A Tata Steel Enterprise

THIRD PARTY VERIFIED ISO 14025 & EN 15804

SAB 135R/930 structural deep deck with Colorcoat® PE15

Environmental Product Declaration

Owner of the Declaration: SAB-profiel bv, produktieweg 2, NL-3401 MG, IJsselstein
Programme Operator: Tata Steel UK Limited, 18 Grosvenor Place, London, SW1X 7HS

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SAB 135R/930 structural deep deck with Colorcoat® PE15
Environmental Product Declaration
(in accordance with ISO 14025 and EN 15804)

This EPD is representative and valid for the specified (named) product

Declaration Number: EPD-TS-2020-010
Date of Issue: 31st July 2020
Valid until: 30th July 2025

Owner of the Declaration: SAB-profiel bv, produktieweg 2, NL-3401 MG, IJsselstein
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The CEN standard EN 15804:2012+A1:2013 serves as the core Product Category Rules (PCR) supported by Tata Steel's EN 15804 verified EPD PCR documents

Independent verification of the declaration and data, according to ISO 14025

Internal ☐ External ☒

Author of the Life Cycle Assessment: Tata Steel UK
Third party verifier: Olivier Muller, PricewaterhouseCoopers, Paris

1 General information

Owner of EPD	SAB-profiel
Product & module	SAB 135/930 structural deep deck with Colorcoat® PE15
Manufacturer	SAB-profiel & Tata Steel Europe
Manufacturing sites	IJsselstein and IJmuiden
Product applications	Construction
Declared unit	$1m^2$ of steel structural roof deck
Date of issue	31st July 2020
Valid until	30th July 2025

This Environmental Product Declaration (EPD) is for SAB 135R/930 roof deep deck manufactured by SAB-profiel in the Netherlands using Colorcoat® pre-finished steel. The environmental indicators are for products manufactured at SAB-profiel in IJsselstein with feedstock from IJmuiden.

The information in the Environmental Product Declaration is based on production data from 2016 and 2018.

EN 15804 serves as the core PCR, supported by Tata Steel's EN 15804 verified EPD programme Product Category Rules documents, and the LCA model supporting this declaration has been independently verified according to ISO 14025 [1,2,3,4,5,6,7].

Third party verifier

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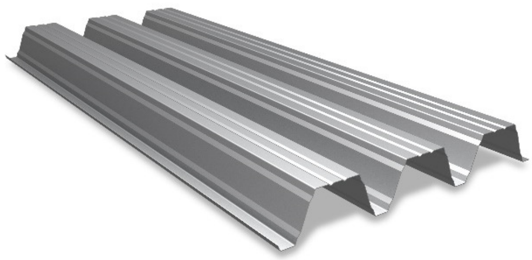
2 Product information

2.1 Product description

The SAB deep deck family of products consists of 14 steel roof trapezoidal profiles which are designed to support all types of insulated roof systems. SAB 135R/930 (Figure 1) has a profile depth of 137mm and a cover width of 930mm, to meet the designers' needs for efficiency, aesthetics, and structural performance. It is manufactured from MagiZinc® hot dip zinc coated steel, with a Colorcoat® PE15 pre-finished interior coating, a guaranteed minimum yield stress of 320N/mm^2, and has a fire rating of Class A1 to EN 13501-1 [8].

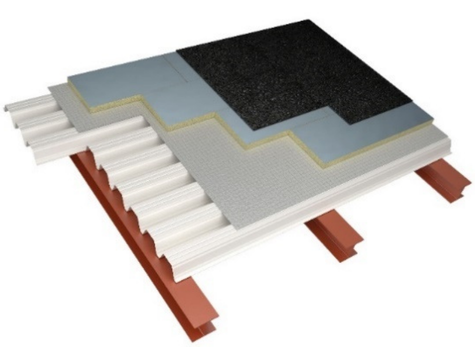
Figure 1 SAB 135R/930 roof deep deck



SAB 135R/930 is an ideal choice of roof deck profile when securing to purlins, typically spanning 4m to 8m. The SAB 135R/930 product has a 310mm profile pitch and the crown is 145mm, which provides an approximate 50% surface area and is more than sufficient for most adhesive systems when bonding to the deck. For those looking for additional architectural features, the SAB 135R/930 profile can be supplied perforated for additional acoustic requirements.

The SAB 135R/930 is usually part of roof system with a foil and insulation layer, and Bitumen or PVC top layer (see Figure 2). Our dedicated and experienced technical team are available to help develop a specification for your project and assist with project specific advice to ensure that all design aspects of the chosen deck system meet your project requirements.

Figure 2 SAB roof deep deck system



2.2 Manufacturing

The manufacturing sites included in the EPD are listed in Table 1.

Table 1 Participating sites

Site name	Product	Manufacturer	Country
IJmuiden	Hot rolled coil	Tata Steel	NL
IJmuiden	Cold rolled coil	Tata Steel	NL
IJmuiden	Pre-finished steel	Tata Steel	NL
IJsselstein	Steel structural deck	SAB-profiel	NL

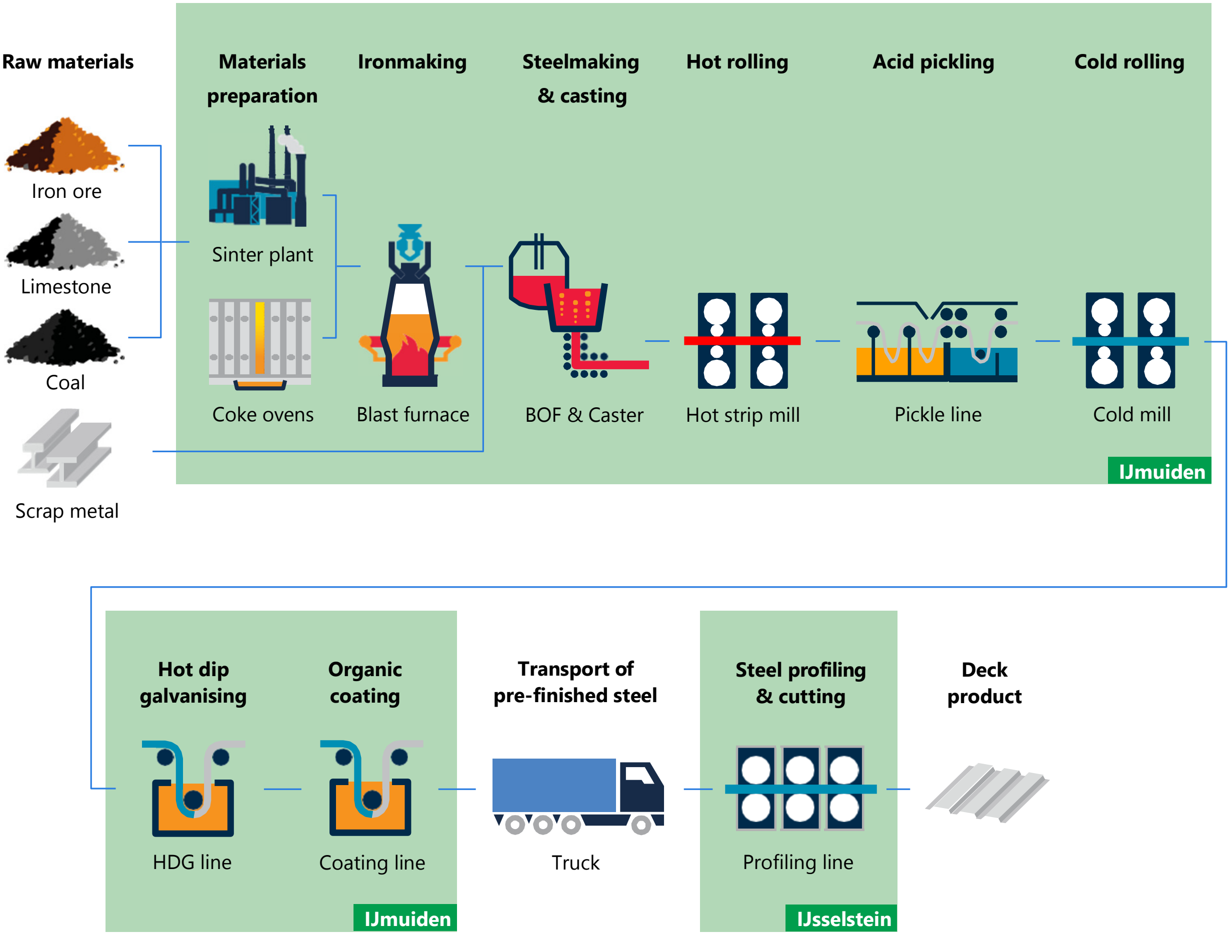
The process of steel coil manufacture at Tata Steel begins with sinter being produced from iron ore and limestone, and together with coke from coal, reduced in a blast furnace to produce iron. Steel scrap is added to the liquid iron and oxygen is blown through the mixture to convert it into liquid steel in the basic oxygen furnace. The liquid steel is continuously cast into discrete slabs, which are subsequently reheated and rolled in a hot strip mill to produce steel coil. The hot rolled coils are pickled and cold rolled, before being galvanised and coated.

Pre-finished steel comprises a number of paint layers and treatments which are applied to the steel in an automated and carefully controlled process with each layer of the product having a particular function. It is the combined effect of all these layers that give the product its overall performance and ensures a material that is robust. During the organic coating process, a zinc based metallic coating is first applied to the steel coil. A pre-treatment is applied and then a primer before adding the final top coat layer in the form of liquid paint. These are cured at elevated temperatures before being recoiled prior to use in the manufacture of the profiled deck. For this pre-finished steel product, the primer and topcoat are applied on the underside surface only, while the top side of the strip has no organic coating.

The pre-finished steel is transported by road from IJmuiden to IJsselstein and is profiled and cut into suitable lengths on a dedicated process line. An overview of the process from raw materials to manufacture of the steel roof deck product, is shown in Figure 3.

Process data for the manufacture of hot and cold rolled coil, and pre-finished steel at IJmuiden was gathered as part of the latest worldsteel data collection. The data collection was not only organised by site, but also by each process line within the site. In this way it was possible to attribute resource use and emissions to each process line, and using processed tonnage data for that line, also attribute resources and emissions to specific products. For the manufacture of the roof deck, process data was also collected from the profiling lines at IJsselstein.

Figure 3 Process overview from raw materials to deck product



2.3 Technical data and specifications

The general properties of the product are shown in Table 2, and the technical specifications of the product are presented in Table 3.

Table 2 General characteristics and specification of the roof deck

	135R/930 roof deck with Colorcoat® PE15
Thickness of decking (mm)	0.88
Cover width (mm)	930
Standard maximum single span (mm)	5570
Standard maximum double span (mm)	6168
Profile weight (kg/m²)	11.14
Mass of coating (kg/m²)	0.02
CE marking	DoP spec to EN 1090-1 [9]
Certification	Certifications applicable to SAB IJsselstein are; ISO 9001 [10], ISO 14001 [11], BES 6001 [12]

Table 3 Technical specification of Colorcoat®

	Colorcoat® pre-finished steel
Metallic coating	Colorcoat® pre-finished steel is supplied with a zinc based metallic coating that conforms to EN 10346:2015 [13]
Paint coating (organic)	Colorcoat® PE15 polyester coating on the underside (exposed face) All pre-finished steel products are fully REACH [14] compliant and chromate free
Certification	Certifications applicable to Tata Steel's IJmuiden site are; ISO 9001 [10], ISO 14001 [11], BES 6001 [12] BBA (Colorcoat®) [15]

2.4 Packaging

The deck profiles are packaged using wood base supports and plastic strapping in order to protect them during delivery to site and prior to installation.

2.5 Reference service life

A reference service life for structural deck is not declared because the steel profiles are part of a composite roofing system that also comprises an insulating roofing material such as slate or tiles, or felt, and the final construction application of the composite roof deck is not defined. To determine the full service life of steel structural deck, all factors would need to be included such as the type of roof material used, and the location and environment.

Under 'normal' conditions, steel deck would not need to be replaced over the life of the building and structure.

3 LCA methodology

3.1 Declared unit

The unit being declared is 1m^2 of steel structural deck.

3.2 Scope

This EPD can be regarded as Cradle-to-Gate (with options) and the modules considered in the LCA are;

A1-3: Production stage (Raw material supply, transport to production site, manufacturing)

C2, C3 & C4: End-of-life (transport, processing for recycling and disposal)

D: Reuse, recycling and recovery

All of the life cycle stages are explained in more detail in Figure 4, but where the text is in light grey, the impacts from this part of the life cycle are not considered for this particular product.

Figure 4 Life Cycle Assessment of steel deck

Module D: Benefits & loads beyond the system boundary

Includes impacts from;

- Deck reuse (0%) and recycling of the steel component (85%)

Module C: End-of-life stage

Includes impacts from:

- Deconstruction of composite deck system
- Transport from site to end-of-life
- Processing of deck system for reuse or recycling
- Disposal to landfill of steel (15%) and other system components

Module B: Use stage

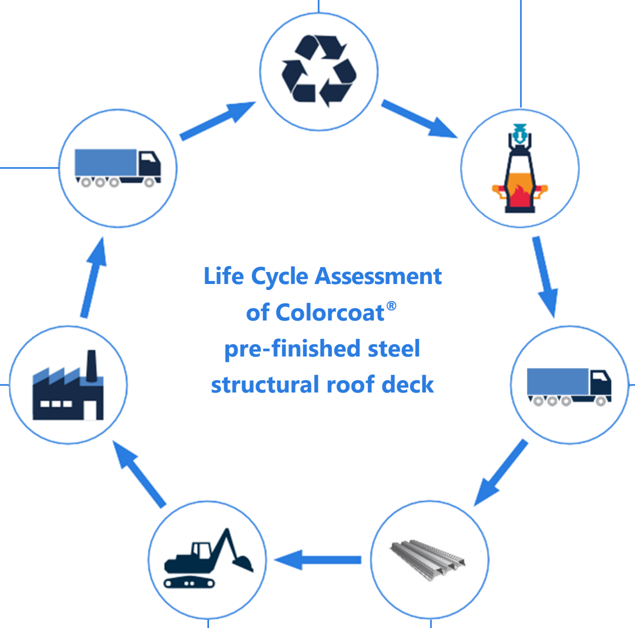
Includes impacts from;

- Use or application of the composite deck in a building
- Maintenance, repair, replacement, refurbishment of the system

Modules A4 & A5: Construction process stage

Includes impacts from;

- Delivery of steel decks and other components to site
- Installation of composite deck system at construction site



Module A1: Product stage (primary processing)

Includes impacts from;

- Raw material extraction and processing (iron ore, coal)
- Steelmaking, casting, and production of cold rolled coil at IJmuiden
- Preparation of recycled scrap
- Hot dip metallic coating and production of pre-finished steel at IJmuiden
- Production of paints for coatings
- Responsible sourcing of materials to BES 6001 standard

Module A2: Product stage (transport)

Includes impacts from;

- Transport of pre-finished steel from IJmuiden to the deck manufacturing site at IJsselstein

Module A3: Product stage (deck manufacture)

Includes impacts from;

- Profiling and cutting of pre-finished steel
- Packaging of decks for delivery to site

3.3 Cut-off criteria

All information from the data collection process has been considered, covering all used and registered materials, and all fuel and energy consumption. On-site emissions were measured and those emissions have been considered. Data for all relevant sites were thoroughly checked and also cross-checked with one another to identify potential data gaps. No processes, materials or emissions that are known to make a significant contribution to the environmental impact of the steel deck have been omitted. On this basis, there is no evidence to suggest that inputs or outputs contributing more than 1% to the overall mass or energy of the system, or that are environmentally significant, have been omitted. It is estimated that the sum of any excluded flows contribute less than 5% to the impact assessment categories. The manufacturing of required machinery and other infrastructure is not considered in the LCA.

3.4 Background data

For life cycle modelling of the cladding system, the GaBi Software System for Life Cycle Engineering is used [16]. The GaBi database contains consistent and documented datasets which can be viewed in the online GaBi documentation [17].

Where possible, specific data derived from Tata Steel's and SAB's own production processes were the first choice to use where available. Data was also obtained directly from the relevant suppliers, such as the paint which is used in the coating process.

To ensure comparability of results in the LCA, the basic data of the GaBi database were used for energy, transportation and auxiliary materials.

3.5 Data quality

The data from Tata Steel's own production processes are from 2016, and the SAB production data was from 2018. The technologies on which these processes were based during that period, are those used at the date of publication of this EPD. All relevant background datasets are taken from the GaBi software database, and the last revision of all but one of these data sets took place less than 10 years ago. However, the contribution to impacts of this dataset is small and relatively insignificant, and therefore, the study is considered to be based on high quality data.

3.6 Allocation

To align with the requirements of EN 15804, a methodology is applied to assign impacts to the production of slag and hot metal from the blast furnace (co-products from steel manufacture), that was developed by the World Steel Association and EUROFER [18]. This methodology is based on physical and chemical partitioning of the manufacturing process, and therefore avoids the need to use allocation methods, which are based on relationships such as mass or economic value. It takes account of the manner in which changes in inputs and outputs affect the production of co-products and also takes account of material flows that carry specific inherent properties. This method is deemed to provide the most representative method to account for the production of blast furnace slag as a co-product.

Economic allocation was considered, as slag is designated as a low value co-product under EN 15804. However, as neither hot metal nor slag are tradable products upon leaving the blast furnace, economic allocation would most likely be based on estimates. Similarly BOF slag must undergo processing before being used as a clinker or cement substitute. The World Steel Association and EUROFER also highlight that companies purchasing and processing slag work on long term contracts which do not follow regular market dynamics of supply and demand.

Process gases arise from the production of the continuously cast steel slabs at IJmuiden and are accounted for using the system expansion method. This method is also referenced in the same EUROFER document and the impacts of co-product allocation, during manufacture, are accounted for in the product stage (Module A1).

End-of-life assumptions for recovered steel and steel recycling are accounted for as per the current methodology from the World Steel Association 2017 Life Cycle Assessment methodology report [19]. A net scrap approach is used to avoid double accounting, and the net impacts are reported as benefits and loads beyond the system boundary (Module D).

3.7 Additional technical information

The main scenario assumptions used in the LCA are detailed below in Table 4. The end-of-life percentages are based upon the results of a survey carried out by the Steel Construction Institute in 2000 [20].

The environmental impacts presented in the 'LCA Results' section (4) are expressed with the impact category parameters of Life Cycle Impact Assessment (LCIA) using characterisation factors. The LCIA method used is CML 2001-April 2013 [21].

3.8 Comparability

Care must be taken when comparing EPDs from different sources. EPDs may not be comparable if they do not have the same functional unit or scope (for example, whether they include installation allowances in the building), or if they do not follow the same standard such as EN 15804. The use of different generic data sets for upstream or downstream processes that form part of the product system may also mean that EPDs are not comparable.

Comparisons should ideally be integrated into a whole building assessment, in order to capture any differences in other aspects of the building design that may result from specifying different products. For example, a more durable product would require less maintenance and reduce the number of replacements and associated impacts over the life of the building.

Table 4 Main scenario assumptions

Module	Scenario assumptions
A1 to A3 – Product stage	Manufacturing data from Tata Steel's site at IJmuiden is used, as well as data from SAB-profiel at IJsselstein
A2 – Transport to the deck manufacturing site	The deck manufacturing facilities are located at IJsselstein and the pre-finished steel coils are transported there from IJmuiden a distance of 69km by road on a 28 tonne payload truck. A utilisation factor of 45% was assumed to account for empty returns
C2 – Transport for recycling, reuse, and disposal	A transport distance of 100km to landfill or to a recycling site is assumed. Transport is on a 25 tonne load capacity lorry with 15% utilisation to account for empty returns
C3 – Waste processing for reuse, recovery and/or recycling	Steel deck that is recycled is processed in a shredder
C4 - Disposal	At end-of-life, 15% of the steel is disposed in a landfill, based upon the findings of a SCI survey
D – Reuse, recycling, and energy recovery	At end-of-life, 85% of the steel is recycled, based upon the findings of a SCI survey

4 Results of the LCA

Description of the system boundary

Product stage			Construction stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse Recovery Recycling
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	X	X	X	X

X = Included in LCA; MND = module not declared

Environmental impact:

1m^2 of SAB 135R/930 roof deck with Colorcoat® PE15

Parameter	Unit	A1 – A3	C2	C3	C4	D
GWP	kg CO_2 eq	2.99E+01	2.44E-01	1.11E-01	2.49E-02	-1.46E+01
ODP	kg CFC11 eq	1.18E-08	3.82E-17	4.80E-12	1.45E-16	4.44E-14
AP	kg SO_2 eq	4.72E-02	6.66E-04	3.30E-04	1.50E-04	-2.82E-02
EP	kg PO_4^{3-} eq	5.68E-03	1.58E-04	3.14E-05	1.70E-05	-1.96E-03
POCP	kg Ethene eq	5.99E-03	-2.37E-04	2.28E-05	1.17E-05	-6.82E-03
ADPE	kg Sb eq	6.96E-04	1.50E-08	4.55E-08	9.18E-09	-2.46E-04
ADPF	MJ	5.22E+02	3.30E+00	1.59E+00	3.49E-01	-1.37E+02

GWP = Global warming potential

ODP = Depletion potential of stratospheric ozone layer

AP = Acidification potential of land &water

EP = Eutrophication potential

POCP = Formation potential of tropospheric ozone photochemical oxidants

ADPE = Abiotic depletion potential for non-fossil resources

ADPF = Abiotic depletion potential for fossil resources

Resource use:

1m² of SAB 135R/930 roof deck with Colorcoat® PE15

Parameter	Unit	A1 – A3	C2	C3	C4	D
PERE	MJ	1.05E+01	9.79E-02	6.65E-01	4.58E-02	1.02E+01
PERM	MJ	3.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.08E+01	9.79E-02	6.65E-01	4.58E-02	1.02E+01
PENRE	MJ	5.68E+02	3.54E+00	2.46E+00	3.89E-01	-1.35E+02
PENRM	MJ	1.72E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	5.70E+02	3.54E+00	2.46E+00	3.89E-01	-1.35E+02
SM	kg	7.31E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	1.30E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	1.97E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.10E-02	1.27E-03	1.44E-03	2.15E-03	-5.48E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials

PERM = Use of renewable primary energy resources used as raw materials

PERT = Total use of renewable primary energy resources

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials

PENRM = Use of non-renewable primary energy resources used as raw materials

PENRT = Total use of non-renewable primary energy resources

SM = Use of secondary material

RSF = Use of renewable secondary fuels

NRSF = Use of non-renewable secondary fuels

FW = Use of net fresh water

Output flows and waste categories:

1m² of SAB 135R/930 roof deck with Colorcoat® PE15

Parameter	Unit	A1 – A3	C2	C3	C4	D
HWD	kg	1.77E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	7.39E-01	0.00E+00	0.00E+00	1.68E+00	0.00E+00
RWD	kg	1.93E-04	2.90E-06	2.95E-04	4.85E-06	4.67E-06
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	8.77E+00	0.00E+00	0.00E+00
MER	kg	1.23E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

HWD = Hazardous waste disposed

NHWD = Non-hazardous waste disposed

RWD = Radioactive waste disposed

CRU = Components for reuse

MFR = Materials for recycling

MER = Materials for energy recovery

EEE = Exported electrical energy

EET = Exported thermal energy

5 Interpretation of results

Figure 5 shows the relative contribution per life cycle stage for each of the seven environmental impact categories for 1m^2 of SAB 135R/930 roof deck profiles. Each column represents 100% of the total impact score, which is why all the columns have been set with the same length. A burden is shown as positive (above the 0% axis) and a benefit is shown as negative (below the 0% axis). The main contributors across all impact categories are A1-A3 (burdens) and D (benefits beyond the system boundary).

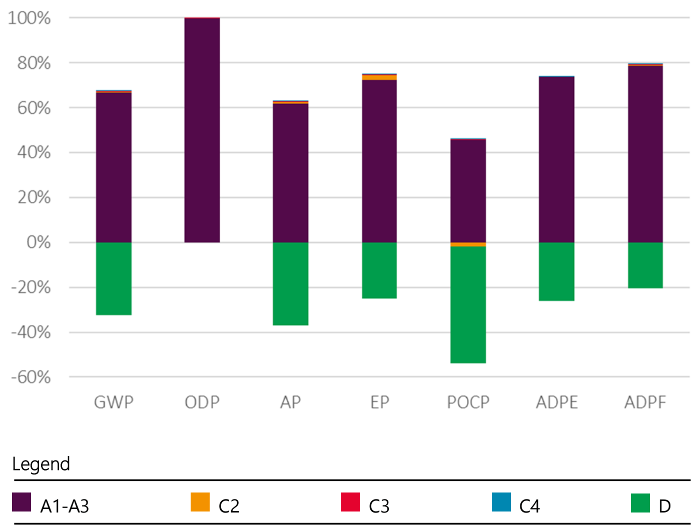
The manufacture of the cold rolled coil during stage A1-A3 is responsible for approximately 90% of each impact in most of the categories, specifically, the conversion of iron ore into liquid steel which is the most energy intensive part of the deck manufacturing process.

The primary site emissions come from use of coal and coke in the blast furnace, and from the injection of oxygen into the basic oxygen furnace, as well as combustion of the process gases. These processes, give rise to emissions of CO_2, which contributes 94% of the Global Warming Potential (GWP), and sulphur oxides, which are responsible for almost two thirds of the impact in the Acidification Potential (AP) category. In addition, oxides of nitrogen are emitted which contribute one third of the A1-A3 Acidification Potential, and almost 90% of the Eutrophication Potential (EP), and the combined emissions of carbon monoxide (68%) together with sulphur and nitrogen oxides, contribute to the Photochemical Ozone indication (POCP).

Figure 5 clearly indicates the relatively small contribution to each impact from the other life cycle stages, which are transport of the decks to their end-of-life fate, processing of the steel scrap for recycling, and disposal to landfill.

Module D values are largely derived using worldsteel's value of scrap methodology which is based upon many steel plants worldwide, including both BF/BOF and EAF steel production routes. At end-of-life, the recovered steel deck is modelled with a credit given as if it were re-melted in an Electric Arc Furnace and substituted by the same amount of steel produced in a Blast Furnace [19]. This contributes a significant reduction to most of the environmental impact category results, with the specific emissions that represent the burden in A1-A3, essentially the same as those responsible for the impact reductions in Module D.

Figure 5 LCA results for the deck profile



The exception, with regard to the end-of-life credit given to steel scrap after the use stage in Module D, is the depletion potential of the stratospheric ozone layer (ODP) indicator. This particular impact score is a positive value and does not contribute a reduction to the total results as do the other listed impact categories. The very different energy sources (coal versus grid electricity mix) and technologies (BF/BOS versus EAF) are the main reasons why this is so, and the Module D burden comes from the allocation methodology used in the worldsteel model for calculating the 'value of scrap'.

However, for this particular product, recycling of steel deck at end-of-life results in an insignificant ODP burden when compared with that from the manufacture of the organic coating during the product stage, A1-A3. Indeed, apart from ODP, the paint manufacturing process and application to the steel deck results in a relatively small increase across all the other main impact categories.

For use of net fresh water, Module D is a benefit, but the magnitude of this benefit is greater than the impact from Modules A1-A3. This is explained by the Module D benefit for net use of fresh water being based upon a worldsteel calculation for many steel plants worldwide. IJmuiden, the biggest water user in this study, is a relatively modest user of fresh water as reported in A1-A3. The worldwide average calculation for Module D includes many sites with considerably greater fresh water use in A1-A3 than IJmuiden.

6 References and product standards

1. Tata Steel's EN 15804 verified EPD programme, General programme instructions, Version 1.0, January 2017

2. Tata Steel's EN 15804 verified EPD programme, Product Category Rules Part 1, Version 1.0, January 2017

3. Tata Steel's EN 15804 verified EPD programme, Product Category Rules Part 2 – Steel Structural Deck, Version 1.0, October 2018

4. ISO 14044:2006, Environmental management - Life Cycle Assessment - Requirements and guidelines

5. ISO 14025:2010, Environmental labels and declarations - Type III environmental declarations - Principles and procedures

6. ISO 14040:2006, Environmental management - Life Cycle Assessment - Principles and framework

7. EN 15804:2012+A1:2013, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

8. EN 13501-1:2007+A1:2009, Fire classification of construction products and building elements

9. EN 1090-1:2009+A1:2011, Execution of steel structures and aluminium structures. Requirements for conformity assessment of structural components

10. ISO 9001:2015, Quality management systems

11. ISO 14001:2015, Environmental management systems

12. BES 6001, Responsible sourcing of construction products

13. EN 10346:2015, Continuously hot-dip coated steel flat products for cold forming

14. REACH, EU regulation for Registration, evaluation, authorisation and restriction of chemicals

15. BBA Certification, British Board of Agrément product certification

16. Sphera; GaBi: Software-System and Database for Life Cycle Engineering. Copyright, TM. Stuttgart, Echterdingen, 1992-2020

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20. Steel Construction Institute (SCI), Survey of recycling and reuse rates for UK demolition contractors, European Commission funded research project on LCA for steel construction, Sansom M and Meijer J, 2000

21. CML LCA methodology, Institute of Environmental Sciences (CML), Faculty of Science, University of Leiden, Netherlands

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