

Appendix 6C Emissions Calculation

Technical note

Introduction

Calculations were undertaken in order to determine greenhouse gas (GHG) emissions from a ‘typical quarry lorry’ undertaking journeys of 20, 50, 64 and 70 miles each way fully laden on the outgoing trip then empty upon return. These distances were selected because they represent the respective distances to Exeter from Linhay Hill Quarry or from other quarries outside Devon which would represent the nearest alternative source of limestone to contribute to supply in Devon to supplement limestone from the other three existing limestone quarries in the county in the event that Linhay Hill Quarry stops operating.

Quarry	Distance to Exeter (one way)	Additional one way distance by comparison with LHQ
Linhay Hill Quarry	20	n/a
Castle Hill, near Bridgwater	70	50
Callow Rock	84	64
Batts Coombe near Cheddar	84	64
Gurney Slade/Binegar	90	70m

Greenhouse gas emissions are reported in kg CO₂e (kilograms carbon dioxide equivalent), the universal unit of measurement for global warming potential as well as its constituent parts, kg CO₂, kg CH₄ and kg N₂O (kilograms of carbon dioxide, methane and nitrogen dioxide respectively).

A typical quarry lorry (4 axle rigid tipper) is shown in figure 1 and is assumed to carry a typical load of 20 tonnes with a maximum vehicle weight of 32 tonnes.



Figure 1: Typical 4 axle rigid tipper.

The Department for Environment and Rural Affairs ‘Greenhouse Gas Conversion Factor Repository’ was consulted (<http://www.ukconversionfactorscarbonsmart.co.uk/>) in order to gain statistics typical for this vehicle.

The web based tool was interrogated as follows:

- Factor repository Homepage – ‘I want to choose my own set of carbon conversion factors 2015’
- ‘Delivery Vehicles’ drop down – ‘HGV (all diesel)’

To represent the position with tippers travelling laden when delivering from the quarry and empty on the return journey, the options for 100% and 0% laden were chosen. The full choice of Heavy Goods Vehicles (all diesel) included:

- Rigid (>3.5 – 7.5 tonnes)
- Rigid (>7.5 – 17 tonnes)
- Rigid (>17 tonnes)*

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- All rigids*
- Articulated (>3.5 – 33 tonnes)
- Articulated (>33 tonnes)
- All artics
- All HGVs*

Of these, those marked with a * were considered relevant to the current calculations.

From this a customised spreadsheet was downloaded (Version 2.0, expiry date 31/05/2016) based on mileage as detailed fuel consumption data was not available. The spreadsheet contained conversion factors for use within the GHG emission calculations. Assumptions of the spreadsheet include;

- That the vehicles are owned by the company and therefore fall within ‘Scope 1’ – Direct emissions, and
- That the vehicle does not utilise biofuels in any way.

DEFRA GHG conversion factors

The downloaded spreadsheet gave the conversion factors shown in table 1 below

Table 1. DEFRA GHG Conversion Factors

Activity	Type	Unit	0% Laden				100% Laden			
			kg CO ₂ e	kg CO ₂	kg CH ₄	kg N ₂ O	kg CO ₂ e	kg CO ₂	kg CH ₄	kg N ₂ O
HGV (all diesel)	Rigid (>17 tonnes)	miles	1.27171	1.255562	0.000425	0.015723	1.822943	1.806794	0.000425	0.015723
	All rigids	miles	1.071292	1.057822	0.000354	0.013116	1.535684	1.522214	0.000354	0.013116
	All HGVs	miles	1.145985	1.131211	0.000386	0.014388	1.681832	1.667058	0.000386	0.014388

Utilising these conversion factors round trip emissions were calculated as;

$$\text{GHG emissions} = \text{activity data} \times \text{emissions conversion factor}$$

Where

$$\text{GHG emissions} = (\text{outward trip} \times 100\% \text{ laden conversion factor}) + (\text{return trip} \times 0\% \text{ laden conversion factor})$$

20 mile trip each way

Table 2. GHG emissions for a 20 mile trip each way

Vehicle type	Kg CO ₂ e	Kg CO ₂	Kg CH ₄	Kg N ₂ O
Rigid (> 17 t)	61.893	61.247	0.017	0.629
All rigids	52.140	51.601	0.014	0.525
All HGVs	56.556	55.695	0.015	0.576

50 mile trip each way

Table 3. GHG emissions for a 50 mile trip each way

Vehicle type	Kg CO ₂ e	Kg CO ₂	Kg CH ₄	Kg N ₂ O
Rigid (> 17 t)	154.733	153.118	0.042	1.572
All rigids	130.349	129.002	0.035	1.312
All HGVs	141.391	139.913	0.039	1.439

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64 mile trip each way

Table 4. GHG emissions for a 64 mile trip each way

Vehicle type	Kg CO ₂ e	Kg CO ₂	Kg CH ₄	Kg N ₂ O
Rigid (> 17 t)	198.058	195.991	0.054	2.013
All rigids	166.846	165.122	0.045	1.679
All HGVs	180.980	179.089	0.049	1.842

70 mile trip each way

Table 5. GHG emissions for a 70 mile trip each way

Vehicle type	Kg CO ₂ e	Kg CO ₂	Kg CH ₄	Kg N ₂ O
Rigid (> 17 t)	216.626	214.365	0.059	2.201
All rigids	182.488	180.603	0.050	1.836
All HGVs	197.947	195.879	0.054	2.014

Conclusions

The conversion factors utilised in the ‘rigid >17 tonnes’ scenario return the higher GHG emission values for all gasses and as such should be considered as a ‘worst case scenario’. Although gas specific data is presented in the tables above kg CO₂ e can be used as a tool for assessing total global warming potential. The emission values calculated for kg CO₂ e are illustrated in the figure below for the selected distances of 20, 50, 64 and 70 miles.

Figure 2: Greenhouse gas emission values give in kg CO₂ e for all relevant DEFRA vehicle scenarios and over travel distances of 20, 50, 64 and 70 miles.

