

LCA report | Torun 2.85 m

Goal and scope

The goal of this study is to provide necessary data of the product *Torun 2.85 m* to gain insights into the environmental impacts that can work as a basis for decision-making in order to reduce possible negative environmental impacts from the product.

The intended audience of this LCA are Ramudden Global, customers and other parties with an interest in the environmental impacts of this product.

Declared products

The declared product is Torun 2.85 m.

Table 1: Content declaration of *Torun 2.85 m*.

Product components	Weight (kg)
Steel S235	119
Steel S355	22
Steel C9D	2,4
Reinforcing steel HRB 45	15
Concrete	396
Rubber	4
Aluminum 6063	2
Zinc coating	11
Total	571,4

Declared unit

The declared unit of this LCA is 1 piece of product.

Reference service life

30 years.

Geographical scope

The LCA has been modeled for global raw material supply and Swedish sales. Therefore, it might not be applicable for sales outside of Europe.

Impact categories

The choice of impact categories is based on the obligatory indicators for construction products according to EN 15804.

Table 4: Included impact categories.

Impact category	Subcategory
Global warming potential (GWP)	Fossil Biogenic Land use and land use change Total
Ozone depletion potential (ODP)	
Acidification potential (AP)	
Eutrophication potential (EP)	Aquatic freshwater Aquatic marine Terrestrial
Photochemical ozone creation potential (POCP)	
Abiotic depletion potential (ADP)	Minerals and metals Fossil fuels
Water deprivation potential (WDP)	

System boundaries

The choice of system boundaries is based on the obligatory modules for construction products according to EN 15804. This includes the product stage (A1-A3) which consist of raw material extraction and processing, processing of secondary material input e.g. recycling processes, transport to the manufacturer, manufacturing, and transport to customer. Future waste management (C1-C4) and its consequences outside the product lifecycle (D) has also been included.

Table 5: Description of system boundaries.

Module A1	Extraction and processing of raw materials; reuse of materials from previous product systems; processing of secondary materials; generation of electricity, steam, and heat from primary energy sources; energy recovery and other recovery processes from secondary fuels.
Module A2	Transportation to the factory gate and internal transport.
Module A3	Production of ancillary materials or pre-products; manufacturing of products and co-products; manufacturing of packaging. Transportation from factory to customer (Ramuddens depots).

End-of-life stage

Module C1	Deconstruction, including dismantling or demolition of the product.
Module C2	Transportation of the discarded product to the recycling site and final disposal.
Module C3	Waste processing e.g. collection of waste fractions from the deconstruction and waste processing of materials for reuse, recycling, and energy recovery.

Module C4	Disposal including physical pre-treatment and management of the disposal site.
Module D	Benefits and loads beyond the product system boundary, like secondary materials or fuels and raw material substitution.

LCA standard | Product category rules | Software & database

The standards that have been used are EN 15804+A2 for European construction products and the ISO standards 14040 and 14044.

The Product Category Rules (PCR) that has been used 2019:14 for construction products. The PCR provides requirements, guidelines and rules for an EPD of a specific product category.

This LCA has been conducted using the software SimaPro and the Ecoinvent 3 database.

Life cycle inventory analysis

Inventory of raw materials (A1)

All of the components for the product as well as the products themselves are manufactured in Poland. Generic datasets from Ecoinvent 3 were used for the modeling of the material inputs. The datasets were modified by specific amounts provided by Worxsafe and by changing to Polish conditions for input water and electricity mix.

Transport (A2)

No material or energy impacts are expected to occur in this module.

Manufacturing and transport to customer (A3)

All of the components for the products as well as the barriers themselves are manufactured in the same factory located in Stare Swierczyny, Poland. The barriers are then transported by truck to the different depots in Sweden. The transportation distance was calculated as an average distance between the factory in Poland and the different customers in Sweden (depots) based on previous transports of the products between year 2020 and 2023. The distance was then multiplied by the weight of the goods being transported in tons.

Deconstruction (C1)

No material or energy impacts are expected to occur in this module.

Transport to waste management (C2)

In the end-of-life stage the barriers can either be reused or recycled. The recycling can take place at different recycling facilities (Skanska, Stena, NCC), and therefore no definite transport distance can be determined. In order to create some sort of estimation of this transport, the transportation distance to waste management has been assumed to be 100 km. The locations for reuse of the barrier are also unknown and therefore the distance to reuse has been assumed to be 50km.

Waste processing (C3)

This stage includes recycling of concrete and steel which is modelled for 10% of the product since about 90% of the products are reused for different purposes.

Waste disposal (C4)

No material or energy impacts are expected to occur in this module.

Benefits and loads beyond the system boundary (D)

This module includes the avoided production of barriers due to reuse. As there is no specific time limit for how long the barriers can be reused, an assumption was made that they can be reused as long as their technical life length. Because of this, the environmental impacts were divided by half for 90% of the products, which is presented in module D.

Table 6: Inventory analysis for Torun 2.85 m.

	Material	Data description	Dataset	Data quality	Source
A1 Raw material supply	Steel S235 and S355	Production and processing of steel produced in Poland.	Steel, unalloyed {RER} steel production, converter, unalloyed Cut-off, U	Specific amounts modelled with generic dataset. Dataset has been modified by changing to water and electricity from Poland.	Worxsafe Ecoinvent v3
	Steel C9D	Production of steel.	Steel, unalloyed, {RER} steel production, converter, unalloyed Cut-off, U	Specific amounts modelled with generic dataset. Dataset has been modified by changing to water and electricity from Poland.	Worxsafe Ecoinvent v3
	Reinforcing steel HRB45	Production of reinforcing steel	Reinforcing steel {Europe without Austria} production Cut-off, U	Specific amounts modelled with generic dataset.	Worxsafe Ecoinvent v3
	Aluminum 6063	Production of aluminium	Aluminum alloy, AIMg3 {RER} production Cut-off, U	Specific amounts modelled with generic dataset.	Worxsafe Ecoinvent v3

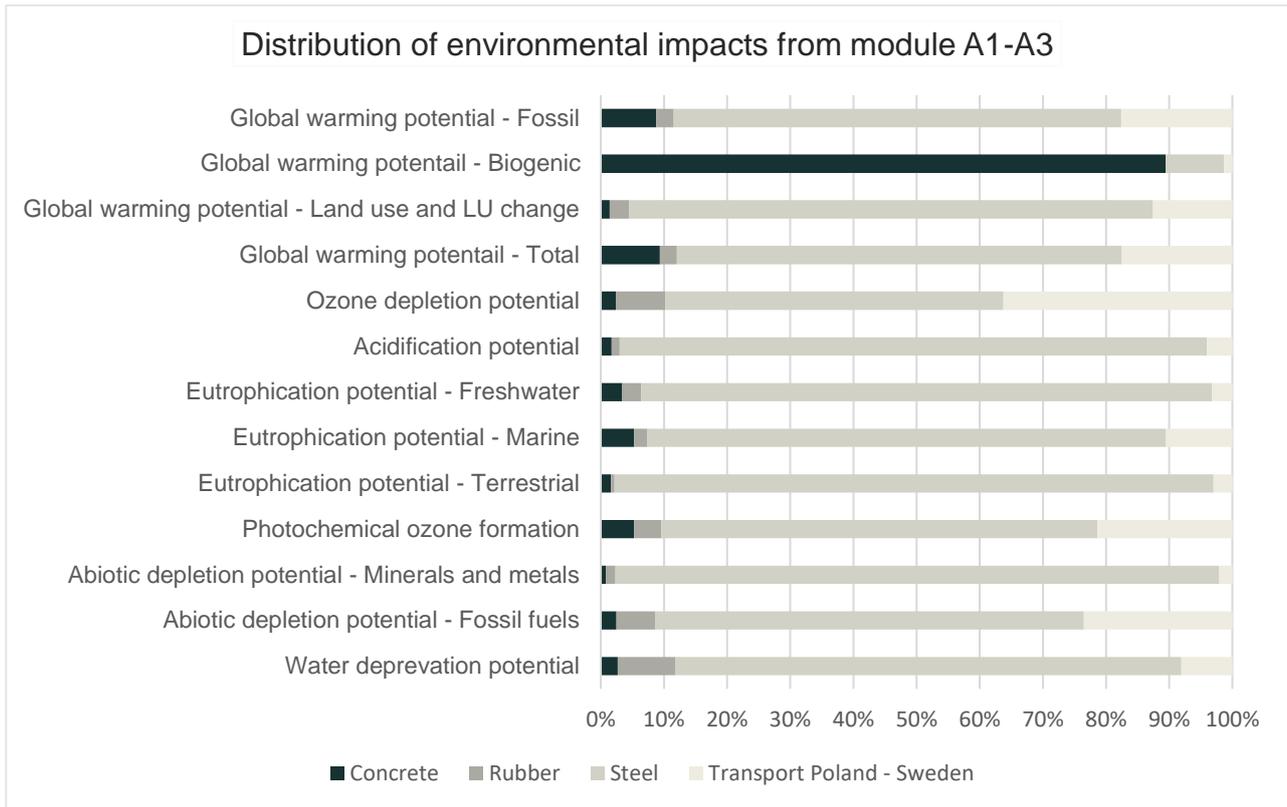
	Concrete C30	Production of concrete	Concrete, 37MPa {CH} concrete production, 37MPa, for civil engineering, with cement, Portland Cut-off, U	Specific amounts modelled with generic dataset. Dataset has been modified by changing to electricity from Poland and removing the waste scenario as that has been modeled separately.	Worxsafe Ecoinvent v3
	Zinc coating	Galvanization of zinc	Zinc coat, coils {RER} zinc coating, coils Cut-off, U	Specific amounts modelled with generic dataset. Dataset has been modified by changing to electricity from Poland.	Worxsafe Ecoinvent v3
	Rubber EPDM	Production of synthetic rubber	Synthetic rubber {RER} synthetic rubber production Cut-off, U	Specific amounts modelled with generic dataset. Dataset has been modified by changing to electricity from Poland.	Worxsafe Ecoinvent v3
	Electricity	Electricity used at the production site in Poland.	Electricity, medium voltage {PL} market group for electricity, medium voltage Cut-off, U	Electricity used for modifying the generic datasets to represent Polish production.	Worxsafe Ecoinvent v3
A3 Manufacturing	Transport by Truck	Transportation between the factory in Poland and the different customers in Sweden.	Transport, freight, lorry >32 metric ton, EURO6 {RER} transport, freight, lorry >32 metric ton, EURO6 Cut-off, U	Average transportation distance multiplied by the weight of the goods being transported in tons, modelled with generic dataset.	Worxsafe Ecoinvent v3
C1- Deconstruction	-	-	-	-	-
C2 – Transport to waste treatment	Transport by truck	Transportation to waste treatment. Assumed distance to recycling is 100 km and to reuse 50 km.	Transport, freight, lorry >32 metric ton, EURO6 {RER} transport, freight, lorry >32 metric ton,	Assumed transportation distance multiplied by the weight of the goods being transported in tons,	Ramudden Ecoinvent v3

			EURO6 Cut-off, U	modelled with generic dataset.	
C3 – Waste processing	Recycling of concrete	Material recycling of concrete.	Waste reinforced concrete {CH} treatment of waste reinforced concrete, recycling Cut-off, U	Specific amounts modelled with generic dataset.	Ramudden Ecoinvent v3
	Recycling of steel	Material recycling of steel parts.	Waste reinforcement steel {CH} treatment of waste reinforcement steel, recycling Cut-off, U	Specific amounts modelled with generic dataset.	Ramudden Ecoinvent v3
C4- Waste disposal	-	-	-	-	-
D – Benefits and loads beyond the life cycle	Reuse of product	Avoided production of barriers resulting from reuse of the products.	No dataset used- modelled in Excel	Specific amounts modelled I Excel.	Ramudden

Results

Table 7: Results of the environmental impacts of Torun 2.85 m.

Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Global warming potential – Fossil	kg CO2 eq	4,78E+02	0,00E+00	8,85E+00	1,26E+00	0,00E+00	-2,15E+02
Global warming potential - Biogenic	kg CO2 eq	3,25E+00	0,00E+00	4,74E-03	1,38E-04	0,00E+00	-1,46E+00
Global warming potential - Land use and LU change	kg CO2 eq	2,38E-01	0,00E+00	3,14E-03	1,10E-04	0,00E+00	-1,07E-01
Global warming potential - Total	kg CO2 eq	4,82E+02	0,00E+00	8,86E+00	1,27E+00	0,00E+00	-2,17E+02
Ozone depletion potential	kg CFC11 eq	4,84E-06	0,00E+00	1,85E-07	1,94E-08	0,00E+00	-2,18E-06
Acidification potential	mol H+ eq	4,96E+00	0,00E+00	2,09E-02	1,14E-02	0,00E+00	-2,23E+00
Eutrophication potential - Freshwater	kg P eq	1,82E-01	0,00E+00	6,23E-04	3,69E-05	0,00E+00	-8,19E-02
Eutrophication potential - Marine	kg N eq	4,95E-01	0,00E+00	5,49E-03	5,29E-03	0,00E+00	-2,23E-01
Eutrophication potential - Terrestrial	mol N eq	1,89E+01	0,00E+00	5,93E-02	5,80E-02	0,00E+00	-8,51E+00
Photochemical ozone formation	kg NMVOC eq	1,62E+00	0,00E+00	3,63E-02	1,73E-02	0,00E+00	-7,28E-01
Abiotic depletion potential - Minerals and metals	kg Sb eq	1,13E-02	0,00E+00	2,47E-05	4,51E-07	0,00E+00	-5,09E-03
Abiotic depletion potential - Fossil fuels	MJ	5,37E+03	0,00E+00	1,33E+02	1,65E+01	0,00E+00	-2,42E+03
Water depreivation potential	m3 depriv.	7,46E+01	0,00E+00	6,33E-01	3,58E-02	0,00E+00	-3,36E+01
“E” means exponent (10 ^x). For example, 4,78E+02 means 4,78*10 ² and can be read as 478.							



Interpretation of results

The result shows that for most of the impact categories, the biggest environmental impacts come from the raw material supply in module A1, and especially the steel production which has the highest impact on all of the categories except for GWP-biogenic where the production of concrete has the highest impact. However, as the primary data was very limited, this LCA has been conducted using generic data. Because of this, the steel production was modeled with average data from European steel makers and has not been modified to represent the specific steel production for this product except for changing to water and electricity from the producing county (Poland).

The transportation of the barriers from Poland to Sweden is also contributing to some of the environmental impacts, especially the ozone depletion potential. Compared to module A1-A3, the end-of-life modules C1-C4 does not have a high impact for any of the categories.

Recommendations

Based on the results from the LCA, some recommendations can be made in order to reduce the environmental impacts. Since the steel production is the biggest contributor to the environmental impacts, this would be the stage where the most significant changes could be made. One of those changes could be to use recycled steel and increasing the use of renewable energy in the steel-making process. However, since the primary data for this LCA was very limited, the steel production was modeled with average data from European steel makers and might not be representative for this specific production process. In fact, recycled steel and renewable energy might already be used. Because of this, the results and recommendations should be used with caution.

Appendix

Figure 1: Network showing the distribution of the input materials impact on global warming potential.

