Product Carbon Footprint

Product Carbon Footprint: Life Cycle Assessment Report for ExcelEdge

A comparison of ExcelEdge steel edging product vs concrete edging product

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Executive Summary

This executive summary provides an overview analysis of the greenhouse gas emissions associated with ExcelEdge Ltd.'s (ExcelEdge) steel Bison edging product(s) and comparison with the concrete edging alternative product. The assessment includes the full cradle-to-grave lifecycle of the products; from the embodied raw materials, and transportation of these materials; the manufacture and distribution of the finished product; as well as the disposal.

All ExcelEdge's edging products are made from 2mm galvanised steel sheets, with three product size classifications of 75mm, 100mm, and 150mm Bison edging respectively. For the purposes of assessment and comparison, a standard per product length of 2400mm (2.4 meters) steel edging has been applied.

The 2mm galvanised steel sheets are used to produce the edging surface itself, with the steel transported from a supplier located in Hastings, UK, to the company's manufacturing site in Battle, UK. Here, the edging products are manufactured through use of a two-stage process, with each steel sheet cut via a laser cutter and then folded into shape using a press brake. From here the product is dispatched to the company's warehouse in Eastbourne, before being transported to different distributors sites, located across the UK. Disposal has been modelled on the product's potential for recycling (up to 85%) at the end of life (with the remaining 15% going to landfill). ExcelEdge's products also require the use of steel spiral spikes, to secure the edging in place. The spikes are produced and manufactured in China, before being shipped to the company's warehouse in Eastbourne. The disposal route for these spikes has been modelled as the same as that of the steel edging product.

The concrete edging products were modelled for comparison. These were modelled based on 75mm, 100mm, and 150mm edging, at a standard per product length of 2.4 meters, with the edging material and haunching reinforcement both consisting of concrete. These concrete products require use of substantially more material, with a higher total weight for both the edging product itself and the concrete haunching required to secure the edging in place. The concrete was estimated to have been sourced from within 20 miles of the building site, based on the UK average construction-sector distance for sourcing this material. Disposal route for the concrete edging was modelled as landfill.

Total cradle-to-grave product carbon emissions for each of ExcelEdge's Bison steel edging products are shown in the following table and chart; split by lifecycle stage: The majority of emissions are associated with the raw embodied emissions of the materials, across all three of the products.

Process	Bison Steel Edging Emissions ($kgCO_2e$)		
	75mm edging	100mm edging	150mm edging
Raw materials - embodied	19.78	24.68	32.89
Raw materials transport	0.34	0.40	0.48
Manufacturing	1.47	1.47	1.47
Production distribution	0.19	0.24	0.31
Disposal	0.01	0.01	0.02
Total emissions (per 2.4m length of edging)	**21.80**	**26.79**	**35.18**

The breakdown of life cycle carbon emissions for the ExcelEdge's steel edging products and the concrete edging comparison products are shown in the following tables:

Process	Emissions ($kgCO_2e$)		Percentage Reduction (%)
	Concrete Edging 75mm	ExcelEdge 75mm	
Raw materials - embodied	22.28	19.78	13%
Raw materials transport	0.36	0.34	6%
Manufacturing	-	1.47	-
Production distribution	2.01	0.19	91%
Disposal	0.11	0.01	91%
Total	**24.76**	**21.80**	**11%**

Process	Emissions ($kgCO_2e$)		Percentage Reduction (%)
	Concrete Edging 100mm	ExcelEdge 100mm	
Raw materials - embodied	28.63	24.68	16%
Raw materials transport	0.45	0.40	13%
Manufacturing	-	1.47	-
Production distribution	2.48	0.24	90%
Disposal	0.14	0.01	93%
Total	**31.70**	**26.79**	**15%**

Process	Emissions ($kgCO_2e$)		Percentage Reduction (%)
	Concrete Edging 150mm	ExcelEdge 150mm	
Raw materials - embodied	41.53	32.89	26%
Raw materials transport	0.62	0.48	29%
Manufacturing	-	1.47	-
Production distribution	3.47	0.31	91%
Disposal	0.19	0.02	89%
Total	**45.82**	**35.18**	**23%**

Process	Emissions ($kgCO_2e$)		Percentage Reduction (%)
	Concrete Edging 150mm	ExcelEdge 75mm	
Raw materials - embodied	41.53	19.78	52%
Raw materials transport	0.62	0.34	45%
Manufacturing	-	1.47	-
Production distribution	3.47	0.19	95%
Disposal	0.19	0.01	95%
Total	**45.82**	**21.80**	**52%**

The carbon footprint of the ExcelEdge steel edging product produces 21% less emissions than the concrete edging alternative, on average. The ExcelEdge 75mm Bison steel edging can be used as a potential alternative for concrete edging of 75mm also. The 75mm Bison steel edging produces 52% less emissions than that of the standard, 150mm concrete edging alternative.

ExcelEdge has achieved **Carbon Assessed Standard** by completing this project. This shows this product has lower carbon emissions than the traditional method. To help bring additional PR and CSR opportunities and to compensate for ExcelEdge's emissions we recommend that ExcelEdge strives to achieve our **Carbon Neutral Standard** by offsetting its carbon emissions through certified carbon offset projects.

Table of Contents

Quality Control

Report issue number:	1.0
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Calculations completed by:	Joe Murray
Calculations reviewed by:	Myles Howard
Report produced by:	Joe Murray
Report reviewed by:	Myles Howard
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1. Introduction

1.1 Scope of this Assessment

The aim of this assessment is to demonstrate the carbon footprint of the ExcelEdge's Bison 75mm, 100mm and 150mm steel edging and to compare it against the emissions associated with a concrete edging alternative. This is the first assessment ExcelEdge has completed and will be used to demonstrate to their clients the environmental credentials of their steel edging product and to differentiate their service in an increasingly competitive marketplace.

Carbon emissions for the products assessed in this report include those derived from the extraction, transport and processing of virgin raw materials, the manufacture of materials to a finished product, modelled distribution to consumers, and the disposal of the product at its end-of-life.

1.2 What is a Product Life Cycle Assessment (LCA)?

Product LCA is the assessment of the environmental impacts of a service during its life cycle. It incorporates the analysis of raw materials, manufacture, transport and disposal. LCA can evaluate several environmental impacts (air pollution, ozone layer depletion, climate change, etc.) or focus on a single impact (e.g., climate change). When only climate change is considered, it is called service carbon footprint or carbon LCA.

The service carbon footprint detailed in this report is a *Cradle-to-Grave* carbon LCA.

1.3 How is the service carbon footprint calculated?

The product carbon footprint is derived from a combination of activity data provided by ExcelEdge and from publicly available sources (primary data), and emission factors extracted from internationally recognised metrics, greenhouse gas (GHG), activity data is then multiplied by GHG emission factors to produce carbon metrics.

To guarantee transparency and reproducibility, the emission factors used in this report are shown in Annex A detailing the exact name of the emission factor as it appears on its respective database. Material emissions factors are sourced either from EcoInvent's database (v3.7.1), ICE v3.0 (2019), or the UK Government (BEIS, 2020). All EcoInvent factors account for all processes during the production of raw materials and all processes.

1.4 Abbreviations

CO_2e	Carbon Dioxide Equivalent
Defra	Department of Environment, Food and Rural Affairs
GHG	Greenhouse Gases
kg	Kilogrammes
km	Kilometres
kWh	Kilowatt Hours
LCA	Life Cycle Assessment

2. Service overview

2.1 ExcelEdge's Bison Steel Edging

ExcelEdge aims to encourage its customers to be more sustainable when it comes to their choice of edging products. ExcelEdge's steel edging products consist entirely of steel, in contrast to the traditional industry standard of concrete edging. As ExcelEdge's steel edging products are made entirely of steel, they have significantly lower weight than that of their concrete alternative. This alongside the lack of haunching needed to secure the edging results in a significant reduction in the emissions of the total raw embodied materials and transport components of the footprint. The concrete haunching is necessary for the traditional product to secure the concrete edging in situ (as opposed to the steel spiral spikes used to secure ExcelEdge's product).

All of ExcelEdge's edging products are made from 2mm galvanised steel sheet, with three product size classifications of 75mm, 100mm, and 150mm Bison edging respectively. For the purposes of assessment and comparison, a standard per product length of 2.4 meters steel edging has been applied. The 2mm galvanised steel sheets are used to produce the edging surface itself, with the steel transported from a supplier located in Hastings, UK before being delivered to the company's manufacturing site in Battle, UK. The steel spiral spikes are produced and manufactured in China, before being shipped to the company's warehouse in Eastbourne.

The disposal route for both the steel edging and steel spiral spikes have been modelled on the product's potential for recycling (up to 85%) at the end of life (with the remaining 15% to landfill).

Table 1 below details the material types and weights for Excel Edges' edging:

Table 1: Overview of all raw material used to produce a 2.4m length of Bison 75mm, 100mm, and 150mm steel edging

Product	Raw material	Material (kg)	Percentage of total weight
ExcelEdge 75mm	Steel rebar (sheet) for edging	9.04	91.9%
	Steel rebar (wire) for spike	0.90	9.1%
Total		9.94	100%
ExcelEdge 100mm	Steel rebar (sheet) for edging	11.50	92.7%
	Steel rebar (wire) for spike	0.90	7.3%
Total		12.40	100%
ExcelEdge 150mm	Steel rebar (sheet) for edging	15.63	94.6%
	Steel rebar (wire) for spike	0.90	5.4%
Total		16.53	100%

2.2 Traditional Concrete Edging

The traditional concrete edging products have been modelled for comparison. These were modelled based on 75mm, 100mm, and 150mm edging, at a standard per product length of 2.4 meters to allow for an improved comparison between the products, with the edging material and haunching reinforcement both consisting of concrete. These concrete products require use of substantially more material, with a higher total weight for both the edging product itself and the additional concrete haunching required to secure the edging in place.

The concrete was estimated to have been sourced from within 20 miles of the building site, based on the UK average construction-sector distance for sourcing this material. The disposal route for the product has been modelled as landfill.

Table 2 details the individual material types and weights for traditional concrete edging:

Table 2: Overview of all raw material used to produce the comparison 2.4 length of 7mm, 100mm, and 150mm concrete edging

Product	Raw material	Material (kg)	Percentage of total weight
Concrete Edging 75mm	Aerated concrete block for edging	28.76	27.3%
	Concrete for haunching	76.68	72.7%
Total		105.44	100%
Concrete Edging 100mm	Aerated concrete block for edging	38.34	29.4%
	Concrete for haunching	92.02	70.6%
Total		130.36	100%
Concrete Edging 150mm	Aerated concrete block for edging	57.51	31.6%
	Concrete for haunching	124.61	68.4%
Total		182.12	100%

3. Accuracy of the carbon footprint LCA calculation

The accuracy of the overall carbon footprint calculations for the ExcelEdge's steel edging products (Table 3) is good as the majority of the data used in the calculation is primary data or an average based on past experience and industry standards. The accuracy of the data for the concrete edging comparison product (Table 4) was modelled. Similar models were used for both service methods to avoid bias.

Table 3: Source data and calculation accuracy for the ExcelEdge's steel edging products

Dataset	Source of data and comments	Accuracy
Raw materials Embodied material emissions and processes	Individual component weights and material types provided by ExcelEdge, based on the amount of weight of material needed for the assessed products.	Very Good
Transportation of raw materials	Calculated based on the supplier details provided by ExcelEdge.	Very Good
Manufacturing	Energy consumption data was provided by ExcelEdge for the laser cutter equipment, with a typical runtime for a single sheet of steel applied. This was then apportioned to the weight of product produced to calculate the electricity usage per product (2.4m length of edging). hourly energy consumption data was provided for the steel spikes from the manufacturer in China which was then apportioned on a per box basis. Energy Consumption for the brake pedal was estimated based on a lack of primary data available from the manufacturer.	Good
Production distribution	Calculated based on average distance from ExcelEdge's manufacturing site to its primary distributor's locations (organised by county), provided by ExcelEdge.	Average
Disposal	Modelled based on the average disposal route of steel in the UK[1].	Average

Table 4: Source data and calculation accuracy for the comparison concrete edging products

Dataset	Source of data and comments	Accuracy
Raw materials Embodied material emissions and processes	Individual component weights and material types provided based on the amount of weight of material required for the equivalent 2.4m of concrete edging and haunching.	Very Good
Transportation of raw materials	Calculated based on the UK average construction-sector distance for sourcing this material; within 20 miles of the building site.	Modelled
Production distribution	Calculated applied the same average distance as from ExcelEdge's manufacturing site to its primary distributor's locations.	Modelled
Disposal	Modelled based on the average disposal route of concrete in the UK.	Modelled

[1] DEFRA, 'UK Statistics on Waste – July 2021 update', 2021

4. Carbon Footprint LCA Results

4.1 Embodied emissions from raw materials

Embodied emissions have been calculated by multiplying the mass of each material by the correspondent carbon emission factor (Table 5 and Table 6). The emission factors used typically include, for each material: the extraction of the raw materials they are made of, their transportation, processing and distribution.

Table 5: Embodied GHG emissions per 2.4m length of steel and concrete edging products.

Product	Method	Raw material	Material in final product (kg)	Embodied ($kgCO_2e$)
Excel Edge	ExcelEdge 75mm	Steel rebar (sheet) for edging	9.04	17.990
		Steel rebar (wire) for spike	0.90	1.791
	Total		9.94	19.78
	ExcelEdge 100mm	Steel rebar (sheet) for edging	11.50	22.89
		Steel rebar (wire) for spike	0.90	1.79
	Total		12.40	24.68
	ExcelEdge 150mm	Steel rebar (sheet) for edging	15.63	31.10
		Steel rebar (wire) for spike	0.90	1.79
	Total		16.53	32.89
Average				
Traditional	Concrete edging 75mm	Aerated concrete block for edging	28.76	14.20
		Concrete for haunching	76.68	8.09
	Total		105.44	22.29
	Concrete edging 100mm	Aerated concrete block for edging	38.34	18.93
		Concrete for haunching	92.02	9.70
	Total		130.36	28.63
	Concrete edging 150mm	Aerated concrete block for edging	57.51	28.39
		Concrete for haunching	124.61	13.14
	Total		182.12	41.53
Average				

4.2 Emissions from transport of raw materials

The emissions associated with transport reflect the mass of each component, the mode of transport and the distance travelled. These were calculated based on ExcelEdge's supplier locations. The concrete alternative was calculated at 20 miles for all raw materials, as these materials will likely be sourced from local merchants.

4.3 Emissions from manufacturing

The steel edging goes through a single stage of manufacture, broken down into its two component pieces of machinery required to produce a single length of edging. These are the laser cutter used to cut the edging from the galvanised steel sheet and the press brake used to bend the material. ExcelEdge provided production energy data from its manufacturing site for each of these pieces of equipment, which was then apportioned to the that required to produce a single 2.4m length of edging (with a consistent run time assumed between all three products; 75mm, 100mmm and 150mm). Data for the production energy of the steel spikes were also supplied by ExcelEdge, taken from the Chinese manufacturer and supplier of the components. There was no emissions data available for comparison of the concrete edging comparison product, however, most of the emissions generated through the manufacture of this should be accounted for within the emissions factors already applied for the concrete within the calculation of embodied material emissions.

4.4 Implementation from production and distribution

The product distribution emissions have been calculated based on the distribution of ExcelEdge's typical distribution routes for its supplier. These were supplied in the form of a breakdown of the average distance travelled to each of the three UK-based locations to which the steel edging products are currently distributed; 50% to London, 40% to Chelmsford, and 10% to Northampton. The distance applied for the production and distribution of the concrete edging products were modelled as the same.

4.5 Emissions from Disposal

The disposal emissions of the steel used in ExcelEdge's Bison steel edging product was calculated through multiplying the total weight of the product by the relevant emissions factors developed by the DEFRA.

4.6 Summary of results

This report provides an analysis of the greenhouse gas (GHG) emissions associated with a ExcelEdge Stee Edging product compared against a concrete edging product alternative. The total ***cradle to grave*** product life cycle carbon emissions for both services are shown in the following Tables 6-9 below; split by lifecycle stage.

Table 6: GHG emissions and comparison per 75mm edging product

Process	Emissions ($kgCO_2e$)		Percentage Reduction (%)
	Concrete Edging 75mm	ExcelEdge 75mm	
Raw materials - embodied	22.28	19.78	13%
Raw materials transport	0.36	0.34	6%
Manufacturing	-	1.47	-
Production distribution	2.01	0.19	91%
Disposal	0.11	0.01	91%
Total	**24.76**	**21.80**	**11%**

Table 7: GHG emissions and comparison per 100mm edging product

Process	Emissions ($kgCO_2e$)		Percentage Reduction (%)
	Concrete Edging 100mm	ExcelEdge 100mm	
Raw materials - embodied	28.63	24.68	16%
Raw materials transport	0.45	0.40	13%
Manufacturing	-	1.47	-
Production distribution	2.48	0.24	90%
Disposal	0.14	0.01	93%
Total	**31.70**	**26.79**	**15%**

Table 8: GHG emissions and comparison per 150mm edging product

Process	Emissions ($kgCO_2e$)		Percentage Reduction (%)
	Concrete Edging 150mm	ExcelEdge 150mm	
Raw materials - embodied	41.53	32.89	26%
Raw materials transport	0.62	0.48	29%
Manufacturing	-	1.47	-
Production distribution	3.47	0.31	91%
Disposal	0.19	0.02	89%
Total	**45.82**	**35.18**	**23%**

Figure 1: Average percentage breakdown of product footprint for ExcelEdge steel edging products

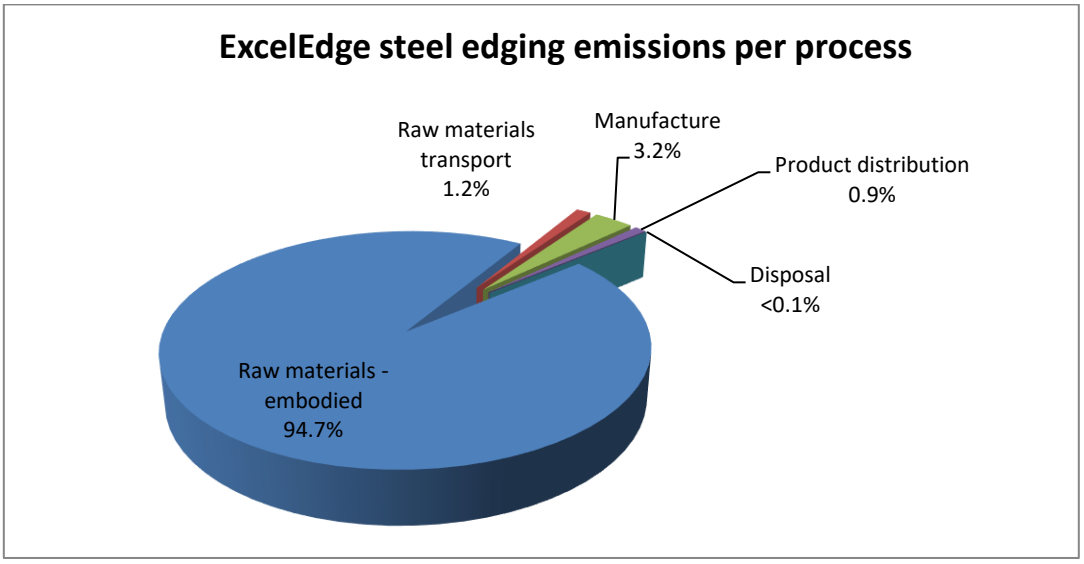

Table 9: GHG emissions and comparison per 150mm edging product

Process	Emissions ($kgCO_2e$)		Percentage Reduction (%)
	Concrete Edging 150mm	ExcelEdge 75mm	
Raw materials - embodied	41.53	19.78	52%
Raw materials transport	0.62	0.34	45%
Manufacturing	-	1.47	-
Production distribution	3.47	0.19	95%
Disposal	0.19	0.01	95%
Total	**45.82**	**21.80**	**52%**

As Tables 6-8 show, based on the agreed scenario, overall, the ExcelEdge steel edging has lower emissions when compared to the concrete edging alternative of the same thickness (an average of 21%) and when comparing that of 75mm steel edging against 150mm concrete edging product, has 52% less emissions (see Table 9).

In both the ExcelEdge and traditional products the embodied emissions attributed to the raw material account for the majority of the total emissions. However, as the ExcelEdge steel edging uses significantly less materials, the total weight of steel is significantly less than the concrete used in the traditional edging, as seen in Tables 5 and 6 (section 4.1), this decrease in the volume of steel required results in 52% lower embodied emissions associated with the raw material for Excel Edge's 75mm steel edging product, when compared with the 150mm concrete edging alternative. Table 5 also provides a breakdown of the weight of the raw materials used in both methods and the associated embodied emissions; it can be seen that despite the embodied emissions for the steel edging product being high (94.7% of each of the respective product's total carbon footprints), the overall emissions are lower due to the lower volume of raw materials required.

The raw materials transport emissions from the ExcelEdge steel edging and concrete products are also lower than that of the concrete edging, due to the significantly reduced total volume of materials. The disposal emissions are also substantially less for the ExcelEdge steel edging products, due to the waste being primarily disposed of via recycling, rather than being sent to landfill.

5. Carbon Footprint Standard

5.1 Brand endorsement

ExcelEdge in conjunction with Carbon Footprint Ltd, has assessed the *cradle-to-grave* carbon emissions associated with a typical **ExcelEdge Bison Steel Edging**. By achieving this, ExcelEdge has qualified to use the Carbon Footprint Standard branding. This can be used on all marketing materials, including web site and customer tender documents, to demonstrate your carbon management achievements.

The Carbon Footprint Standard is in recognition of your organisation's commitment to managing your services' carbon emissions.

6. References

1. EcoInvent database v3.7.1 2021, available at http://www.Ecoinvent.org/
2. Guidelines to Defra's Greenhouse Gas (GHG) Conversion Factors for Company Reporting – annexes (June 2013)
3. UK Government GHG Conversion Factors for Company Reporting (August 2020)
4. ICE Database V3.0 – 10 Nov 2019- Inventory of Carbon & Energy (ICE) database
5. DEFRA, UK Statistics on Waste – July 2021 update, 2021, available at; https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1002246/UK_stats_on_waste_statistical_notice_July2021_accessible_FINAL.pdf

Annex A: Emission Factors

The following table shows the emission factors used for the calculations contained in this report.

Table 8 Emission factors sources

Element	Emissions factor	Comments	Unit	Database
Raw Materials (embodied)				
Steel edging	1.55	ICE v3.0 (2019) - Steel, Rebar	$kgCO_2e$ per kg material	EcoInvent v3.7.1 + ICE v3.0 (2019)
Steel spiral spike	1.99	ICE v3.0 (2019) - Steel, Rebar		
Concrete edging	0.49	ICE v3.0 (2019) – Concrete – Aerated block		
Concrete haunching	0.11	ICE v3.0 (2019) – Concrete - general		
Transport				
ALL HGVs (average)	0.1065	Transport of raw materials	$kgCO_2e$ per tonne.km	DEFRA UK 2020
Production and distribution				
ALL HGVs (average)	0.1065	Transport of products	$kgCO_2e$ per tonne.km	DEFRA UK 2020
Disposal				
Steel	0.000	Recycling	$kgCO_2e$ per tonne.km	DEFRA UK 2020
Steel	8.934	Landfill	$kgCO_2e$ per tonne.km	DEFRA UK 2020
Concrete	1.249	landfill	$kgCO_2e$ per tonne.km	DEFRA UK 2020

Please note – In accordance with IEA and EcoInvent's End User License Agreement (EULA) emissions factors cannot be presented in the report. A full emissions factor reference has been provided which will allow users with an active EcoInvent account to search for the emissions factor. Please see http://www.Ecoinvent.org/ for further details and to search for factors.