Service Carbon Footprint

# Service Carbon Footprint: Life Cycle Assessment Report for Geobear


A comparison of the standard Geobear Geopolymer Injection service vs a traditional Concrete Rail Level Crossing Replacement

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# Executive Summary

This executive summary provides an overview analysis of the greenhouse gas emissions associated with the Geobear Geopolymer Injection service and a traditional Concrete Rail Level Crossing Replacement method. This assessment focuses on the embodied raw material emissions, the transport of these materials, the manufacture/processing, distribution and disposal of the two services. The Geobear method extends the lifetime of the existing asset, whereas the traditional replacement method, results in a brand-new asset.

The determined scenario for both services for this study is defined as:

***<u>A UK Concrete Rail Level Crossing project</u>***[1]

Geobear aims to encourage its customers to be more sustainable when it comes to subsidence/settlement problems, Geopolymer injection below existing slabs and foundations to improve ground strength will avoid excavations and save emissions.

Geobear Geopolymer Injection uses a two-part Geopolymer, and steel injection tubes to inject the Geopolymer[2]. The raw material transport is modelled based on an average supply distance by sea freight and truck to site. The emissions from the fuels used on site were calculated based on the typical machinery fuel consumption. This includes the transport to and from the site as well as the red diesel fuel used on-site. The two-part Geopolymer remains in-situ following the end of the project, however the steel is removed where possible and any Geopolymer wastage from testing is taken back to the depot for disposal.

**The comparable traditional method was modelled as using precast concrete, slab reinforcements, concrete sleepers, rail sleeper steel reinforcement, rail ballast, steel rails and Type 1 MOT (Ministry of Transport), based on quantities provided by Geobear.** The precast concrete was modelled as sourced from the Netherlands. The remaining materials come from within the UK and are transported via HGVs or Rail. The traditional method uses substantially more materials including steel for reinforcement and requires concrete for the precast slabs and sleepers. The emissions calculation also includes the waste generated when removing the original slabs and associated transition zones.

For the case in question, the Geobear method is predicted to have extended the life of the concrete rail level crossing by around 6 years. In contrast, the traditional replacement method would result in a brand-new concrete rail level crossing with an anticipated life of 60 years. Therefore, to result in an equivalent asset lifetime, Geobear would need to carry out treatment at site around 10 times over 60 years.

Two separate scenarios have been considered, one over a 60-year period and the other over a 120-year period. For the 60-year period, the traditional method of replacing the concrete rail level crossing has been compared with 10 treatments carried out by Geobear. For the 120-year period scenario, 2 replacements has been compared with 10 Geobear treatments, plus a traditional replacement after 60 years (due to degradation of the asset).

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[1] This covers a project completed by Geobear, the scope of works included treatment of 8 slabs on a concrete rail level crossing, totaling circa $64m^2$.

[2] Both the Geopolymer and Hardener formula and reagent are protected.

The following table shows the percentage emissions breakdown for the assessed Geobear Geopolymer Injection service for 1 treatment (Annex A):

| Process | Emissions | |
|---|---|---|
| | $kgCO_2e$ | Percentage |
| Raw materials - embodied | 3,710.2 | 74.8% |
| Raw materials transport (excluding materials transported by labourers) | 48.8 | 1.0% |
| Implementation Fuels | 521.6 | 10.5% |
| Travel to and from site (including materials transported by labourers) | 677.6 | 13.7% |
| Disposal[3] | 0.7 | 0.0% |
| **Total emissions from the project** | **4,958.8** | **100%** |

The breakdown of life cycle carbon emissions for the Geobear Geopolymer Injection service and the comparison traditional method over a 60-year lifespan (Including 10 Geobear treatments vs 1 asset replacement), are shown in the following table:

| Process | Traditional | Geobear (10 treatments over 60 years) |
|---|---|---|
| | $kgCO_2e$ | $kgCO_2e$ |
| Raw materials - embodied | 186,200.0 | 37,102.0 |
| Raw materials transport (excluding materials transported by labourers) | 10,485.4 | 487.9 |
| Implementation Fuels (Diesel) | 986.8 | 5,215.5 |
| Travel to and from site (including materials transported by labourers) | 1,248.6 | 6,775.8 |
| Disposal | 447.2 | 6.5 |
| **Total** | **199,367.9** | **49,587.7** |

**The Geobear Geopolymer Injection service produces less emissions than the traditional method. 10 Geobear treatments results in the avoidance of 75.13% of the modelled traditional method's emissions, this has an overall avoidance of 149,780.2 $kgCO_2e$.**

**The 120-year scenario would produce 398,736 $kgCO_2e$ for the traditional method (consisting of 2 asset replacements), with the Geobear service (10 treatments) followed by a traditional replacement of the concrete rail level crossing (due to degradation of the asset), would produce 248,956 $kgCO_2e$. This means there is an overall carbon emissions avoidance of 37.56%.**

Geobear has achieved the **Carbon Assessed Standard** by completing this project. This assessment shows Geobear's service has lower carbon emissions than the traditional method. To provide additional environmental savings and benefits, Geobear could consider supporting carbon offset projects, to mitigate the services unavoidable emissions. This will also allow the use of our **Carbon Neutral Standard** in relation to its client's projects.

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# Quality Control

| | |
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| **Report issue number:** | 1.3 |
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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 Geobear Geopolymer Injection service undertaken at the rail level crossing in question and to compare it against a traditional method of replacing the level crossing. This is the second assessment Geobear has completed and will be used to demonstrate to their clients the environmental credentials of their services and to differentiate their service in an increasingly competitive marketplace.

Carbon emissions for the service assessed in this report include those derived from the extraction and processing of virgin raw materials, transport of raw materials and on-site construction vehicles to the site, the fuels used on site by the construction vehicles, and disposal.

For the case in question, the Geobear method is predicted to have extended the life of the concrete rail level crossing by around 6 years. In contrast, the traditional replacement method would result in a brand-new concrete rail level crossing with an anticipated life of 60 years. Therefore, to result in an equivalent asset lifetime, Geobear would need to carry out treatment at site around 10 times over 60 years.

Two separate scenarios have been considered, one over a 60-year period and the other over a 120-year period. For the 60-year period, the traditional method of replacing the concrete rail level crossing has been compared with 10 treatments carried out by Geobear. For the 120-year period scenario, 2 replacements have been compared with 10 Geobear treatments, plus a traditional replacement after 60 years (due to degradation of the asset).

## 1.2 What is a Service Life Cycle Assessment (LCA)?

Service 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-Gate* carbon LCA.**

## 1.3 How is the service carbon footprint calculated?

The service carbon footprint is derived from a combination of activity data provided by Geobear 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 1 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 Geobear Geopolymer Injection service

Geobear has teams and offices across the UK and in Ireland. Geobear aims to encourage its customers to be more sustainable when it comes to subsidence/settlement problems, through Geopolymer injection below existing assets to improve ground strength. This is an alternative to the traditional method of replacing the concrete rail level crossing that requires a significant amount of steel, concrete and stone which both have large CO2e emissions and subsequent logistical, implementation and disposal emissions. For the case in question, the Geobear method is predicted to have extended the life of the concrete rail level crossing by around 6 years. In contrast, the traditional replacement method would result in a brand-new concrete rail level crossing with an anticipated life of 60 years. Therefore, to result in an equivalent asset lifetime, Geobear would need to carry out treatment at site around 10 times over 60 years.

The Geopolymer Injection service provided by Geobear injects a two-part Geopolymer below the existing concrete rail level crossing to enhance and improve the strength of the ground (and subsequently lift the level crossing). This is injected through steel tubes below the Concrete Rail Level Crossing. The sourcing of the raw materials was all calculated based on the distance from the source of materials to the contractor's yard. Therefore, within this assessment, an average supply distance of 252km was used for the transport to site.

Once the materials and machinery are transported to site, the machinery is used to drill and inject the Geopolymer. The only waste materials are the steel and small amounts of Geopolymer used in testing which are returned to the depot with the laborers. Table 1 below details the individual materials:

***Table 1: Overview of all raw material used to produce a Geopolymer Injection service***

| Material ID | Material (kg) per visit | Material (kg) per 10 visits | Percentage of total weight |
|---|---|---|---|
| Part A- Hardener | 361.91 | 3,619.10 | 54.33% |
| Part B- Polymer | 268.09 | 2,680.90 | 40.25% |
| Steel Injection Tubes | 36.082 | 360.82 | 5.42% |
| **Grand Total** | **666.08** | **6660.82** | **100%** |

## 2.2 Traditional method (Track Slab Replacement)

For the comparison, a traditional method of Concrete Rail Level Crossing replacement was used to compare and show carbon savings. The traditional method does not use any Geopolymers, instead this method uses precast concrete, steel as reinforcements, stone for ballast aswell as Type 1 MOT and Steel Rails. The existing Concrete Rail Level Crossing and associated transition zone is excavated/removed with a large quantity being removed in waste skips. This excavation requires significantly more fuel, as there is more time and machinery required. The level crossing/transition zone is then replaced. Within this assessment, the emissions associated with the raw materials, transport, production and disposal of the traditional method is modelled based on standard distances and weights from Geobear's employee knowledge, and corroborated with scientific papers for the machinery and process (Krezo et al. 2018).

Due to a lack of actual data, the transport of the raw materials and the service distribution for the traditional method was modelled based on the marketing materials and known supply chain for the UK rail industry.

Disposal of materials from the implementation state is modelled based on DEFRA emissions factors for the waste types.

Table 2 details the individual components and their materials used to produce the traditional method calculations.

***Table 2: Overview of all raw material used to replace the concrete level crossing***

| Raw material | Material (kg) | Percentage |
|---|---|---|
| Pre cast concrete | 64,046.4 | 16.97% |
| Reinforcement (Steel) | 41,897.0 | 11.10% |
| Rails (Steel) | 9,360.0 | 2.48% |
| Railway Sleepers (concrete) | 26,574.0 | 7.04% |
| Reinforcement Steel for sleepers | 19,546.5 | 5.18% |
| Rail Ballast | 65,917.0 | 17.47% |
| Type 1 MOT Gravel | 150,015.6 | 39.75% |
| **Grand Total** | **377,356.5** | **100%** |

# 3. Accuracy of the carbon footprint LCA calculation

The accuracy of the overall carbon footprint calculations for the Geobear Geopolymer Injection service (Table 3) is very good as the majority of the data used in the calculation is primary data or modelled based on past experience and industry standards submitted by Geobear. The accuracy of the data for the comparison traditional method (Table 4) was modelled due to lack of primary data. Similar models were used for both service methods to avoid bias.

*Table 3: Source data and calculation accuracy for the Geobear Geopolymer Injection service*

| Dataset | Source of data and comments | Accuracy |
|---|---|---|
| **Raw materials**<br>Embodied material emissions and processes | Individual component weights and material types provided by Geobear, based on the amount of weight of material needed for the assessed project. | Very Good |
| **Raw materials transport**<br>(excluding materials transported by labourers) | Calculated based on the supplier details provided by Geobear. | Very Good |
| **Travel to and from site**<br>Transport (including materials transported by labourers) | Modelled based on average distance from Geobear contractors' site to project site. | Modelled |
| **Implementation Fuels (Red Diesel)** | Calculated based on red diesel usage for a weeks' worth of projects apportioned to the active minutes recorded on technicians' timesheets. | Good |
| **Disposal** | Calculated based on the steel used and the percentage of typical Geopolymer offcuts. | Modelled |

*Table 4: Source data and calculation accuracy for the traditional method*

| Dataset | Source of data and comments | Accuracy |
|---|---|---|
| **Raw materials**<br>Embodied material emissions and processes | Individual component weights and material types provided by Geobear based on industry experience. | Modelled |
| **Raw materials transport**<br>(excluding materials transported by labourers) | Modelled based on industry standard distances and vehicle types. | Modelled |
| **Travel to and from site**<br>Transport (including materials transported by labourers) | Modelled based on industry standard distances and vehicle type data provided by Geobear. Corroborated with scientific papers for the machinery (Krezo et al. 2018). | Modelled |
| **Implementation Fuels (Red Diesel)** | Fuels and quantities provided by Geobear based on industry experience. | Modelled |
| **Disposal** | Calculated based on the expected material extraction needs, provided by Geobear. | Modelled |

# 4. Carbon Footprint Service 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). The emission factors used typically include, for each material: the extraction of the raw materials they are made of, their transportation, processing and distribution. The emissions from the Polymer and Hardener[4] (the two components which are combined to form the injected Geopolymer), have been apportioned based on the recorded combined weight and standard ratio. Geobear has provided material safety data sheet (MSDS) for both the Polymer and Hardeners, to allow for sourcing of the emissions factors based on the chemical composition.

***Table 5: Embodied GHG emissions per 60-year timeframe***

| Method | Raw material | Material in final product (kg) | Embodied ($kgCO_2e$) |
|---|---|---|---|
| Geopolymer | Part A- Hardener | 3,619.10 | 25,826.98 |
| | Part B- Polymer | 2,680.90 | 10,506.45 |
| | Steel Injection Tubes | 360.82 | 768.54 |
| Total | | 6,660.82 | 37,101.97 |
| Traditional | Pre cast concrete | 64,046.4 | 8,438.7 |
| | Reinforcement (Steel) | 41,897.0 | 64,940.4 |
| | Rails (Steel) | 9,360.0 | 18,626.4 |
| | Railway Sleepers (concrete) | 26,574.0 | 3,501.4 |
| | Reinforcement Steel for sleepers | 19,546.5 | 30,297.1 |
| | Rail Ballast | 65,917.0 | 46,141.9 |
| | Type 1 MOT Gravel | 150,015.6 | 14,254.2 |
| Total | | 377,356.5 | 186,200.0 |

## 4.2 Emissions from transport of raw materials (excluding materials transported by labourers)

The emissions associated with transport reflect the mass of each component, the mode of transport and the distance travelled. Items related to the Geopolymer injection method were calculated based on Geobear's supplier locations. For the traditional method, the precast concrete was modelled as sourced from the Netherlands. The remaining materials come from within the UK and are transported via HGVs or Rail. The railway concrete sleepers and steel reinforcement for the sleepers were modelled based on a 176km rail distance, with the rail ballast also being based on rail travel with an estimated distance of 442km. The steel rails were modelled as 400km on an average HGV. The Type 1 MOT was modelled as travelling 200km on an average HGV.

[4] Geopolymer and hardener are protected.

## 4.3 Emissions from travel to and from site (including materials transported by labourers)

Includes one HGVs and two vans, calculated to include transport to and from site for 1 of Geobear's treatments. These carry the materials that are coming from the construction site, the technicians and the welfare facilities.

In terms of the traditional method, an equivalent distance to Geobear's travel was assumed with two labourer's vans, one van for the manual tamper, two HGVs (to account for the excavator and vibrating plate compactor), and a rail journey for the ballast profiler.

## 4.4 Implementation fuel use

The implementation fuels are higher for the Geopolymer service, over the 60-year period, as a result of the 10 treatments needed (Table 6). The fuel use is significantly higher for the traditional method, in the first year, due to the need to remove the concrete rail crossing prior to replacement. However, due to the Geobear treatment being repeated every 6 years, more fuels are needed over the 60-year timeframe.

Geobear has calculated the average diesel litres per minute for their generator (0.0616 L/minute) based on the fuel usage and time of active minutes recorded on their timesheet.

The traditional method has been calculated based on litres of fuel for the project size (Krezo et al. 2018). An emissions factor was used for excavation, with a hydraulic digger, based on the $m^3$ of ballast in the transition zone and the MOT for under the slab and transition zone.

***Table 6: GHG emissions per implantation machinery per 60-year timeframe***

| Method | Process | Embodied ($kgCO_2e$) |
|---|---|---|
| Geopolymer | Generators | 5,215.5 |
| Geopolymer Total | | 5,215.5 |
| Traditional | Vibrating plate compactor (for ballast & MOT) (Wacker Neuson 2021) | 17.7 |
| | Ballast profiler | 455.0 |
| | Tamper | 445.5 |
| | Ballast in transition zone | 24.2 |
| | MOT for under slab and transition zone | 44.4 |
| Traditional Total | | 986.8 |

## 4.5 Emissions from Disposal

The disposal emissions of the steel and offcuts from the Geopolymer Injection services is accounted for in the project (assuming all steel as waste, and 10% of the Geopolymer used as waste), using the DEFRA material waste emissions factors. With the traditional method, the DEFRA factors have also been applied with the disposal quantities provided by Geobear. The Geobear calculations also include the treatment emissions from inert material landfill. The modelled quantities for both can be seen in the below table.

***Table 7: GHG emissions for disposal per 60-year timeframe***

| Method | Raw material | Weight (kg) | Embodied ($kgCO_2e$) |
|---|---|---|---|
| Geopolymer | Part A | 361.9 | 1.91 |
| | Part B | 268.1 | 1.41 |
| | Steel Tubes | 360.2 | 3.22 |
| Geopolymer Total | | 990.8 | 6.54 |
| Traditional | Pre cast concrete | 53,289.6 | 66.04 |
| | Reinforcement (Steel) | 34,860.3 | 44.08 |
| | Rails (Steel) | 9,360.0 | 11.83 |
| | Railway Sleepers (concrete) | 26,574.0 | 32.93 |
| | Reinforcement Steel for sleepers | 19,546.5 | 24.71 |
| | Rail Ballast | 65,917.0 | 81.69 |
| | Type 1 MOT Gravel | 150,015.6 | 185.92 |
| Traditional Total | | 359,563.0 | 447.21 |

## 4.6 Summary of results

This report provides an analysis of the greenhouse gas (GHG) emissions associated with a Geobear Geopolymer Injection compared against a traditional service. The total ***cradle to gate*** service life cycle carbon emissions for both services are shown in the following table and chart; split by lifecycle stage.

***Table 7: GHG emissions per 60-year lifespan***

| Process | Traditional | Geobear |
|---|---|---|
| | $kgCO_2e$ | $kgCO_2e$ |
| Raw materials - embodied | 186,200.0 | 37,102.0 |
| Raw materials transport (excluding materials transported by labourers) | 10,485.4 | 487.9 |
| Implementation Fuels (Diesel) | 986.8 | 5,215.5 |
| Travel to and from site (including materials transported by labourers) | 1,248.6 | 6,775.8 |
| Disposal | 447.2 | 6.5 |
| **Total** | **199,367.94** | **49,587.7** |

As Table 7 shows, based on the agreed 60-year scenario, overall, the Geobear Geopolymer Injection has significantly lower emissions when compared to the traditional method. **10 Geobear treatments results in the avoidance of 75.13% of the modelled traditional method's emissions, this has an overall avoidance of 149,780.2 $kgCO_2e$.**

**The 120-year scenario would produce 398,736 $kgCO_2e$ for the traditional method (consisting of 2 asset replacements), with the Geobear service (10 treatments) followed by a traditional replacement of the concrete rail level crossing (due to degradation of the asset), would produce 248,956 $kgCO_2e$. This means there is an overall carbon emissions avoidance of 37.56%.**

In both the Geobear and traditional services the embodied emissions attributed to the raw material account for the majority of the total emissions. However, as the Geobear method uses the Geopolymer to undertake the work, no concrete is used and the only steel is from the injection tubes, as seen above in Table 5 (section 4.1). This decrease in the amount of concrete and steel required results in significantly lower embodied emissions associated with the raw material for the Geopolymer Injection service compared to the traditional. 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 Geopolymer being high, the overall emissions are lower due to less materials required.

The implementation fuels are higher for the Geopolymer service, over the 60-year period, as a result of the 10 treatments needed. This can also be seen in the emissions resulting from site visits. Despite this, the raw materials transport (excluding materials transported by labourers) emissions from the Geopolymer Injection service is significantly low due to the Geopolymer's considerably lower material weight.

The disposal emissions are substantially less for the Geopolymer Injection service, due to the waste quantities being significantly less (Table 7).

# 5. Carbon Footprint Standard

## 5.1 Brand endorsement

Geobear has achieved the **Carbon Assessed Standard** by completing this project. This assessment shows Geobear's service has lower carbon emissions than the traditional method. To provide additional environmental savings and benefits, Geobear could consider supporting carbon offset projects, to mitigate the services unavoidable emissions. This will also allow the use of our **Carbon Neutral Standard** in relation to its client's projects.

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. S. Krazo; O. Mirxa; S. Kaewunruen; J.M. Sussman (2018). Evaluation of $CO_2$ emissions from railway resurfacing maintenance activities. ELSEVIER 458-465.
6. Wacker Neuson (2021) Construction machinery, equipment & service | Wacker Neuson

# 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)** | | | | |
| **Part A - Hardener** | **See Footnote** | EcoInvent 3.7.1 | $kgCO_2e$ per kg material | EcoInvent v3.7.1 + ICE v3.0 (2019) |
| **Part B - Polymer** | **See Footnote** | EcoInvent 3.7.1 | | |
| **Tubes – Steel Injection Tubes** | **2.13** | ICE v3.0 (2019) -Steel, global seamless tube | | |
| Pre cast concrete | 0.13 | DEFRA - Concrete | | |
| Reinforcement (Steel) | 1.55 | ICE v3.0 (2019) - Steel, Section | | |
| Rails (Steel) | 1.99 | ICE v3.0 (2019) - Steel, Rebar | | |
| Railway Sleepers (concrete) | 0.13 | DEFRA - Concrete | | |
| Reinforcement Steel for sleepers | 1.55 | ICE v3.0 (2019) - Steel, Section | | |
| Rail Ballast | 0.70 | ICE v3.0 (2019) - Granite | | |
| Type 1 MOT Gravel | **See Footnote** | ICE v3.0 (2019)/EcoInvent 3.7.1- Limestone and Crushing | | |
| **Transport** | | | | |
| Container ship | 0.0161 | Transport of raw materials | $kgCO_2e$ per tonne.km | DEFRA UK 2020 |
| ALL HGVs (average) | 0.1065 | Transport of raw materials | $kgCO_2e$ per tonne.km | |
| All HGVs - Average laden | 0.86407 | Transport to and from site | $kgCO_2e$ per km | |
| Rail (Freight) | 0.02556 | Transport of raw materials | $kgCO_2e$ per tonne.km | |
| **Implementation** | | | | |
| Diesel (Retail) | 2.68787 | UK Govt – Defra/BEIS 2020 | $kgCO_2e$ per litre | Defra/BEIS 2020 |
| **Disposal** | | | | |
| All HGVs - Average laden | 0.86407 | Transport of raw materials | $kgCO_2e$ per 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.