geobear

Low Carbon Solutions
- extending asset life
through geoploymers

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Traditional Concrete Rail Level Crossing Replacement compared to Geobear life Extension

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Geobear commissioned Carbon Footprint to produce a report on the greenhouse gas emissions associated with the Geobear geopolymer injection method of extending the life of a rail level crossing and a traditional concrete rail level crossing replacement method.

Core findings

The total cradle to gate service life cycle carbon emissions for both services are shown in the following table.

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 result in the avoidance of 75.13% of the modelled traditional method's emissions, this has an overall avoidance of 149,780.2 $kgCO_2e$.

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**

> *10 Geobear treatments are 75% lower than the modelled traditional method's emissions*

The comparison

The findings of this study are based upon the calculation of carbon emissions from:

- Embodied raw material emissions
- Transport of materials
- Implementation fuels
- Transportation of labour
- Distribution and disposal

The Geobear method extends the lifetime of the existing asset, whereas the traditional method is a replacement.

Method comparison	Traditional replacement	Geobear method
Asset life	Construction of a new concrete rail level crossing with an anticipated life of 60 years.	Models predict the geopolymer solution will extend the life of the concrete rail level crossing by around 6 years*.
Method/materials	Precast concrete, slab reinforcements, concrete sleepers, rail sleeper steel reinforcement, rail ballast, steel rails	Two-part geopolymer and steel injection tubes to inject the geopolymer beneath the asset.

** To provide a comparable carbon figure, we base results on Geobear carrying out treatment 10 times over 60 years.*

Calculation source

The service carbon footprint is derived from a combination of activity data provided by Geobear and from publicly available sources. Emission factors are extracted from internationally recognised metrics Greenhouse gas (GHG), activity data is then multiplied by GHG emission factors to produce carbon metrics. (See report for full details).

Embodied raw material emissions

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

> *Materials used by a geopolymer method emit only 19% of the embodied carbon than that of a traditional method*

Embodied GHG emissions per 60-year timeframe

Method	Embodied ($kgCO_2e$)
Geobear	37,101.97
Traditional	186,200.0

Transportation of materials

Geobear is based on an average supply distance by sea freight and truck to site. Fuel emissions in transport and during works based on typical consumption.

The precast concrete was modelled as sourced from the Netherlands, with remaining materials from within the UK.

Process	Traditional	Geobear
	$kgCO_2e$	$kgCO_2e$
Raw materials transport *(excluding materials transported by labourers)*	10,485.4	487.9

> *Geopolymer life extension emits only 5% of the emissions of traditional methods in terms of material transport*

Implementation fuels

The implementation fuels are higher for the geopolymer solution, over a 60-year period, as a result of the 10 treatments needed. 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 fuel is required over the 60-year timeframe.

GHG emissions per implantation machinery per 60-year timeframe

Method	Embodied ($kgCO_2e$)
Geobear Total	5,215.5
Traditional Total	986.8

Transport of labour

Includes one HGVs and two vans, calculated to include transport to and from site for 1 of Geobear's treatments.

For 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.

Process	Traditional	Geobear
	$kgCO_2e$	$kgCO_2e$
Travel to and from site *(including materials transported by labourers)*	1,248.6	6,775.8

Emissions from disposal

DEFRA factors have been applied with the disposal quantities provided by Geobear. The Geobear calculations also include the treatment emissions from inert material landfill.

> ***"Traditional methods emit 98% more carbon from disposal than geopolymer"***

GHG emissions for disposal per 60-year timeframe

Method	Weight (kg)	Embodied ($kgCO_2e$)
Geopolymer	990.8	6.54
Traditional	359,563.0	447.21

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CO2e Assessed

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.

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

Full Study:

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