



Onderbouwing van de duurzaamheid van staalconstructies = Large Valorisation on Sustainability of Steel Structures

MACRO-COMPONENTEN EN *IPHONE* EN *IPAD* APPS

November 2014



Inhoud

1) Aanpak met Macro-componenten

- Algoritme voor levenscyclus analyse gebaseerd op macro-componenten

2) iPad en iPhone Applicaties

- Beschrijving programma

3) Conclusies



1) Aanpak met Macro-componenten

Deze methodologie is ontwikkeld in RFCS onderzoeksproject:



SB STEEL

SB_Steel (2014), Sustainable Building Project in Steel. RFSR-CT-2010-00027

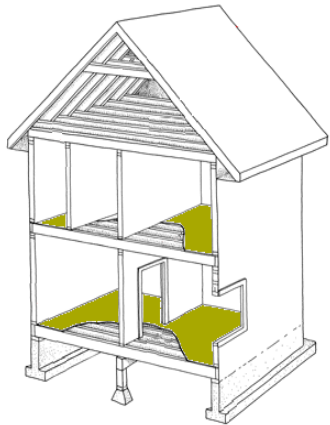
REFERENCE: Gervásio, H., Martins, R., Santos, P., Simões da Silva, L., “A macro-component approach for the assessment of building sustainability in early stages of design”, Building and Environment 73 (2014), pp. 256-270, DOI information: 10.1016/j.buildenv.2013.12.015.

Classificatie gebouwen met staalconstructie

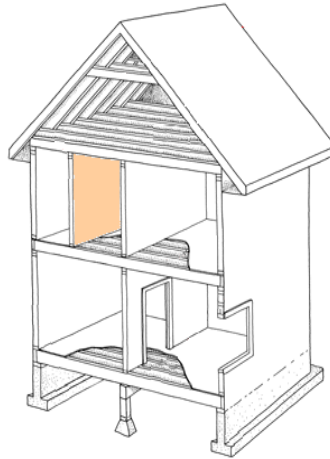
	Category 1	Category 2	Category 3
Single & multi-family building			
Apartment blocks			
Office buildings			
Commercial/Industrial buildings			

Eengezinswoning in
Category 1
(hoog staalverbruik)

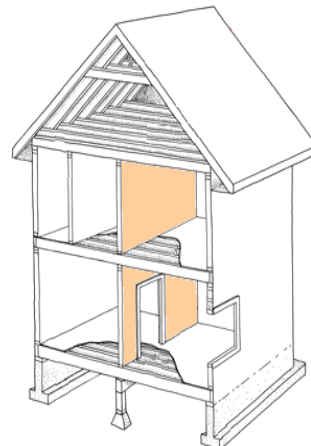
DEFINITIE MACRO-COMPONENT



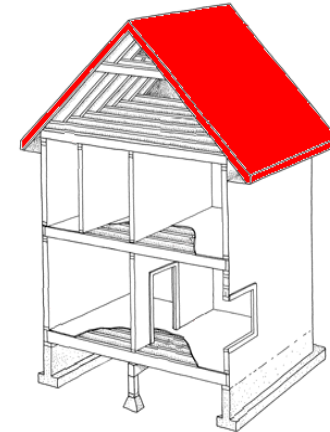
Vloersysteem



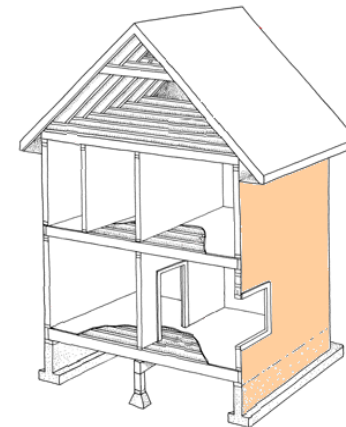
**Binnenwanden
(niet dragend)**



**Binnenwanden
(dragend)**



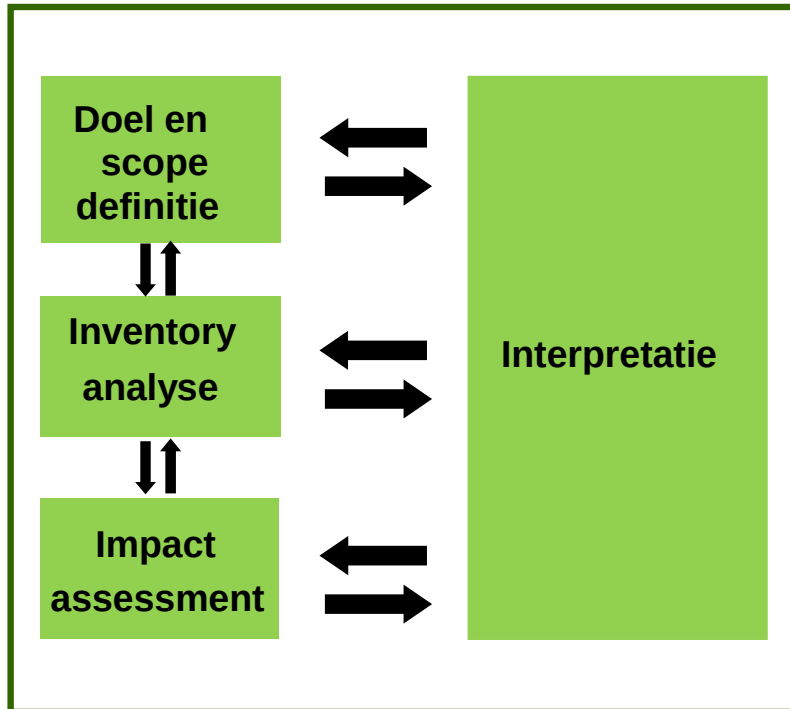
Dak



**Buitengevel
(dragend)**

MACRO-COMPONENT BEREKENING

ISO NORM 14040/14044



Doel en scope

Twee niveaus:

- (i) LCA op productniveau;
- (ii) LCA op gebouwniveau.

Systeemgrenzen

Product stage			Construc stage		Use stage							End-of-life stage				
Raw material supply	Transport	Manufacturing	Transport	Construction process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Demolition	Transport	Waste processing	Disposal	Reuse/Recycling
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
x	x	x	x	-	-	x	x	x	x	-	-	x	x	x	x	x

Andere relevante normen CEN/TC350 - Sustainability of construction works - EN15643-2:2011



INVENTORISATIE FASE

	Time coverage		Geographical coverage	Technology coverage	Completeness
Steel section	2007,	annual average	Europe	European producers	> 99% of mass and energy
Steel rebar	2007,	annual average	World	World producers	> 99% of mass and energy
Steel coil	2007,	annual average	Europe	European producers	> 99% of mass and energy
Concrete C20/25	2011,	annual average	Germany	German producers	> 95% of mass and energy
Oriented strand board OSB	2008,	annual average	Germany	German producers	> 99% of mass and energy
Gypsum plasterboard	2008,	annual average	Europe	European producers	> 95% of mass and energy
Bricks	2011,	annual average	Germany	German producers	> 95% of mass and energy
Rock wool	2011,	annual average	Europe	European producers	> 95% of mass and energy
Expanded polystyrene EPS	2011,	no data	Europe	No data	No data
Extruded polystyrene XPS	2011,	annual average	Germany	German producers	> 95% of mass and energy
Polyurethane rigid foam PUR	2011,	annual average	Germany	German producers	> 95% of mass and energy
Expanded Cork	2011,	annual average	Germany	German producers	> 95% of mass and energy
Glass wool	2011,	annual average	Europe	European producers	> 95% of mass and energy
Polyethylene foam PE	2011,	annual average	Germany	German producers	> 95% of mass and energy

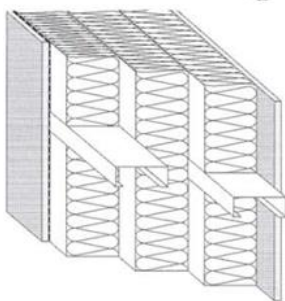
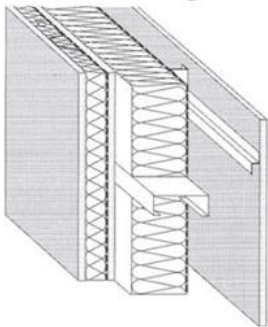
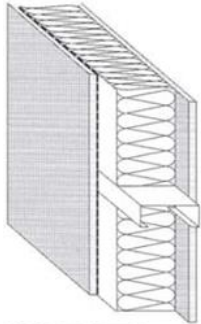


LARGE VALORISATION ON SUSTAINABILITY OF STEEL STRUCTURES

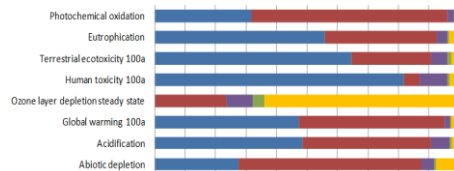
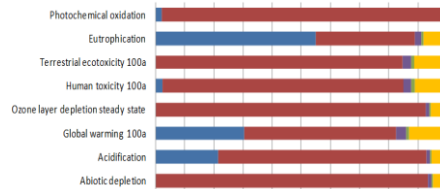
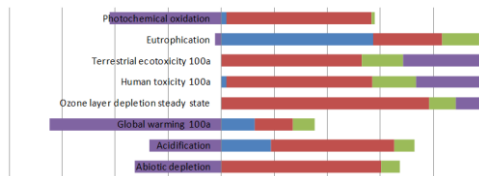


MACRO-COMPONENTEN DATABASE

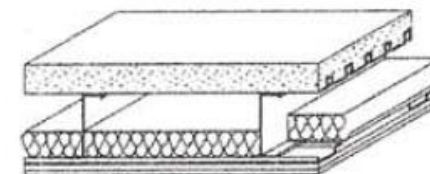
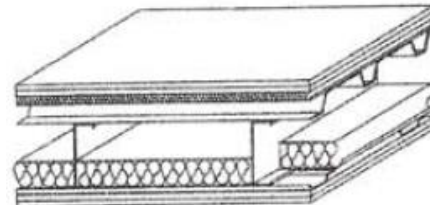
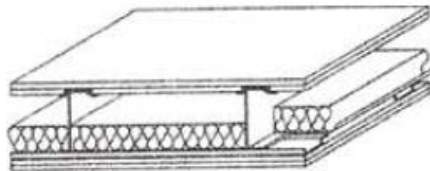
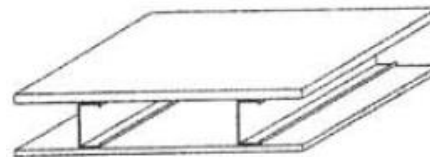
Buitengevel



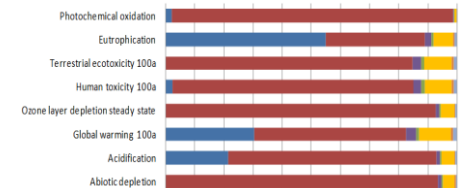
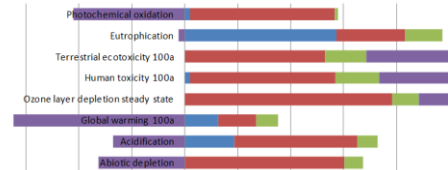
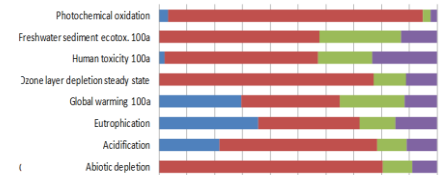
Milieuprofiel



Vloersysteem



Milieuprofiel





MACRO-COMPONENTEN CLASSIFICATIE

(A) Fundering	(A40) Vloer op grondslag	(A4010) Standaard vloer op grondslag	
(B) Gebouwschil	(B10) Hoofddraagconstructie	(B1010) Vloerconstructie	(B1010.30) Constructie vloer
			(B1010.20) Vloeropbouw
		(B1020) Dakconstructie	(B1020.10) Constructie dak
			(B1020.20) Dakopbouw
	(B20) Verticale vlakken in buitenschil	(B2010) Buitenwanden	(B2010.10) Afwerking gevel
			(B2010.20) Constructie gevel
		(B2020) Buitenramen	
		(B2050) Buitendeuren	
(C) Interieur	(B30) Horizontale vlakken in buitenschil	(B3010) Dak	
		(B3060) Horizontale openingen	
	(C10) Constructies binnen	(C1010) Scheidingswanden	
(C) Interieur	(C20) Afwerking binnen	(C2010) Wandafwerking	
		(C2030) Vloerafwerking	
		(C2050) Plafondafwerking	

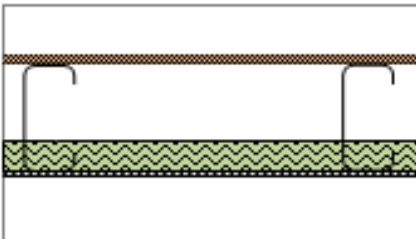


MACRO-COMPONENTEN DATABASE

VOORBEELD:

B1010.10 Floor structural frame

B1010.10.1a

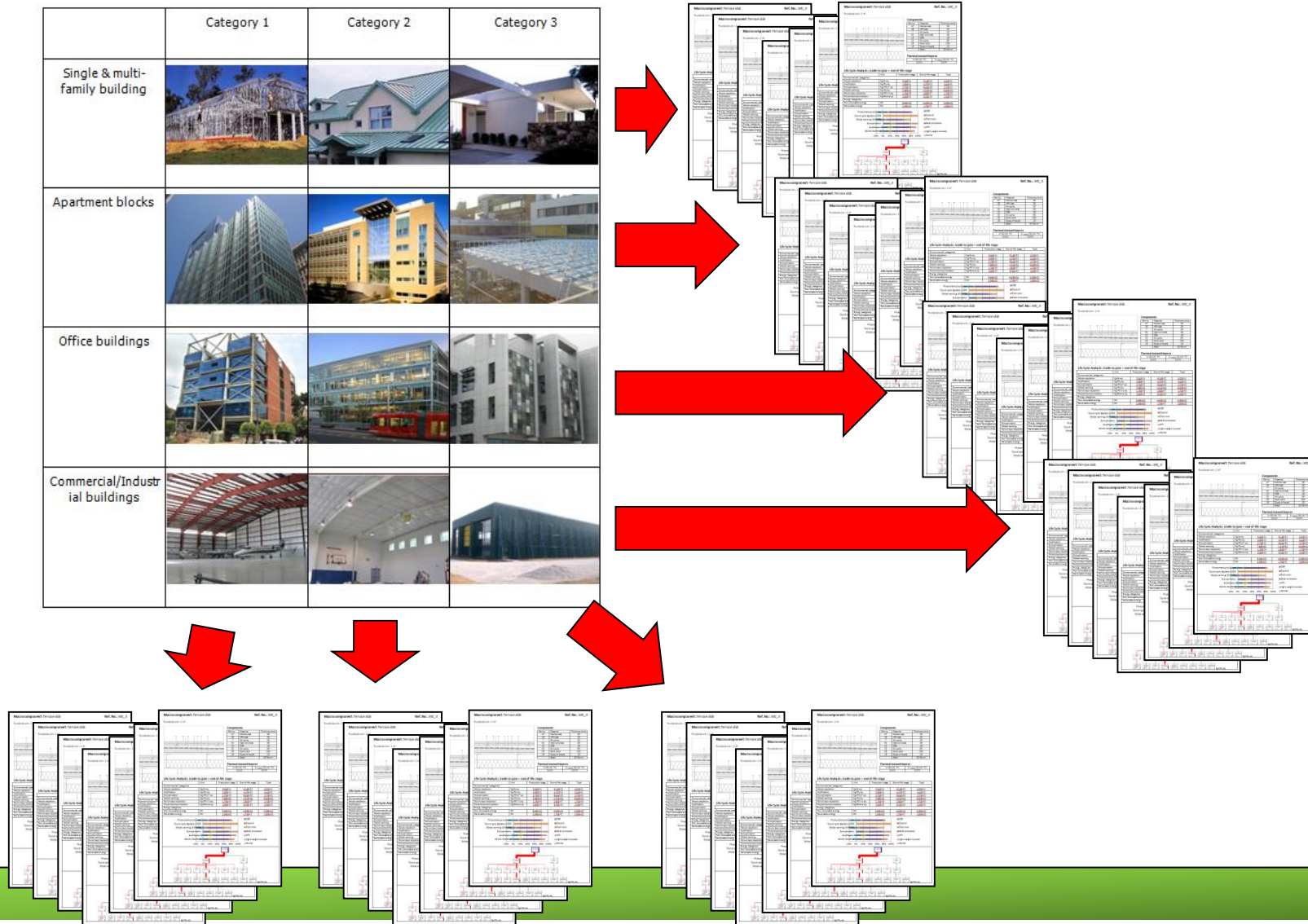


Materials	Thickness/ density	End-of-life scenario	RR (%)
OSB (mm)	18	Incineration	80
Air cavity (mm)	160		
Rock wool (mm)	40	Recycling	80
Gypsum board (mm)	15	Recycling	80
LWS (kg/m2)	14	Recycling	90

B1010.10.1a - LCA

	A1-A3	A4	C2	C4	D
ADP elements [kg Sb-Equiv.]	2,83E-05	1,76E-09	1,54E-09	3,37E-08	-1,96E-04
ADP fossil [MJ]	5,48E+02	6,54E-01	5,72E-01	1,31E+00	-3,35E+02
AP [kg SO2-Equiv.]	1,70E-01	2,11E-04	1,83E-04	5,74E-04	-4,45E-02
EP [kg Phosphate-Equiv.]	1,41E-02	4,86E-05	4,20E-05	8,79E-05	-1,01E-03
GWP [kg CO2-Equiv.]	5,12E+01	4,71E-02	4,12E-02	3,86E-01	-1,46E+01
ODP [kg R11-Equiv.]	7,65E-07	8,25E-13	7,21E-13	7,21E-11	1,76E-07
POCP [kg Ethene-Equiv.]	2,53E-02	-6,89E-05	-5,95E-05	1,49E-04	-1,07E-02

MACRO-COMPONENTEN DATABASE





2) iPad en iPhone Applicatie

Menu

Staal_LCA

Catalogus

Handleiding

Rapporten

Instellingen



Menu

Staal_LCA

Catalogus

Handleiding

Rapporten

Instellingen



Menu >> Staal_LCA

Twee berekeningsniveaus:

Productniveau



EN15804:2012

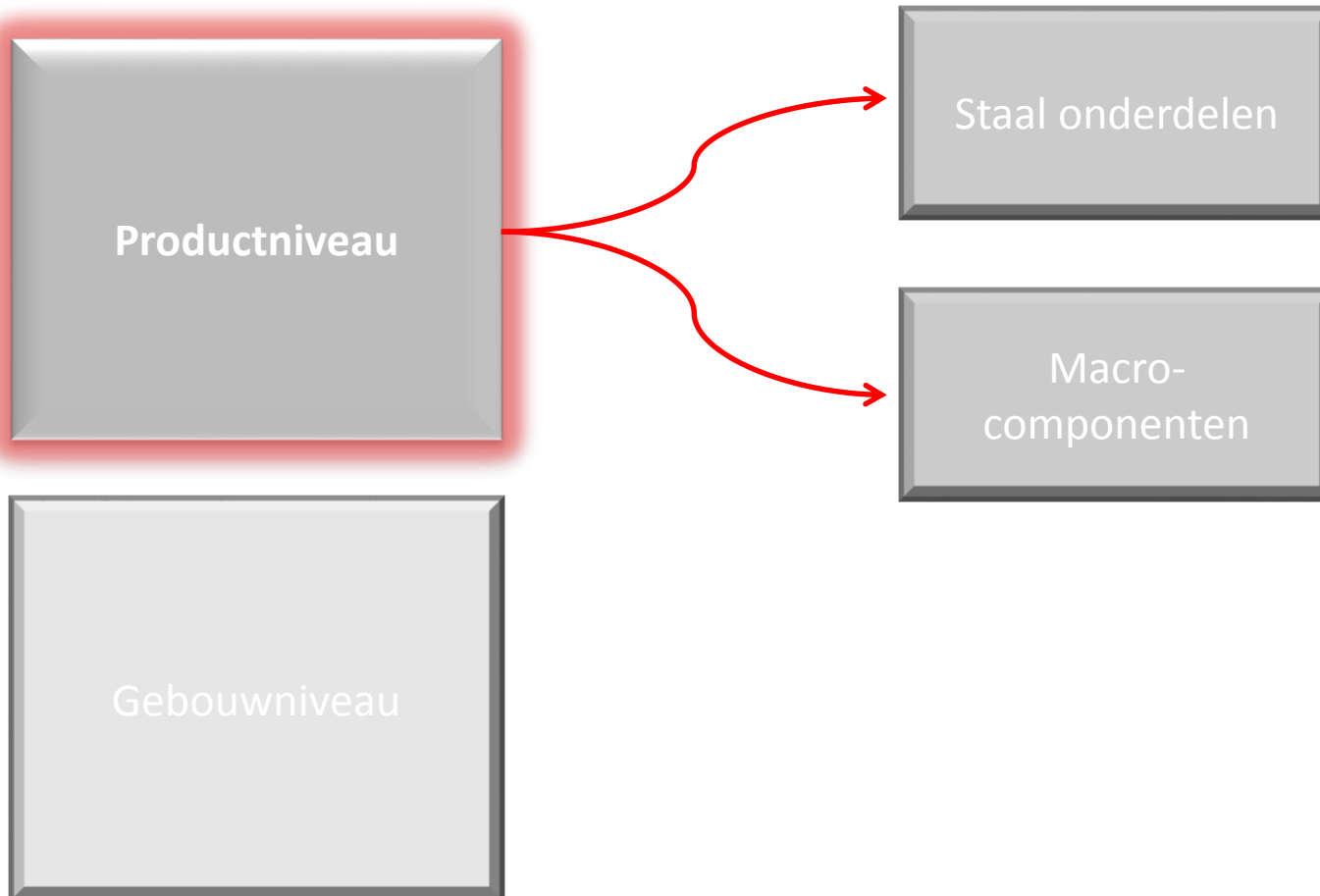
Gebouwniveau



EN15978:2011

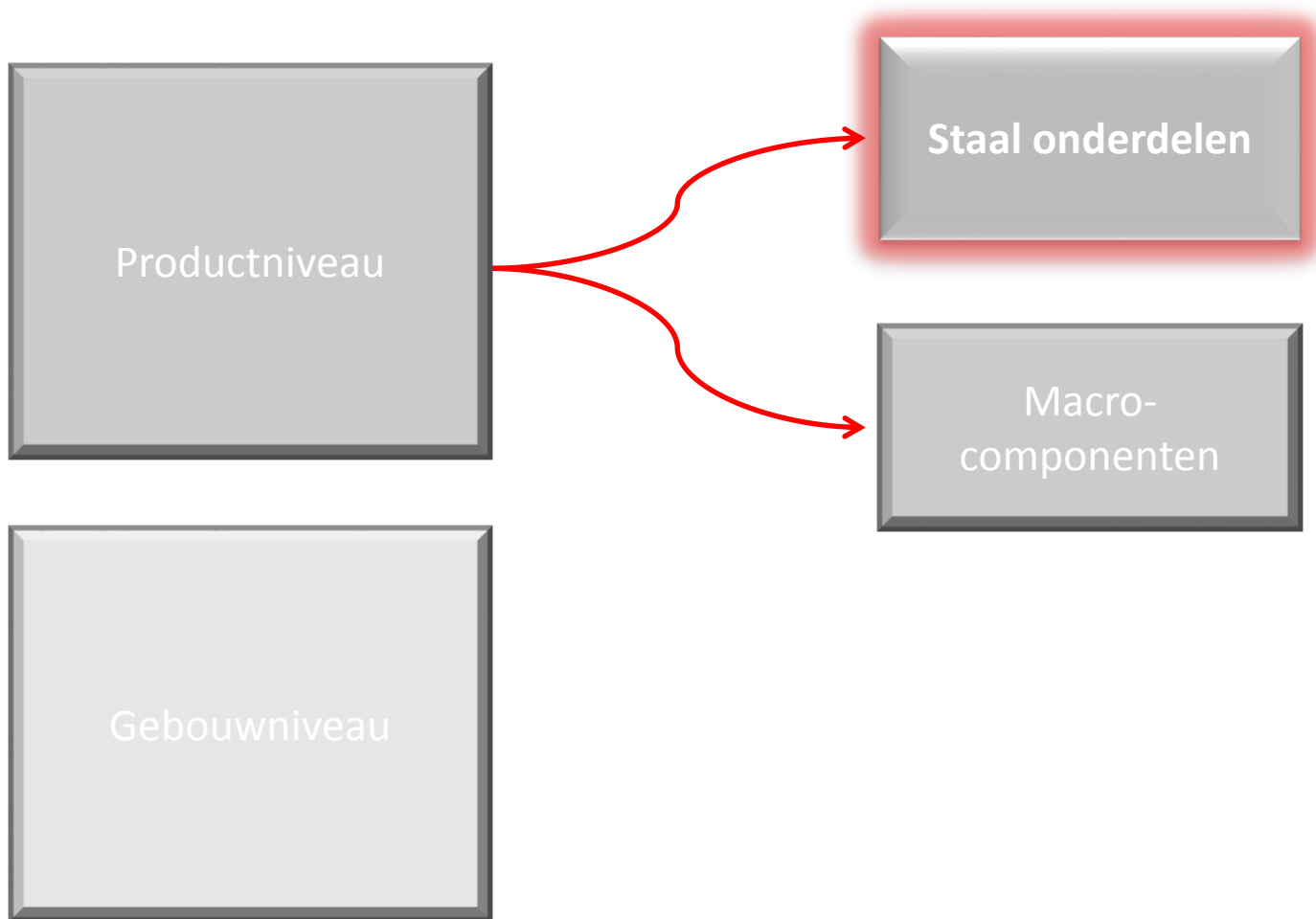


Menu >> Staal_LCA >> Productniveau





Menu >> Staal_LCA >> Productniveau





Menu >> Staal_LCA >> Productniveau

No SIM
16:59
69%

I or H sections
CALCULATE

HE

HE 100 AA
HE 100 A
HE 100 B
HE 100 M
HE 120 AA
HE 120 A
HE 120 B
HE 120 M
HE 140 AA
HE 140 A
HE 140 B
HE 140 M

HE 100 AA

add your company

Designation		
G	12.24	[kg/m]

Dimensions		
h	91.00	[mm]
b	100.00	[mm]
t.w	4.20	[mm]
t.f	5.50	[mm]

Inputs parameters

Length [m]

Lifespan [years]

Steel Grade
S235

Quality
JR

Fabrication Procedure
Hot Rolled

Scope of the Analysis

Cradle-to-gate

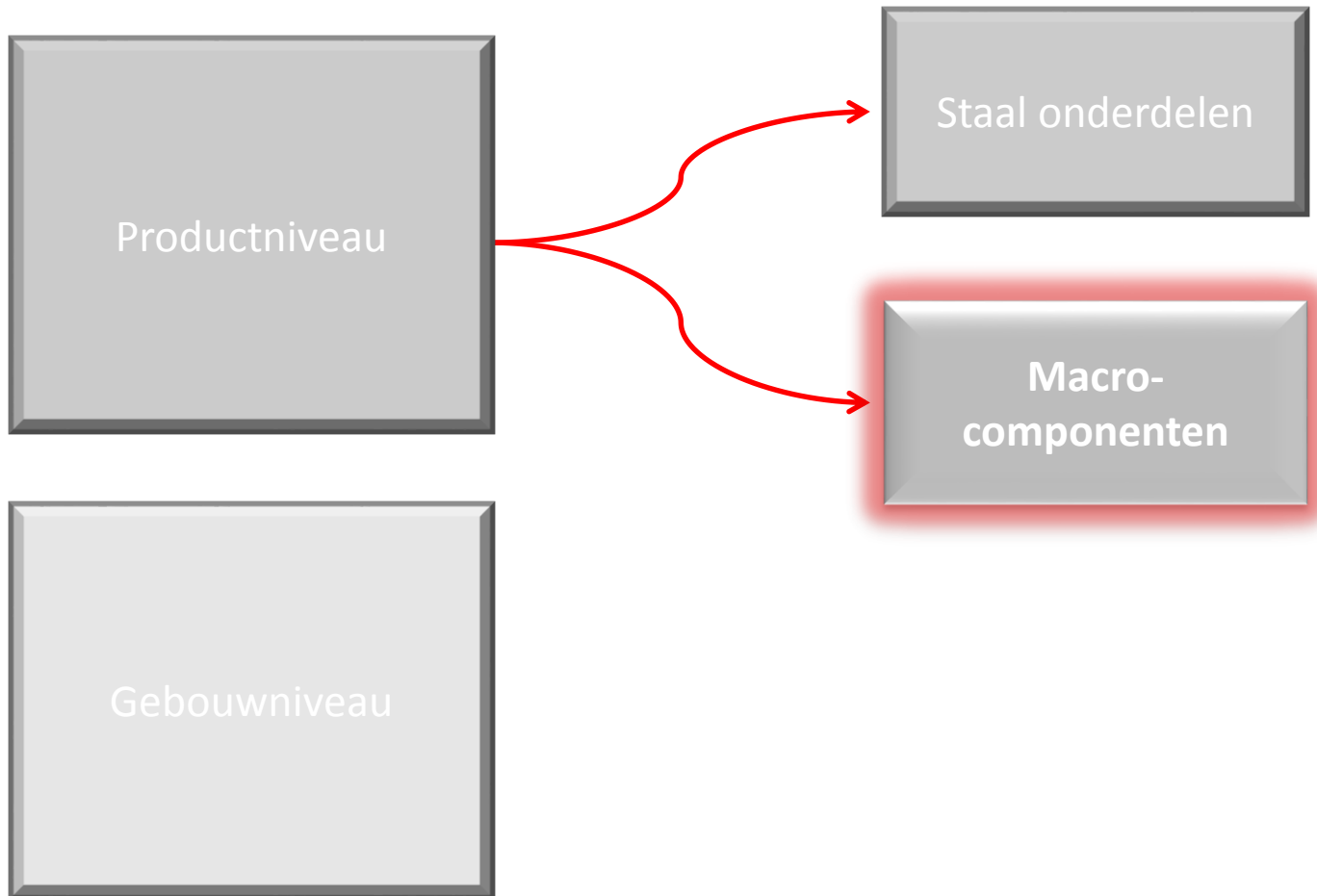
Coating System
☒

Transportation
☒

End-of-life recycling
☒



Menu >> Staal_LCA >> Productniveau





Menu >> Staal_LCA >> Productniveau >> Macro-componenten

Macro-componenten

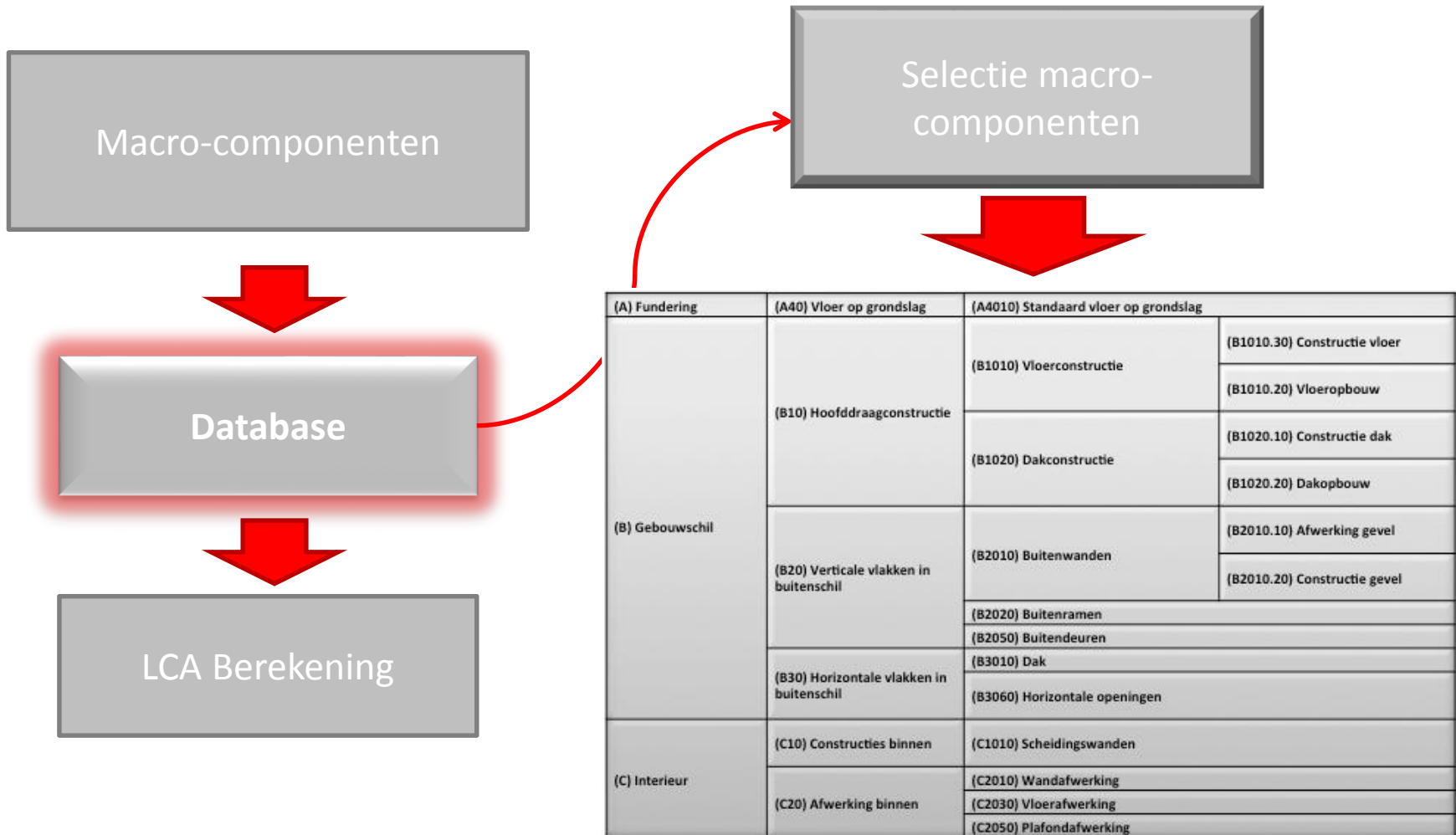


Database



LCA Berekening

Menu >> Staal_LCA >> Productniveau >> Macro-componenten





Menu >> Staal_LCA >> Productniveau >> Macro-componenten

Macro-componenten



Database



LCA Berekening

11-02

(B1010.10) Floor structur...

(B1010.10) Floor structural frame

CALCULATE

B1010.10.1 – Light-weight steel slabs

B1010.10.1a

B1010.10.1b

B1010.10.1c

B1010.10.1d

B1010.10.1e

B1010.10.1a

add your company

MAP

Inputs parameters

Rock wool [mm] 60

Scope of the Analysis

Cradle-to-grave + EOL

ADPelements

A1-A3	2.90e-5
A4	1.89e-9
B	0.00e+0
C2	1.65e-9

Full Report

Rock wool

Density 150 [kg/m2]

Thickness 40 [mm]

Weight

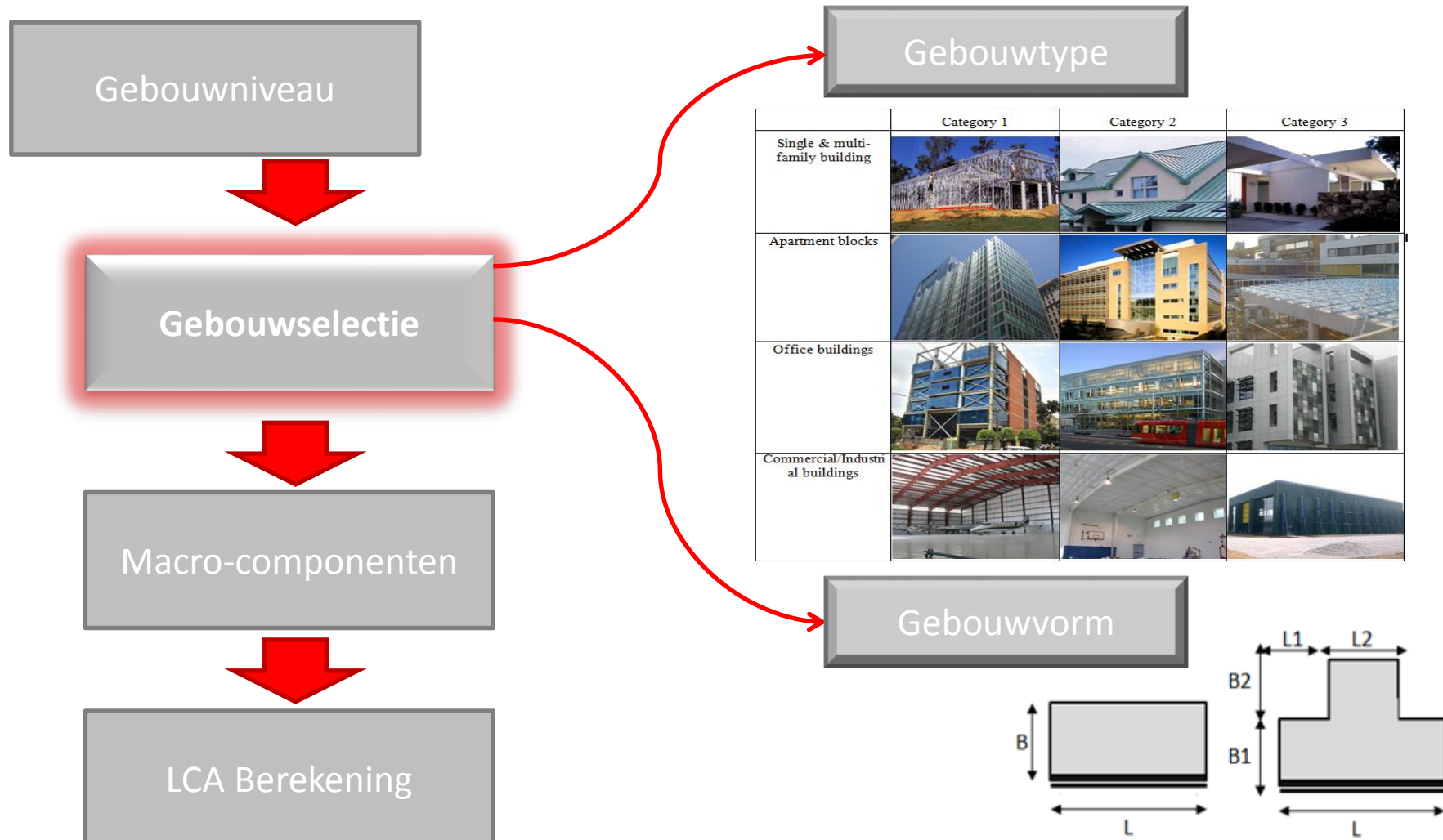


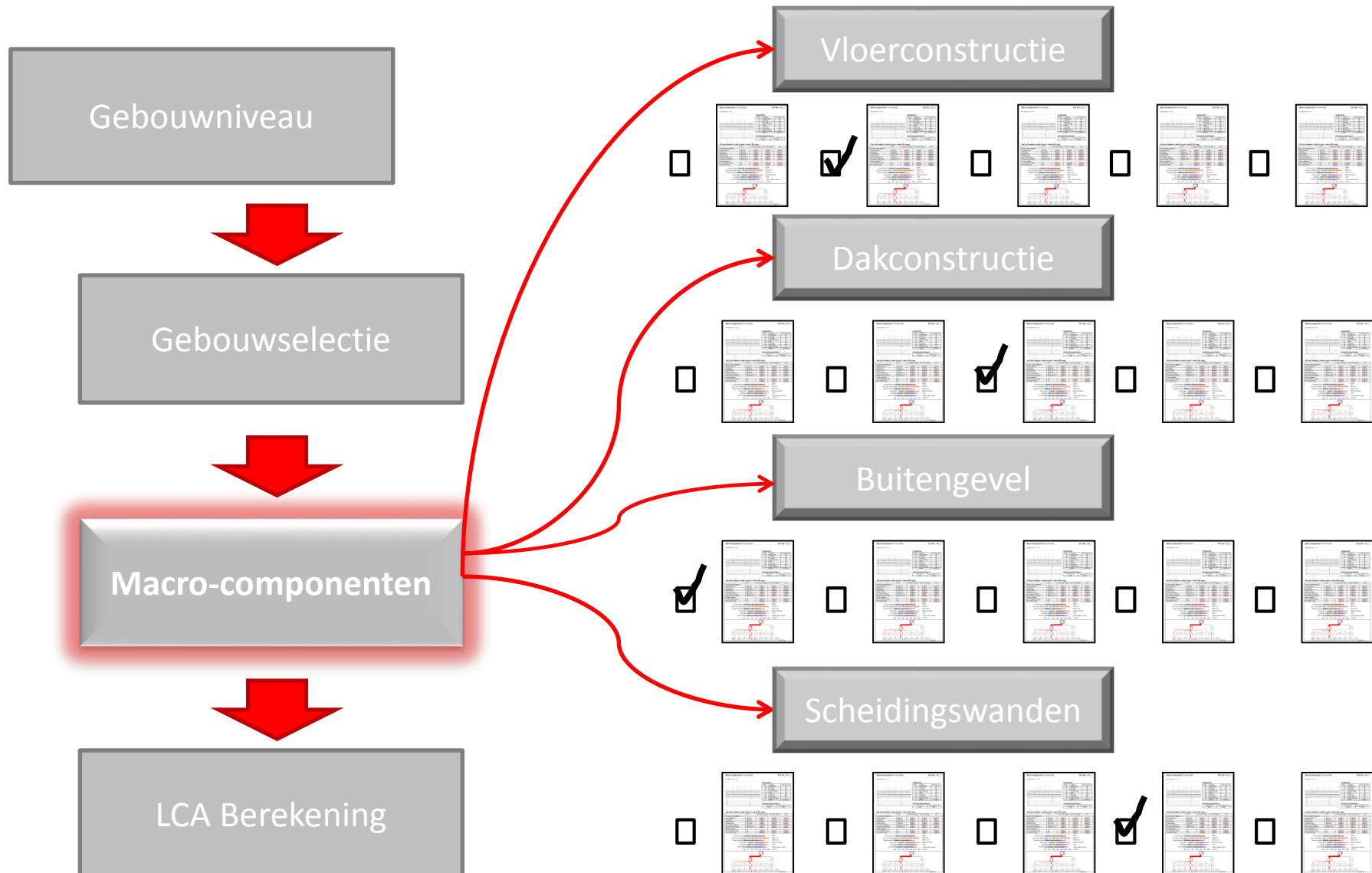
Menu >> Staal_LCA >> Gebouwniveau

Productniveau

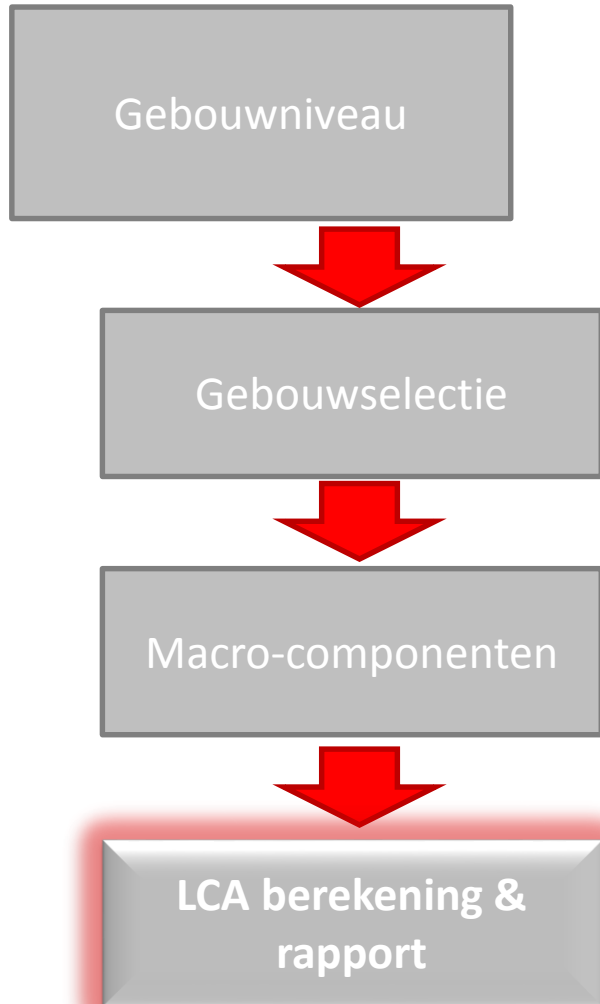
Gebouwniveau

Menu >> Staal_LCA >> Gebouwniveau >> selectie gebouw





Menu >> Staal_LCA >> Gebouwniveau >> LCA Berekening



LCA REPORT FOR STEEL BUILDINGS

SUMMARY

Scope: Cradle-to-grave + EOL

Lifespan: 50 years

Environmental Impacts

LCA index: -1.42E-11

Global Warming Potential (GWP): 41 kg CO₂ eq

Primary Energy Demand

Total Primary Energy Demand: 679 MJ

DETAILED RESULTS

LCA Input Data

B1010.10 Floor structural frame

	Materials	Thickness (mm)	End-of-life scenario	RR (%)
	Light weight steel (LWS)		Recycling	90
	OSB	18	Incineration	80
	Gypsum plasterboard	15	Recycling	80
	Rock wool	40	Recycling	80

LCA Results

LCA of 1m² of a Roof macro-component

Parameters describing enviromental impacts

Indicator	Unit	A1-A3	A4	B1-B5	C2	C4	D	TOTAL
ADP elements	[kg Sb Eq.]	2.90e-5	1.89e-9	0.00e+0	1.65e-9	3.67e-8	-1.97e-4	-1.68e-4
ADP fossil	[MJ]	5.88e+2	7.02e-1	0.00e+0	6.14e-1	1.43e+0	-3.36e+2	2.55e+2
AP	[kg SO ₂ Eq.]	1.93e-1	2.27e-4	0.00e+0	1.97e-4	6.25e-4	-4.45e-2	1.50e-1
EP	[kg PO ₄ - Eq.]	1.66e-2	5.22e-5	0.00e+0	4.51e-5	9.59e-5	-1.01e-3	1.58e-2
GWP	[kg CO ₂ Eq.]	5.48e+1	5.06e-2	0.00e+0	4.41e-2	4.20e-1	-1.46e+1	4.05e+1
ODP	[kg CFC-11 Eq.]	7.65e-7	8.86e-13	0.00e+0	7.73e-13	7.95e-11	1.78e-7	9.42e-7
POCP	[kg C ₂ H ₄ Eq.]	2.70e-2	-7.40e-5	0.00e+0	-6.38e-5	1.62e-4	-1.07e-2	1.63e-2



3) Conclusies

- De versimpelde LCA aanpak voorkomt het gebruik van complexe tools en experts in het vakgebied. Daardoor is er een substantiële reductie in de tijd die normaal nodig is om een dergelijke analyse te maken.
- De aanpak is getoetst door een vergelijking te maken met een geavanceerde analyse uitgevoerd met het commerciële pakket GaBi 6.
- De resultaten van de vergelijking laten zien dat de nauwkeurigheid van beide aanpakken redelijk is.