Environmental Product Declaration for the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27

According to EN 15804 and ISO 14025
Program operator: International EPD® System
Declaration owner: NCC AB

Reg. no. S-P-00709 UN CPC 53221 / CPV 45221110-6 Date 03/07/2015 Valid until 03/07/2018

The verifier and the program operator do not make any claim nor have any responsibility of the legality of the product, its production process or its supply chain.

The pedestrian and bicycle bridge is a composite bridge made of concrete and steel.

The declared bridge is bridge 15-1787-1 in the project road 27 Viared-Kråkered in Borås municipality, Sweden. It crosses the small river Viskan. The location is shown in Figure 7.

The one-span bridge consists of a structure of steel girders supporting a slab of concrete. In contrast to a conventional composite bridge, this bridge is fixed in the abutments, which also allowed for the dimension of the girders to be significantly reduced.

EPD INFORMATION

Functional unit:	1 m of pedestrian and bicycle bridge referring to per year of RSL
PCR:	Bridges and elevated highways 2013:23 VERSION 1.0, DATE 2013-12-20
RSL:	80 years according to TRVK Bro 11 (TRV 2011: 085)
Program operator:	The International EPD® System Box 210 60 SE-100 31 Stockholm Sweden info@environdec.com

DESCRIPTION OF THE PRODUCT

The bridge is a one-span bridge with a span of 35 m, carrying a pedestrian and bicycle path. The concrete deck acts compositely with two main carbon steel girders of varying height.

The roadway is 5 m wide, and the average thickness of the concrete slab is 220 mm. Center distance between the girders is 3 m. The two embankments up to the bridge are 3 m wide and 30 m long each. The embankments are built with crushed stone and gravel. The bridge and the embankments are paved with asphalt. On the bridge, the asphalt is laid over a sealing layer. The asphalt pavement is 3 m wide. Racks on the bridge are made of carbon steel. The two abutments stand on a foundation of crushed stone and two permanent steel sheets are installed in the ground between the abutments and the river. The material composition of the bridge including the two embankments is shown in Figure 1. The material composition of the bridge excluding the embankments is shown in Figure 2.

The bridge is designed according to relevant standards, mainly described in SS-EN standards (Eurocodes) and TRV AMA. The complete list of standards can be found under references.

Figures 3 and 4 show construction drawings of the bridge.

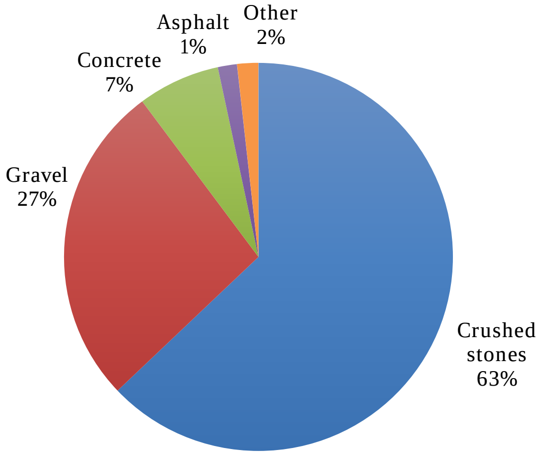

Figure 1: Composition of the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27 including embankments (mass %)

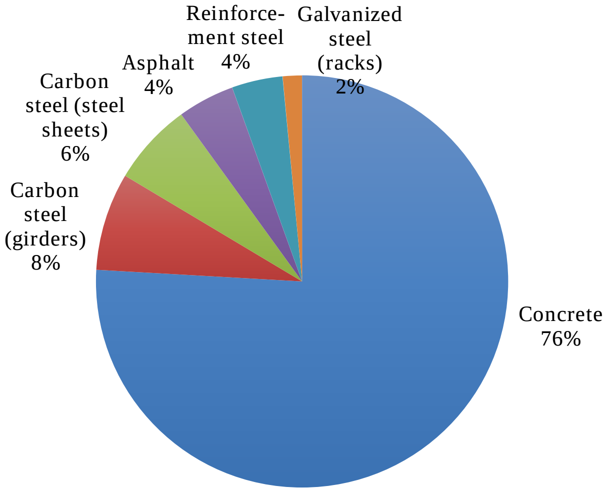

Figure 2: Composition of the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27 excluding embankments (mass %)

TECHNICAL INFORMATION

Bridge	
Length	44,4 m
Span	35 m
Width	5 m
Height	5 m
Embankments	
Length	2 x 30 m
Width	3 m

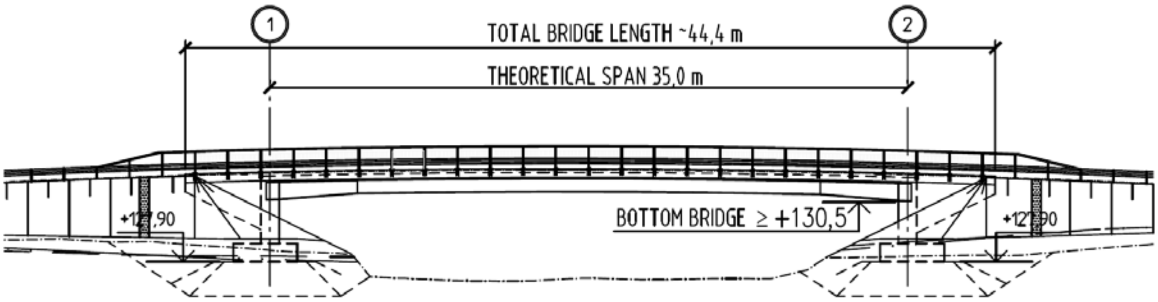

Figure 3: Section of the bridge span.

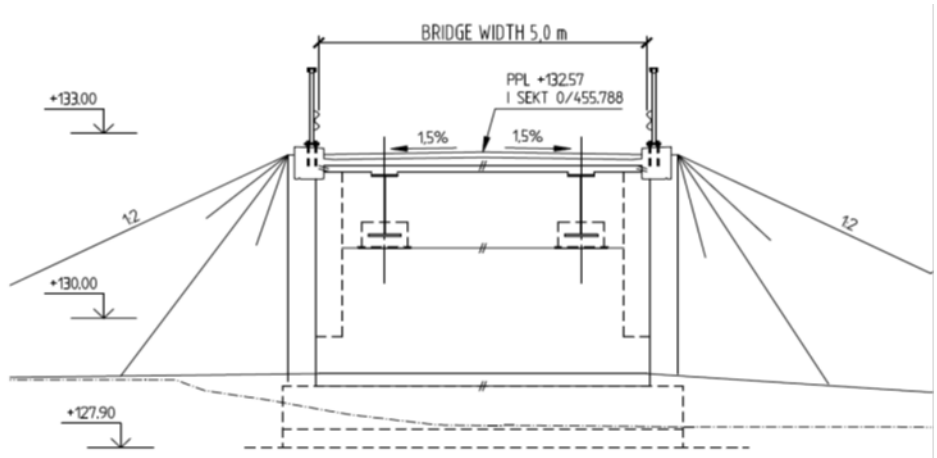

Figure 4: Cross section of the bridge.

1. FUNCTIONAL UNIT

The functional unit is 1 metre of pedestrian and bicycle bridge referring to per 1 year of RSL (Reference Service Life). The RSL of the bridge is 80 years. Additionally, results are given in the Annex for 1 square metre per year of RSL.

2. SYSTEM BOUNDARY

This is a "cradle to grave" EPD. The EPD declares a pedestrian and bicycle bridge. All processes to construct and maintain the bridge are included according to the /PCR/. The declared modules are shown in figure 5. In accordance with the /PCR/, the formworks are excluded from the declaration.

The whole bridge construction including pavement and racks of the bridge is declared. The embankments up to the bridge and groundworks for foundation of the bridge are also included in the system boundary and declared in this EPD.

According to the /PCR/ the materials used for maintenance of the infrastructure shall be declared under the "Upstream" module. The required energy and auxiliary materials, and the waste treatment, are declared in the "Downstream" module.

Figure 5: The system boundaries of the LCA. Modules of the production life cycle included in the EPD

Upstream Module		Core Module	Downstream Module						Other environmental information
Construction			Operation	Maintenance	End-of-Life				
Raw material supply (extraction, processing, recycled material) Transport to manufacturer Manufacturing	Transport to construction site	Construction of the bridge	Use / application Operational energy use Operational water use	Maintenance Repair Replacement Refurbishment	Deconstruction / demolition	Transport to end-of-life	Waste processing for reuse, recovery or recycling	Disposal	Benefits and loads beyond the system boundaries (BLBSB)
A1-A3	A4	A5	B1, B6, B7	B2-B5	C1	C2	C3	C4	D
X	X	X	X	X	MND	X	X	X	X

(X = declared module; MND = module not declared)

3. ESTIMATES AND ASSUMPTIONS

The bridge is assumed to have dimensions as given in the product description and with girders made of carbon steel.

The foreground data was collected by the manufacturers in 2014 and 2015. The data of the raw materials has been collected per bridge component.

Upstream Module
For concrete and asphalt, supplier specific data is applied. For all other materials, general datasets from GaBi have been used. For steel, the input of secondary material (metal scrap) is without burdens since the production of secondary material is not considered. A general truck dataset is used for transport of materials.

Core Module
For the construction of the bridge, Green Electricity from Vattenfall (5 % Windpower: VindEl with EPD; 95 % Water power: VattenEl with EPD) is used.

Downstream Module
The bridge has no lighting or other equipment and no operational maintenance will be required.

The maintenance phase contains a maintenance scenario for the concrete edge beams, the concrete layers, the steel girders and the asphalt pavement. Every 35-40 years the concrete edge beams of the superstructure have to be replaced. Every 10 years, minor repairs of the concrete layers are required. For the steel girders, 10% of the surface needs to be re-painted after 20 years, 20% of the surface after 40 years and complete repainting is required after 60 years. Every 40 years, the top 30 mm of the asphalt pavement is replaced. The steel racks do not need re-painting or other maintenance since they are made of hot-dipped galvanized steel. For the electricity used in the maintenance scenario, Swedish electricity grid mix is used.

In the end-of-life (EoL) scenario, the recycling and landfilling of materials of the bridge is accounted for according to Table A. The collection rate in the EoL stage is assumed to be 100%.

The burdens of these processes are included in module C3, but material benefits – that occur due to the recycling process – are included as benefits in module D.

Table A: Waste treatment in EoL

Material	Waste treatment
Steel (girders and racks)	100% recycling
Reinforcement steel	95% recycling + 5% landfill
Concrete	100% recycling as crushed material (filling) in roads
Asphalt	100% recycling as gravel for new asphalt
Gravel and crushed stone	95% re-used as gravel for fillings in new bridge and embankments + 5% landfill.

4. CUT-OFF CRITERIA

In the assessment, all available data from the production process are considered, i.e. all raw materials used, utilised auxiliary materials, and electricity consumption using GaBi datasets. Only a cotton geotextile used under the gravel has not been included (less than 1% of the cumulative mass). It is considered as irrelevant in comparison with the other raw materials used for the construction of the bridges (e.g. steel, concrete, asphalt and gravel).

In the assessment, all available data were considered, i.e. all raw materials used, thermal energy consumption and electricity consumption - excluding material and energy flows contributing less than 1% of mass or energy (if available). A sensitivity check showed that the impact on the results from this cut-off is insignificant.

5. BACKGROUND DATA

For life cycle modelling of the concept bridge, the software system for Life Cycle Engineering, developed by PE INTERNATIONAL AG /GaBi 6 2013/, is applied. The GaBi-database contains consistent and documented datasets which are available in the online GaBi-documentation /GaBi 6 2013D/.

6. DATA QUALITY

Overall the data quality can be described as good.

The model is based on primary data provided by NCC. Background data is geographically representative of the bridge location, and is less than 10 years old.

7. ALLOCATION

For all refinery products, allocation by mass and net calorific value has been applied.

Two allocation rules for upstream data have been used: 1. the raw material (crude oil) consumption of the respective stages, is allocated by energy (mass of the product * lower calorific value of the product); and 2. the energy consumption (thermal energy, steam, electricity) of a process is allocated to the product according to the share of the throughput of the stage (mass allocation).

Specific information on allocation within each background dataset is available in the corresponding GaBi dataset documentation.
The construction process does not deliver any co-products. The applied software model does not contain any allocation of foreground data.

Regarding the recycling of metals, the metal parts in EoL are declared as end-of-waste status. Thus, the environmental burden for the recycling process and the credits for these materials are considered in module D.

8. COMPARABILITY

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared are created according to /ISO 14025/ and /EN 15804/ and the building context, particularly the product-specific characteristics of performance, are taken into account.

ENVIRONMENTAL PERFORMANCE RELATED-INFORMATION

The results of the life cycle assessment of 1 metre of pedestrian and bicycle bridge referring to 1 year of RSL are given in Table 1 (environmental impact), Table 2 (resource use) and Table 3 (output flows and waste categories). The results for the functional unit of 1 m per one year of RSL are calculated by dividing the total by the length of the bridge and the RSL. Figure 6 shows the use of resources (material and energy) for 1 metre of bridge referring to 1 year of RSL broken down into single material uses. Additionally, all these results are given for 1 square metre of bridge per year of RSL in the Annex. A sensitivity check of the cut-offs have been performed and the cut-offs do not influence the final result.

The results in the upstream module are mainly influenced by the production of the steel girders of the superstructure. The production of the steel sheets, crushed stones and concrete also contributes significantly. The impacts of transport of materials as well as the impact of the on-site construction activities are minor in relation to the impact from the production of the materials used in the construction of the bridge.

The results in the maintenance stage are mostly influenced by the production and combustion of diesel as well as the production of concrete for the replacement of the edge beams. The production of asphalt for the replacement of the top layer also has some influence. In the end-of-life stage, the influence from module C is minor. In module D, the influence from the credits and loads beyond the system boundaries is visible, above all due to the recycling of the metal parts.

Table 1: Results of the LCA - Environmental impact of **1m** of the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27 per year of RSL

RESULTS OF THE LCA		Upstream module		Core module	Downstream module					Other environmental information
		Product stage	**Transport**	**Construction stage**	**Use stage**		**End of life stage**			**BLBSB***
		Raw materials/ production	**Transport to construction site**	**Construction of the bridge**	**Operation**	**Maintenance**	**Transport to EoL**	**Waste processing for reuse, recovery or recycling**	**Disposal**	**Reuse, recovery or recycling potential**
Parameter	Unit	**Module A1-A3**	**Module A4**	**Module A5**	**Module B1, B6, B7**	**Module B2-B5**	**Module C2**	**Module C3**	**Module C4**	**Module D**
ENVIRONMENTAL IMPACT										
Global warming potential; GWP	kg CO2 eq	8,16E+01	1,72E+00	3,03E+00	-1,39E+00[1]	9,08E+00	1,39E+00	1,13E+00	1,04E+00	-3,86E+01
Ozone depletion potential of stratospheric ozone layer; ODP	kg CFC 11 eq	1,64E-08	8,01E-12	6,76E-11	0	9,54E-11	5,73E-12	1,75E-11	1,66E-11	-5,25E-10
Acidification potential of land and water; AP	kg SO2 eq	2,04E-01	7,71E-03	1,72E-02	0	8,48E-02	6,15E-03	1,45E-03	6,3E-03	-1,55E-01
Eutrophication potential; EP	kg PO43- eq	2,42E-02	1,95E-03	2,22E-03	0	1,85E-02	1,56E-03	2,65E-04	8,64E-04	-1,47E-02
Formation potential of tropospheric ozone photochemical oxidants; POCP	kg ethylene eq	2,68E-02	-2,41E-03	4,36E-03	0	1,53E-02	-2,05E-03	1,78E-04	5,91E-04	-2,2E-02
Abiotic depletion potential for non fossil resources; ADPE	kg Sb eq	4,05E-04	8,97E-08	1,41E-06	0	2,97E-06	5,47E-08	3,91E-07	3,86E-07	-1,05E-06
Abiotic depletion potential for fossil resources; ADPF	MJ	7,84E+02	2,35E+01	5,52E+01	0	1,26E+02	1,92E+01	1,64E+01	1,36E+01	-3,76E+02

*BLBSB: Benefits and Loads Beyond the System Boundaries

[1] Negative value due to the carbonation of concrete (*Kjellsen, Guimaraes, Nilsson (2007) and EPD VDZ)*

Table 2: Results of the LCA - Resource use of **1m** of the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27 per year of RSL

RESULTS OF THE LCA		**Upstream module**		**Core module**	**Downstream module**					**Other environmental information**
		Product stage	**Transport**	**Construction stage**	**Use stage**		**End of life stage**			**BLBSB***
		Raw materials/ production	**Transport to construction site**	**Construction of the bridge**	**Operation**	**Maintenance**	**Transport to EoL**	**Waste processing for reuse, recovery or recycling**	**Disposal**	**Reuse, recovery or recycling potential**
Parameter	Unit	**Module A1-A3**	**Module A4**	**Module A5**	**Module B1, B6, B7**	**Module B2-B5**	**Module C2**	**Module C3**	**Module C4**	**Module D**
RESOURCE USE										
Non-renewable materials	kg	1,67E+03	1,55E-01	2,12E+01	0	2,24E00	9,32E-02	6,99E-01	9,27E+00	-1,9E+03
Renewable materials	kg	4,64E+04	1,3E+03	3,34E+04	0	1,64E+03	8,67E+01	06,99E-01	6,99E+02	2,14E+03
Renewable primary energy as energy carrier; PERE	MJ	7,8E+01	-	-	-	-	-	-	-	-
Renewable primary energy resources as material utilization; PERM	MJ	0	-	-	-	-	-	-	-	-
Total use of renewable primary energy resources; PERT	MJ	7,8E+01	2,19E+00	2,14E+01	0	7,91E+00	1,08E+00	1,49E+01	1,39E000	3,02E+00
Non renewable primary energy as energy carrier; PENRE	MJ	7,73E+02	-	-	-	-	-	-	-	-
Non renewable primary energy as material utilization; PENRM	MJ	7,08E+01	-	-	-	-	-	-	-	-
Total use of non renewable primary energy resources; PENRT	MJ	8,46E+02	2,47E+01	5,67E+01	0	1,27E+02	1,93E+01	3,54E+01	1,41E+01	-3,67E+02
Use of secondary material; SM	kg	8,94E+00	0	0	0	0	0	0	0	0
Use of renewable secondary fuels; RSF	MJ	0	0	0	0	0	0	0	0	0
Use of non renewable secondary fuels; NRSF	MJ	0	0	0	0	0	0	0	0	0
Use of net fresh water; FW	m3	6,52E-01	4,22E-03	4,76E-02	0	8,03E-02	1,89E-03	3,23E-02	2,67E-03	-3,93E-02

*BLBSB: Benefits and Loads Beyond the System Boundaries

Table 3: Results of the LCA - Output flows and waste categories of **1 m** of the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27 per year of RSL

RESULTS OF THE LCA		Upstream module		Core module	Downstream module					Other environmental information
		Product stage	Transport	Construction stage	Use stage		End of life stage			BLBSB*
		Raw materials/ production	Transport to construction site	Construction of the bridge	Operation	Maintenance	Transport to EoL	Waste processing for reuse, recovery or recycling	Disposal	Reuse, recovery or recycling potential
Parameter	Unit	Module A1-A3	Module A4	Module A5	Module B1, B6, B7	Module B2-B5	Module C2	Module C3	Module C4	Module D
OUTPUT FLOWS AND WASTE CATEGORIES										
Hazardous waste disposed; HWD	kg	3,25E-03	1,24E-05	1,73E-05	0	6,07E-05	9,15E-06	2,28E-05	4,38E-06	2,3E-05
Non-hazardous waste disposed; NHWD	kg	2,36E+01	4,99E-03	1,44E+02	0	3,53E+00	2,75E-03	2,95E-02	6,45E+01	-5,69E+01
Radioactive waste disposed; RWD	kg	2,47E-02	5,01E-04	6,32E-04	0	7,06E-04	2,64E-005	7,89E-03	2,24E-04	3,3E-03
Components for re-use; CRU	kg	-	-	0	0	0	0	0	0	-
Materials for recycling; MFR	kg	-	-	1,46E+02	0	3,2E+01	0	1,34E+03	0	2,01E+01
Materials for energy recovery; MER	kg	-	-	0	0	0	0	0	0	-
Exported electrical energy; EEE	MJ	-	-	0	0	0	0	0	0	-
Exported thermal energy; EET	MJ	-	-	0	0	0	0	0	0	-

*BLBSB: Benefits and Loads Beyond the System Boundaries

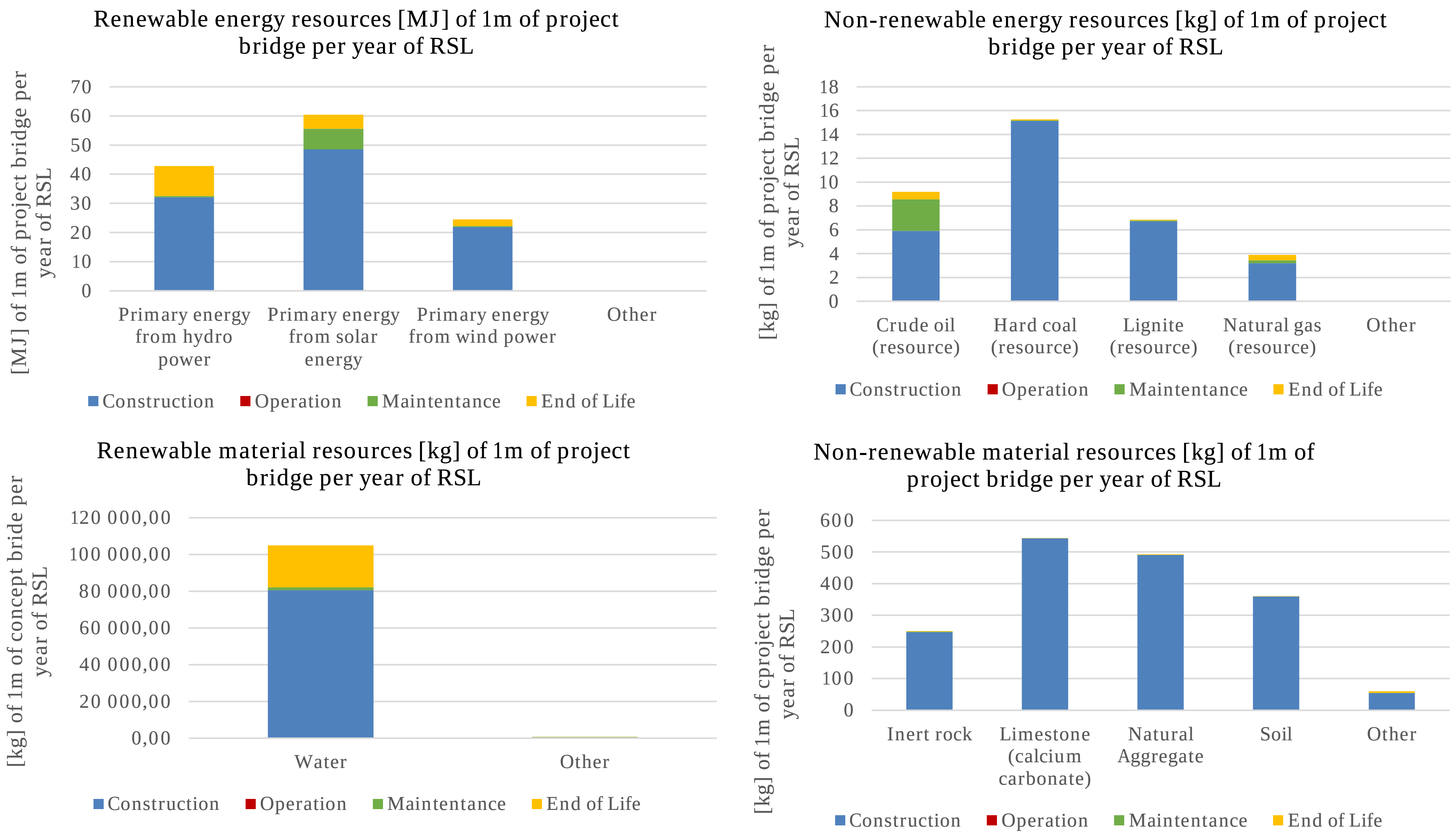

Figure 6: Specification of resources used (material and energy) for **1 m** of the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27 per year of RSL. The “Other” category includes primary energy from geothermics, peat (resource), air, carbon dioxide and oxygen, and bauxite, clay, iron ore, quartz sand, dolomite and gypsum.

ADDITIONAL ENVIRONMENTAL INFORMATION

Impacts on biodiversity are monitored and sought to be minimized in all construction projects. Appropriate monitoring and measurements are dependent on location of each specific project. In the case when there is an impact on protected areas such as waters, habitats, nature reserves etc., appropriate applications, exemptions and permissions are sought. A common measure to minimize impacts on biodiversity is the construction of wildlife crossings. In the whole project road 27, several wildlife crossings have been constructed, such as frog tunnels, hazel dormouse crossings and wildlife bridges. For the bridge 15-1787-1, a disturbance on surrounding habitats has occurred because twenty nesting trees for the shrike (Lanius collurio) have been cut. A habitat conservation measure performed is that otter stones have been placed under both of the abutments. The impact on natural flora and fauna has been abated by bringing back the natural vegetation to slopes.

National regulations regarding noise were adhered to during construction. There were no requirements of vibration measurements during construction. As a rule, neighbours were informed well in advance when potentially disturbing works are going to be undertaken. There is also a cemetery close to the construction site, and noisy construction works were not allowed during specific times. No complaints were received from neighbours or other parties concerned.

The raw materials and auxiliary materials used in the construction and maintenance of the bridge do not include substances deemed to be of high concern such as SVHC or substances on the REACH candidate list. NCC also aims at using only materials that fulfil the BASTA chemical composition criteria. BASTA is a Swedish environmental assessment system for building and construction products. There is a list and safety data sheets of all chemical products used, and consumed amounts are accounted for yearly.

Environmental impacts on water flows, groundwater levels and water quality were monitored during construction in accordance to requirements. Appropriate permissions were sought from the water-rights court. All tanks were kept in retaining dikes and at a specified distance from water courses. Absorbents were kept easily accessible. The groundwater table was lowered locally inside the steel sheets during one period when contaminated soil was excavated and the concrete slabs were cast. It was lowered approximately 1,5 metres in two 6 x 8 metre pits during 3-4 weeks. Since the groundwater table was lowered during a short period of time, it is judged that an acceptable ecological status has been maintained. The water quality and the flow of river Viskan was not affected since excavation of contaminated soil was performed inside steel sheets. Outgoing water from the drained pits was filtered through sand and carbon filters and then released on a grass-covered surface 50 metres from water recipients. The filtering was performed because the water contained a high concentration of dioxin due to the dioxin-contaminated soil. There was no requirement on measuring concentrations in outgoing water from the filters.

VERIFICATION DETAILS

Product Category Rules (PCR) review was conducted by: *The Technical Committee of the International EPD® System. Chair: Massimo Marino* *Contact via info@environdec.com.*
Independent verification of the declaration and data, according to ISO 14025:2006: □ EPD process certification ☒ EPD verification
Third party verifier: Carl-Otto Nevén (carlotto.neven@bredband.net) Accredited or approved by: The International EPD® System

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Concrete structures - Concrete cover (Swedish Standard)

TRV 2011:047
Transport Administration requirements regulated in TRV Geo 11 (TRV 2011: 047)

TRV 2011:086
Transport Administration requirements regulated in TRVK Bro 11, revised version of part A and appendix 103, (TRV 2011:086)

VindEl (1)
Miljödeklaration för vindel med EPD, 5% Windpower: VindEl with Environmental Product Declaration, Vattenfall 2013

WorldSteel
World Steel Association, Life cycle assessment methodology report, 2011. ISBN 978-2-930069-66-1

ABOUT THE EPD

This environmental product declaration (EPD) describes, from a lifecycle perspective, the total environmental impact of a pedestrian and bicycle bridge.

The EPD is drawn up in accordance with Product Category Rules (PCR) 2013:23 for Bridges and elevated highways. The program operator is the International EPD® System (see www.environdec.com for more information). EPDs within the same product category but from different programs may not be comparable unless EN 15804 compliant where relevant.

The aim of this EPD is that it should provide objective and reliable information on the environmental impact of the construction of a pedestrian and bicycle bridge.

This EPD is developed by NCC AB in cooperation with PE INTERNATIONAL. It is certified by Carl-Otto Nevén and the certification is valid for three years (after which it can be revised and reissued). The declaration owner is NCC AB.

As this EPD is based on data relating to the bridge 15-1787-1, the results might not be representative for other bridges. The most important areas that should be checked to be comparable with bridge 15-1787-1 are:

- Bridge functionality
- Type of bridge (e.g. concrete or steel beam)
- Topography
- Origin of materials (mainly steel and concrete)

ABOUT NCC

NCC is one of the leading construction and property development companies in the Nordic region. The Group had sales of SEK 57 billion in 2014, with approximately 18 000 employees. NCC operates within three businesses; an industrial business within NCC Roads, a construction and civil engineering business within NCC Construction and a development business within NCC Housing and NCC Property Development.

NCCs vision is to renew our industry and provide superior sustainable solutions. NCC aims to be the leading society builder of sustainable environments and will capitalize on this sustainability perspective to proactively develop new businesses.

NCC works purposefully to reduce both our own and our customers' environmental impact and continues to further refine our offerings with additional products and solutions for sustainability. In terms of the environment, this entails that NCC, at every step of the supply chain, is to offer resources and energy-efficient products and solutions that help our customers in reducing their environmental impact and operating more sustainably. NCC has an ISO 14001 certificate. Each year NCC reports the Group's emission of greenhouse gases to the CDP.

NCC's sustainability work is based on a holistic approach with all three dimensions of sustainability – the social, environmental and economical – interacting in a distinct and thorough manner. Our long-term sustainability strategy includes the aim of being both a leader and pioneer. NCC reports on its sustainability each year and the report has been included in NCC's Annual Report since 2010. NCC applies G4, the voluntary guidelines of the Global Reporting Initiative (GRI) for the reporting of sustainability information.

NCC is a member in BSCI (Business Social Compliance Initiative) which is the broadest business-driven platform for the improvement of social compliance in the global supply chain. NCC has been a participant to the UN Global Compact since 2010. The UN Global Compact is a strategic policy initiative for businesses that are committed to aligning their operations and strategies with 10 defined and universally accepted principles in the areas of human rights, labour, environment and anti-corruption.

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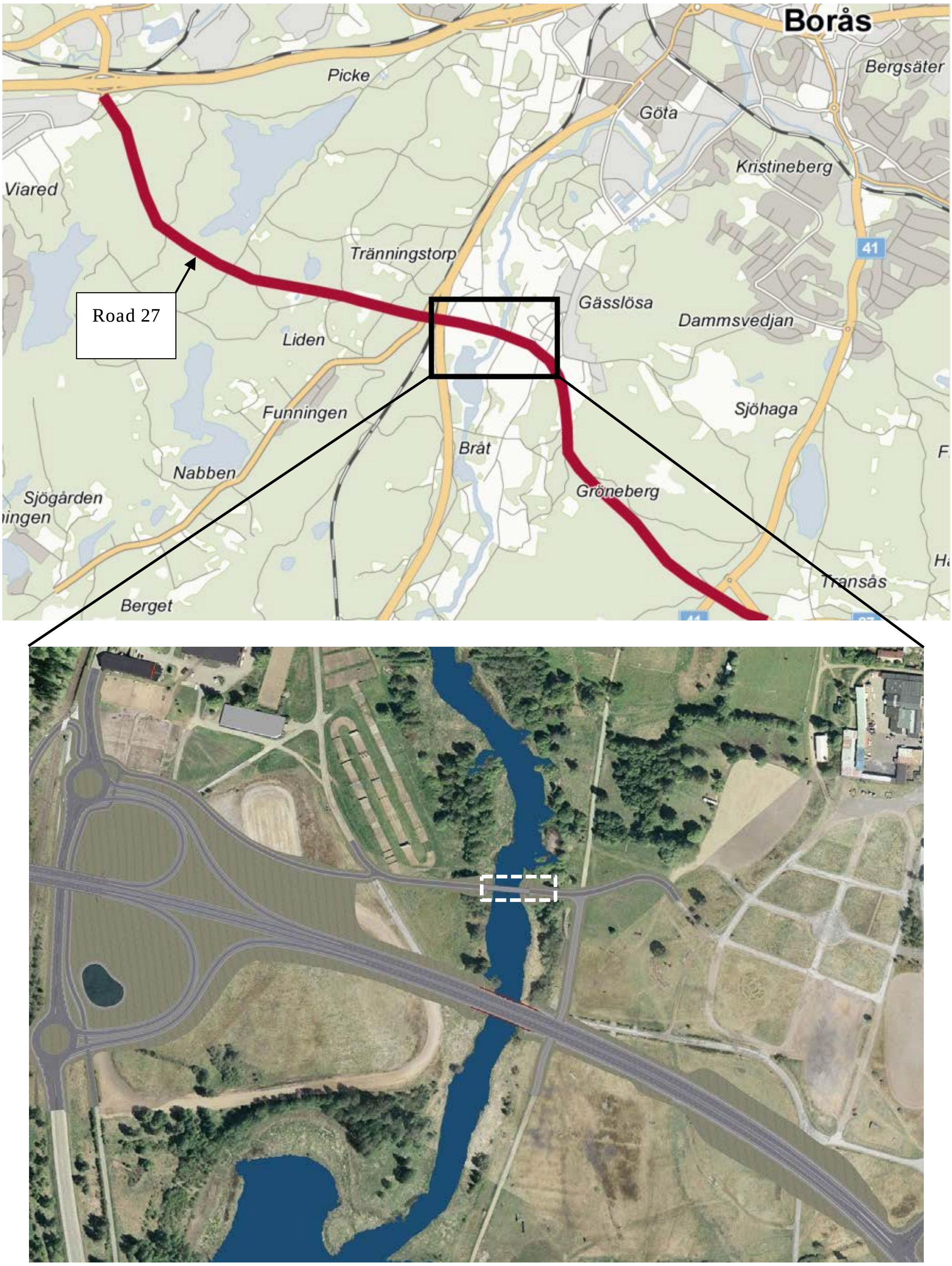

Figure 7. Map showing the geographical location of the declared bridge. The bridge is marked with a white dotted line.

ANNEX ENVIRONMENTAL PERFORMANCE RELATED-INFORMATION WITH ADDITIONAL FUNCTIONAL UNIT

The results for the functional unit of 1 m per one year of RSL are calculated by dividing the total by the length of the bridge and the RSL. To convert these results to the other functional unit of 1 m² per one year of RSL, they are divided again by the width of the bridge.

Table A1: Results of the LCA - Environmental impact of **1 m²** of the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27 per year of RSL

RESULTS OF THE LCA		Upstream module		Core module	Downstream module					Other environmental information
		Product stage	**Transport**	**Construction stage**	**Use stage**		**End of life stage**			**BLBSB***
		Raw materials/ production	**Transport to construction site**	**Construction of the bridge**	**Operation**	**Maintenance**	**Transport to EoL**	**Waste processing for reuse, recovery or recycling**	**Disposal**	**Reuse, recovery or recycling potential**
Parameter	Unit	**Module A1-A3**	**Module A4**	**Module A5**	**Module B1, B6, B7**	**Module B2-B5**	**Module C2**	**Module C3**	**Module C4**	**Module D**
ENVIRONMENTAL IMPACT										
Global warming potential; GWP	kg CO2 eq	1,63E+01	3,43E-01	6,06E-01	-2,79E-01[1]	1,82E+00	2,79E-01	2,26E-01	2,08E-01	-7,72E+00
Ozone depletion potential of stratospheric ozone layer; ODP	kg CFC 11 eq	3,27E-09	1,6E-12	1,35E-11	0	1,91E-11	1,15E-12	3,49E-12	3,32E-12	-1,05E-10
Acidification potential of land and water; AP	kg SO2 eq	4,07E-02	1,54E-03	3,44E-03	0	1,7E-02	1,23E-03	2,9E-04	1,26E-03	-3,11E-02
Eutrophication potential; EP	kg PO43- eq	4,84E-03	3,9E-04	4,44E-04	0	3,7E-03	3,12E-04	5,3E-05	1,73E-04	-2,95E-03
Formation potential of tropospheric ozone photochemical oxidants; POCP	kg ethylene eq	5,37E-03	-4,82E-04	8,72E-04	0	3,06E-03	-4,1E-04	3,55E-05	1,18E-04	-4,4E-03
Abiotic depletion potential for non fossil resources; ADPE	kg Sb eq	8,09E-05	1,79E-08	2,81E-07	0	5,93E-07	1,09E-08	7,83E-08	7,71E-08	-2,1E-07
Abiotic depletion potential for fossil resources; ADPF	MJ	1,57E+02	4,71E+00	1,1E+01	0	2,51E+01	3,84E+00	3,28E+00	2,71E+00	-7,52E+01

*BLBSB: Benefits and Loads Beyond the System Boundaries
[1] Negative value due to the carbonation of concrete (*Kjellsen, Guimaraes, Nilsson (2007) and EPD InformationsZentrum Beton GmbH (2013))*

Table A2: Results of the LCA - Resource use of **1 m²** of the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27 per year of RSL

RESULTS OF THE LCA		Upstream module		Core module	Downstream module					Other environmental information
		Product stage	Transport	Construction stage	Use stage		End of life stage			BLBSB*
		Raw materials/ production	Transport to construction site	Construction of the bridge	Operation	Maintenance	Transport to EoL	Waste processing for reuse, recovery or recycling	Disposal	Reuse, recovery or recycling potential
Parameter	Unit	Module A1-A3	Module A4	Module A5	Module B1, B6, B7	Module B2-B5	Module C2	Module C3	Module C4	Module D
RESOURCE USE										
Non-renewable materials	kg	3,35E+02	3,09E-02	4,25E+00	0	4,48E-01	1,86E-02	1,4E-01	1,85E+00	-3,8E+02
Renewable materials	kg	9,27E+03	2,59E+02	6,68E+03	0	3,29E+02	1,73E+01	1,4E-01	1,40E+02	4,27E+02
Renewable primary energy as energy carrier; PERE	MJ	1,56E+01	-	-	-	-	-	-	-	-
Renewable primary energy resources as material utilization; PERM	MJ	0	-	-	-	-	-	-	-	-
Total use of renewable primary energy resources; PERT	MJ	1,56E+01	4,39E-01	4,27E+00	0	1,58E+00	2,15E-01	2,98E+00	2,78E-01	6,05E-01
Non renewable primary energy as energy carrier; PENRE	MJ	1,55E+02	-	-	-	-	-	-	-	-
Non renewable primary energy as material utilization; PENRM	MJ	1,42E+01	-	-	-	-	-	-	-	-
Total use of non renewable primary energy resources; PENRT	MJ	1,69E+02	4,95E+00	1,13E+01	0	2,55E+01	3,86E+00	7,08E+00	2,82E+00	-7,35E+01
Use of secondary material; SM	kg	1,79E+00	0	0	0	0	0	0	0	0
Use of renewable secondary fuels; RSF	MJ	0	0	0	0	0	0	0	0	0
Use of non renewable secondary fuels; NRSF	MJ	0	0	0	0	0	0	0	0	0
Use of net fresh water; FW	m3	1,3E-01	8,43E-04	9,52E-03	0	1,61E-02	3,78E-04	6,45E-03	5,34E-04	-7,87E-03

*BLBSB: Benefits and Loads Beyond the System Boundaries

Table A3: Results of the LCA - Output flows and waste categories of **1 m²** of the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27 per year of RSL

RESULTS OF THE LCA		Upstream module		Core module	Downstream module					Other environmental information
		Product stage	Transport	Construction stage	Use stage		End of life stage			BLBSB*
		Raw materials/ production	Transport to construction site	Construction of the bridge	Operation	Maintenance	Transport to EoL	Waste processing for reuse, recovery or recycling	Disposal	Reuse, recovery or recycling potential
Parameter	Unit	Module A1-A3	Module A4	Module A5	Module B1, B6, B7	Module B2-B5	Module C2	Module C3	Module C4	Module D
OUTPUT FLOWS AND WASTE CATEGORIES										
Hazardous waste disposed; HWD	kg	6,5E-04	2,48E-06	3,46E-06	0	1,21E-05	1,83E-06	4,55E-06	8,76E-07	4,61E-06
Non hazardous waste disposed; NHWD	kg	4,72E+00	9,98E-04	2,88E+01	0	7,06E-01	5,49E-04	5,91E-03	1,29E+01	-1,14E+01
Radioactive waste disposed; RWD	kg	4,93E-03	1E-04	1,26E-04	0	1,41E-04	5,27E-06	1,58E-03	4,49E-05	6,6E-04
Components for re-use; CRU	kg	-	-	0	0	0	0	0	0	-
Materials for recycling; MFR	kg	-	-	2,92E+01	0	6,41E+00	0	2,69E+02	0	4,03E+00
Materials for energy recovery; MER	kg	-	-	0	0	0	0	0	0	-
Exported electrical energy; EEE	MJ	-	-	0	0	0	0	0	0	-
Exported thermal energy; EET	MJ	-	-	0	0	0	0	0	0	-

*BLBSB: Benefits and Loads Beyond the System Boundaries

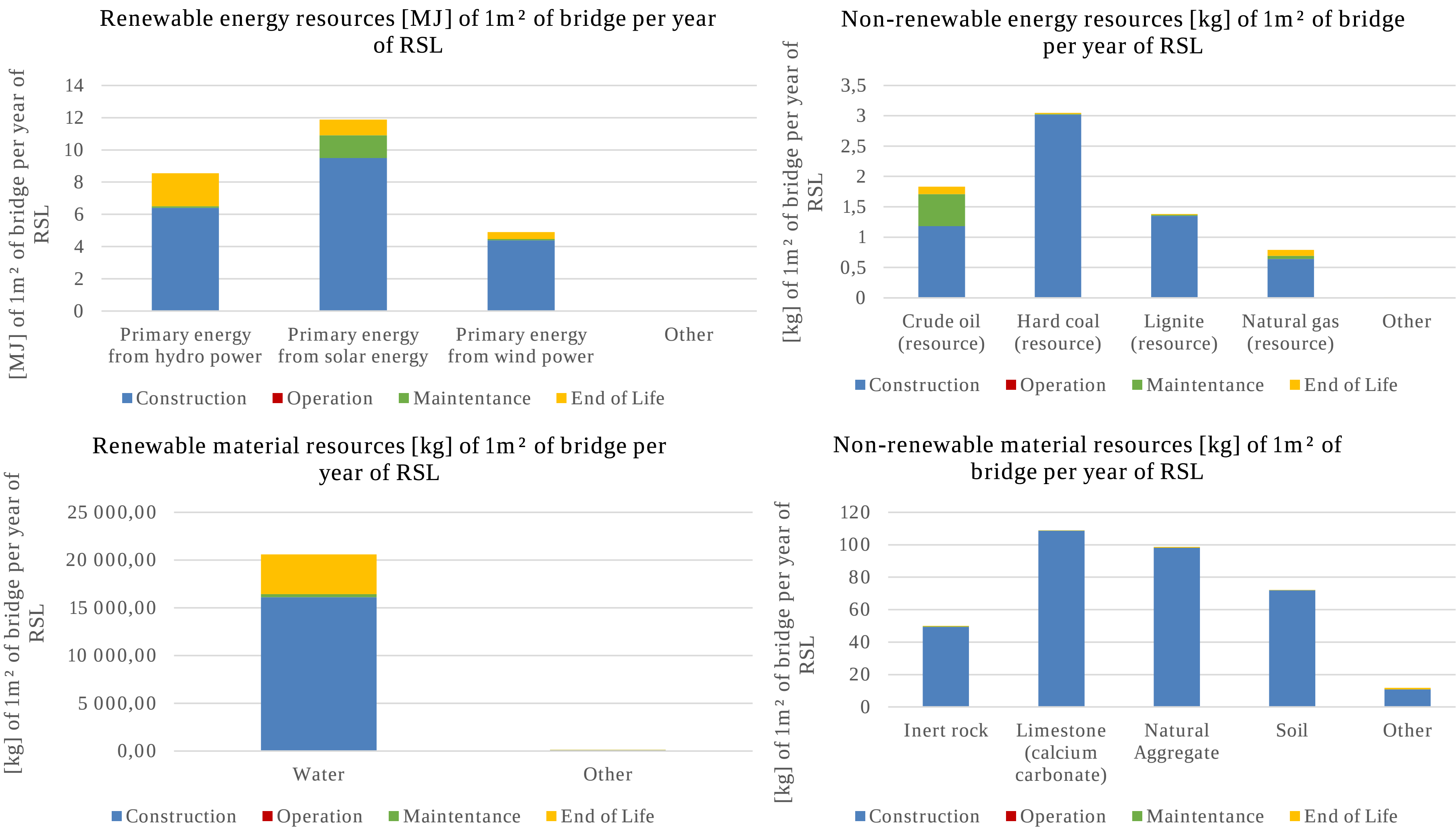

Figure A1: Specification of resources used (material and energy) for **1 m²** of the pedestrian and bicycle bridge 15-1787-1 over Viskan in project Road 27 per year of RSL. The “Other” category includes primary energy from geothermics, peat (resource), air, carbon dioxide and oxygen, and bauxite, clay, iron ore, quartz sand, dolomite and gypsum.