic depletion potential (fossil)	ADP_f	kg SBeq	0,484	0,279	0,291	0,493	0,414	0,344	0,589	0,781	0,673	0,352	0,420
Human toxicity	HTP	kg 1,4-DCBeq	1,12	0,935	1,15	1,44	1,56	0,866	1,36	2,24	1,71	1,06	1,20
Terrestrial ecotoxicity potential	TETP	kg 1,4-DCBeq	0,051	0,064	0,048	0,095	0,114	0,027	0,037	0,084	0,060	0,039	0,041
Freshwater aquatic ecotoxicity potential	FAETP	kg 1,4-DCBeq	0,081	0,082	0,072	0,13	0,149	0,064	0,089	0,194	0,139	0,089	0,095
Marine aquatic ecotoxicity potential	MAETP	kg 1,4-DCBeq	1.600	1.140	1.300	2.130	2.360	1.990	2.670	6.310	4.410	2.880	3.040

RESULTS

STEEL AT WORK

Environmental impact	Abbr.	Unity	Shadow cost	Smallest impact				Biggest impact				Steel production			
			SKB-method	Building (VAC)		Bridge (Junglinster)		Building (BASF)		Bridge (Rapilly)		MRPI - heavy production		MRPI - heavy end of life	
			EUR/unity	Emission/t	EUR/t	Emission/t	EUR/t	Emission/t	EUR/t	Emission/t	EUR/t	Emission/t	EUR/t	Emission/t	EUR/t
Global warming potential	**GWP**	**kg CO_2eq**	0,05	96,4	4,8	110	5,5	223	11,2	194	9,7	908	45,4	-512	-25,6
Ozone depletion potential	**ODP**	**kg CFC-11eq**	30	<<	0,0	<<	0,0	<<	0,0	<<	0,0	<<	0,0	<<	0,0
Acidification potential	**AP**	**kg SO_2eq**	4	0,209	0,8	0,320	1,3	0,632	2,5	0,620	2,5	3,38	13,5	-1,51	-6,0
Eutrophication potential	**EP**	**kg $(PO_3)^{3-}$eq**	9	0,051	0,5	0,082	0,7	0,161	1,4	0,160	1,4	0,374	3,4	-0,153	-1,4
Photochemical oxidants formation potential	**POCP**	**kg C_2H_4eq**	2	0,059	0,1	0,101	0,2	0,26	0,5	0,226	0,5	0,330	0,7	-0,184	-0,4
Abiotic depletion potential (non fossil)	**ADP_e**	**kg SBeq**	0,16	<<	0,0	<<	0,0	<<	0,0	<<	0,0	<<	0,0	<<	0,0
Abiotic depletion potential (fossil)	**ADP_f**	**kg Sbeq**	0,16	0,344	0,1	0,279	0,0	0,589	0,1	0,291	0,0	5,21	0,8	-2,72	-0,4
Human toxicity	**HTP**	**kg 1,4-DCBeq**	0,09	0,866	0,1	0,935	0,1	1,36	0,1	1,15	0,1	33,30	3,0	-8,85	-0,8
Terrestrial ecotoxicity potential	**TETP**	**kg 1,4-DCBeq**	0,06	0,027	0,0	0,064	0,0	0,037	0,0	0,048	0,0	0,468	0,0	-0,14	0,0
Freshwater aquatic ecotoxicity potential	**FAETP**	**kg 1,4-DCBeq**	0,03	0,064	0,0	0,082	0,0	0,089	0,0	0,072	0,0	3,02	0,1	-1,87	-0,1
Marine aquatic ecotoxicity potential	**MAETP**	**kg 1,4-DCBeq**	0,0001	1.990	0,2	1.140	0,1	2.670	0,3	1.300	0,1	6.340	0,6	-1.780	-0,2
					6,6		**8,0**		**16,1**		**14,4**		**67,5**		**-34,9**

RESULTS (kg CO2eq/t)



Compare with "steel making": 1.735 kg CO2eq/t)

CONCLUSIONS

Transport
"20.000 km over sea" causes approx. 1.000 kg CO2eq/t

It is ecological MADNESS to import large fabricated steel structures from far overseas.

STEEL AT WORK

CONCLUSIONS

Suggestion to specification writers:

SPECIFY MAXIMUM ENVIRONMENTAL EFFECTS

Planet earth thanks you !