

# APPENDICES

## APPENDIX A - Simapro LCA INPUTS

### LCA Input Table: Mix 1

Known outputs to technosphere. Products and co-products								
Name	Amount	Unit	Quantity	Allocation %	Waste type	Category	Comment	
CEM I CONCRETE	2406	kg	Mass	100 %	not defined	Construction\Concrete		
Known outputs to technosphere. Avoided products								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Inputs								
Known inputs from nature (resources)								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Known inputs from technosphere (materials/fuels)								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Portland cement, strength class Z 42.5, at plant/CH U	380	kg	Undefined					
Limestone, crushed, for mill/CH U	1028	kg	Undefined					
Sand, at mine/CH U	806	kg	Undefined					
Polycarboxylates, 40% active substance, at plant/RER S	2	kg	Undefined					
Tap water, at user/CH U	190	kg	Undefined					
Transport, lorry 20-28t, fleet average/CH U	79.42	tkm	Undefined					
Known inputs from technosphere (electricity/heat)								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Outputs								
Emissions to air								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Emissions to water								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Emissions to soil								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Final waste flows								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Non material emissions								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Social issues								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Economic issues								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Known outputs to technosphere. Waste and emissions to treatment								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Disposal, concrete, 5% water, to inert material landfill/CH U	16	kg	Undefined					

## LCA Input Table: Mix 2

Known outputs to technosphere. Products and co-products								
Name	Amount	Unit	Quantity	Allocation %	Waste type	Category	Comment	
CEM III/B CONCRETE	2392	kg	Mass	100 %	not defined	ConstructionConcrete		
Known outputs to technosphere. Avoided products								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Inputs								
Known inputs from nature (resources)								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Known inputs from technosphere (materials/fuels)								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Portland cement, strength class Z 42.5, at plant/CH U	114	kg	Undefined					
Limestone, crushed, for mill/CH U	1020	kg	Undefined					
Sand, at mine/CH U	800	kg	Undefined					
Polycarboxylates, 49% active substance, at plant/RER 5	2	kg	Undefined					
Tap water, at user/CH U	190	kg	Undefined					
Transport, lorry 20-28t, fleet average/CH U	23.826	tkm	Undefined					
Transport, lorry 20-28t, fleet average/CH U	116.774	tkm	Undefined					
Known inputs from technosphere (electricity/heat)								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Outputs								
Emissions to air								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Emissions to water								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Emissions to soil								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Final waste flows								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Non material emissions								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Social issues								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Economic issues								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Known outputs to technosphere. Waste and emissions to treatment								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Disposal, concrete, 5% water, to inert material landfill/CH U	16	kg	Undefined					

## LCA Input Table: Mix 3

Known outputs to technosphere. Products and co-products								
Name	Amount	Unit	Quantity	Allocation %	Waste type	Category	Comment	
CEM II/B-V CONCRETE	2379	kg	Mass	100 %	not defined	ConstructionConcrete		
Known outputs to technosphere. Avoided products								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Inputs								
Known inputs from nature (resources)								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Known inputs from technosphere (materials/fuels)								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Portland cement, strength class Z 42.5, at plant/CH U	247	kg	Undefined					
Limestone, crushed, for mill/CH U	1013	kg	Undefined					
Sand, at mine/CH U	794	kg	Undefined					
Polycarboxylates, 40% active substance, at plant/RER 5	2	kg	Undefined					
Tap water, at user/CH U	190	kg	Undefined					
Transport, lorry 20-28t, fleet average/CH U	51.623	tkm	Undefined					
Transport, lorry 20-28t, fleet average/CH U	41.762	tkm	Undefined					
Known inputs from technosphere (electricity/heat)								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Outputs								
Emissions to air								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Emissions to water								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Emissions to soil								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Final waste flows								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Non material emissions								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Social issues								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Economic issues								
Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Known outputs to technosphere. Waste and emissions to treatment								
Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment	
Disposal, concrete, 5% water, to inert material landfill/CH U	16	kg	Undefined					

## APPENDIX B - MIX DESIGN YIELD CHECKS

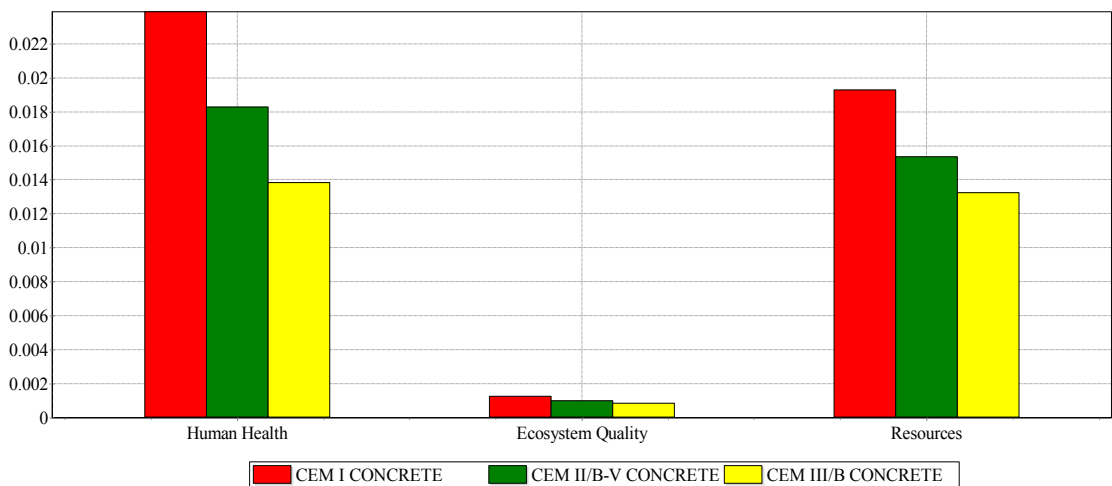
Materials	Mix 1: CEM I (kg/m <sup>3</sup> )	Relative Density (SSD)	Yield check (m <sup>3</sup> )
PC	380	3.12	0.122
10/20mm Limestone Aggregate	615	2.70	0.228
4/10mm Limestone Aggregate	413	2.70	0.153
0-4mm Fine Aggregate	806	2.65	0.304
Plasticiser	2	1.00	0.002
Water	190	1.00	0.190
<b>Theoretical Density:</b>	<b>2406</b>	<b>Total Yield:</b>	<b>0.999</b>

Materials	Mix 2: CEMII/B-V (kg/m <sup>3</sup> )	Relative Density (SSD)	Yield check (m <sup>3</sup> )
PC	247	3.12	0.0792
FA	133	2.30	0.058
10/20mm Limestone Aggregate	606	2.70	0.224
4/10mm Limestone Aggregate	407	2.70	0.151
0-4mm Fine Aggregate	794	2.65	0.298
Plasticiser	2	1.00	0.002
Water	190	1.00	0.190
<b>Theoretical Density:</b>	<b>2379</b>	<b>Total Yield:</b>	<b>1.002</b>

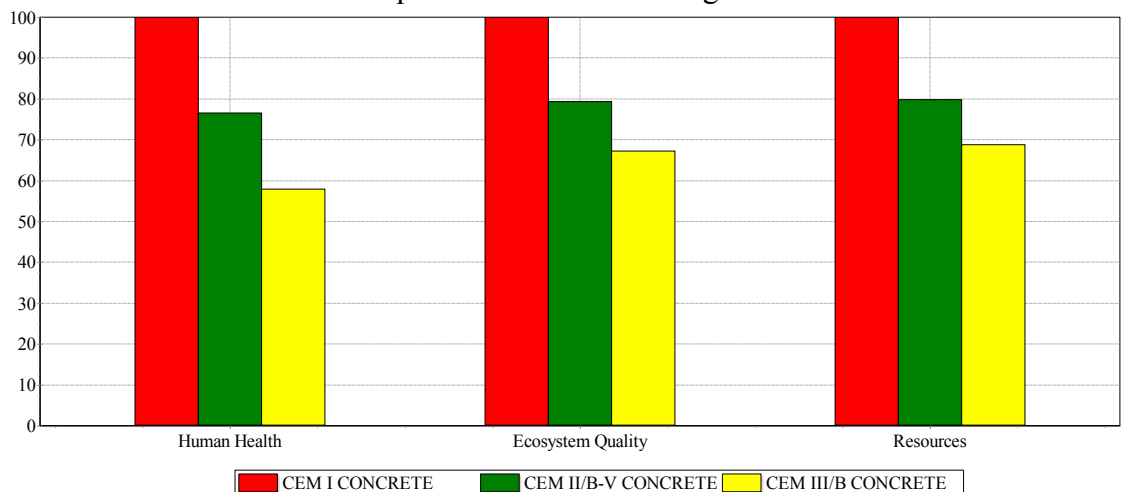
Materials	Mix 3:CEMIII/B (kg/m <sup>3</sup> )	Relative Density (SSD)	Yield check (m <sup>3</sup> )
PC	114	3.12	0.037
GGBS	266	2.90	0.092
10/20mm Limestone Aggregate	610	2.70	0.226
4/10mm Limestone Aggregate	410	2.70	0.152
0-4mm Fine Aggregate	800	2.65	0.301
Plasticiser	2	1.00	0.002
Water	190	1.00	0.190
<b>Theoretical Density:</b>	<b>2392</b>	<b>Total:</b>	<b>1.000</b>

# APPENDIX C – LCA RESULTS BY DAMAGE CATEGORY

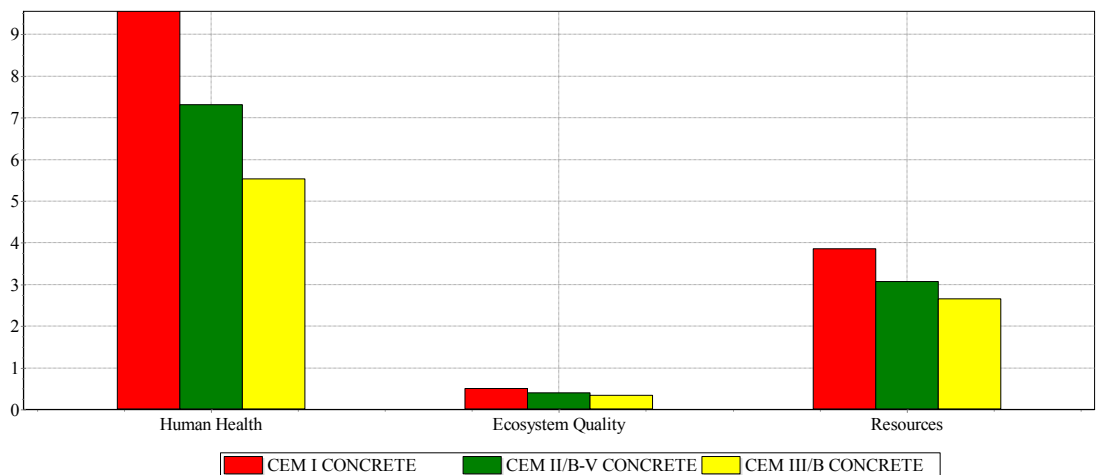
## Eco-indicator 99 Impact Assessment: Normalisation



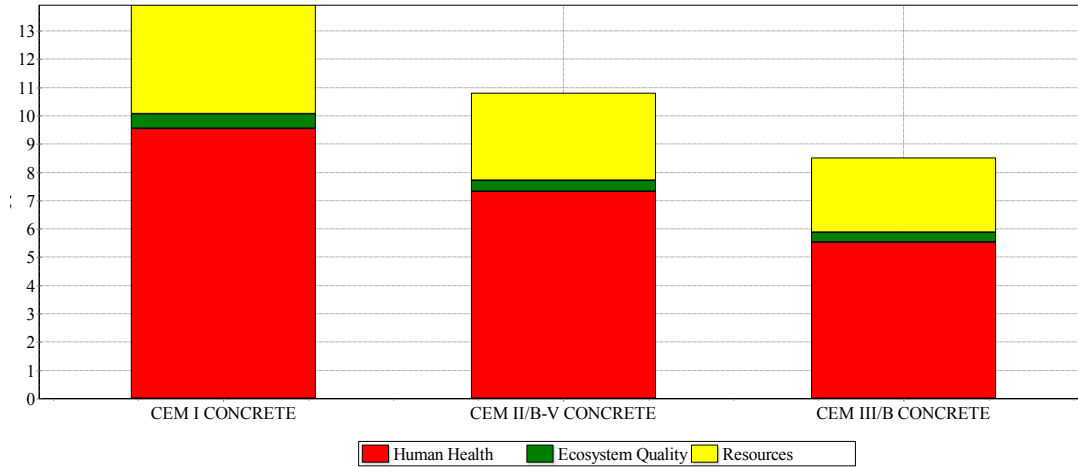
## Eco-indicator 99 Impact Assessment: Damage Assessment.



## Eco-indicator 99 Impact Assessment: Weighting.



### Eco-indicator 99 Impact Assessment: Single Score.



### Tables:

#### Eco-indicator 99 Impact Assessment Table: Damage Assessment.

Sel	Damage category	Unit	CEM I CONCRETE	CEM II/B-V CONCRETE	CEM III/B CONCRETE
<input checked="" type="checkbox"/>	Human Health	DALY	0.000209	0.00016	0.000121
<input checked="" type="checkbox"/>	Ecosystem Quality	PDF*m2yr	7.19	5.71	4.83
<input checked="" type="checkbox"/>	Resources	MJ surplus	145	116	100

#### Eco-indicator 99 Impact Assessment Table: Normalisation.

Sel	Damage category	Unit	CEM I CONCRETE	CEM II/B-V CONCRETE	CEM III/B CONCRETE
<input checked="" type="checkbox"/>	Human Health		0.0239	0.0183	0.0138
<input checked="" type="checkbox"/>	Ecosystem Quality		0.00126	0.000997	0.000845
<input checked="" type="checkbox"/>	Resources		0.0193	0.0154	0.0132

#### Eco-indicator 99 Impact Assessment Table: Weighting/Single Score.

Sel	Damage category	Unit	CEM I CONCRETE	CEM II/B-V CONCRETE	CEM III/B CONCRETE
	Total	Pt	13.9	10.8	8.52
<input checked="" type="checkbox"/>	Human Health	Pt	9.55	7.32	5.53
<input checked="" type="checkbox"/>	Ecosystem Quality	Pt	0.502	0.399	0.338
<input checked="" type="checkbox"/>	Resources	Pt	3.85	3.07	2.65