

A. Materials - Lifecycle Emissions

Material	Material Detail	Unit of measure	Quantity	Equivalent CO ₂ emissions (tonnes)	Equivalent C emissions (tonnes)
Concrete		m ³	4,487	1,907	520.1
Steelwork		tonnes	474.606	312	85.0
Brickwork		m ²	6,263	307	83.7
Blockwork		m ²	328	8.7	2.4
Cladding	limestone	m ³	20	3	0.9
Drylining	polyethylene	m ²	9,714	730	199.2
Doors	internal doors	MDF	30	-46	-12.5
	external doors	PVC	26	0.1	0.0
Tiling		tonnes	185	61.1	16.7
Windows	glass	tonnes	7	4	1.2
TOTAL		n/a	n/a	3,288	897

Notes

All information in italics supplied by the client

Assumptions

Equivalent CO ₂ emissions for concrete:	425 kgCO _{2e} /m ³ concrete used (Finnish Building Information Foundation 2004)
Equivalent CO ₂ emissions for steel work:	0.66 tCO _{2e} /tonne steel used (RTS 1999a)
Equivalent CO ₂ emissions for brickwork:	0.049 tCO _{2e} /m ² brick used (BRE 1999b)
Blockwork is assumed to be aerated concrete blocks .	
Thickness of blockwork:	0.22 m (working estimate)
Density of blockwork:	505 kg/m ³ (BRE 1999c)
Equivalent CO ₂ emissions for blockwork:	0.24 tCO _{2e} /t aerated blockwork used (BRE 1999c)
Equivalent CO ₂ emissions for gypsum and silicon render:	not available
Area of cladding used:	2,540 m ²
Assumed thickness of limestone and granite cladding used:	0.04 m (working estimate)
Assumed % cover of limestone cladding:	20% (working estimate)
Assumed % cover of granite cladding:	80% (working estimate)
Equivalent CO ₂ emissions for granite cladding:	not available
Equivalent CO ₂ emissions for limestone cladding:	160 kgCO _{2e} /m ³ (Finnish Building Information Foundation)
Thickness of insulation:	0.05 m (working estimate)
Density of HD polyethylene:	940 kg/m ³ (APME 2003)
Equivalent CO ₂ emissions for HD polyethylene:	1.6 kgCO _{2e} /kg (APME 2003)
Number of internal doors:	287
Number of external doors:	70
Dimensions of internal doors:	
	height: 2.1 m
	width: 1 m
Dimensions of external doors:	
	height: 2.2 m

	width:	2 m
Assumed thickness of doors:		0.05 m (working estimate)
Density of PVC:		1700 kg/m ³ (www.matter.org.uk)
Equivalent CO ₂ emissions for MDF:		-1,523 kgCO ₂ e/m ³ (Finnish Building Information Foundation)
Equivalent CO ₂ emissions for PVC:		2.4 kgCO ₂ /kg (APME 2003)
assumed % cover of terracotta tiles:		50%
assumed % cover of granite tiles:		50%
Equivalent CO ₂ emissions for clay tiles:		0.33 tCO ₂ e/t clay tile used (BRE 1999f)
Density of clay tiles:		66.5 kg/m ²
Assumed thickness of terracotta tiles:		0.005 m (working estimate)
Total area of tiling:		5,568 m ²
Assumed thickness of glass used:		0.004 metres
Density of glass:		2800 kg/m ³ (www.allmeasures.com)
CO ₂ emissions for glass:		600 kgCO ₂ /tonne glass
Dimensions of windows:		
	height:	0.24 m
	width:	0.15 m
number of 150/ 240mm windows installed:		20
	height:	0.24 m
	width:	0.12 m
number of 120/ 240mm windows installed:		20
	height:	0.15 m
	width:	0.15 m
number of 150/ 150mm windows installed:		36
	height:	0.09 m
	width:	0.24 m
number of 90/ 240mm windows installed:		20

B. Delivery Emissions

source of emissions:	delivery mileage	Total fuel consumed (litres)	CO ₂ emitted (t)	CH ₄ emitted (t)	N ₂ O emitted (t)	CO ₂ emissions (tonnes)	equivalent C emissions (tonnes)
5 tonne LGV	3,150	693	1.8	0.00005	0.0002	1.9	0.5
5 - 22 tonne LGV	8,400	2,352	6.2	0.0002	0.001	6.4	1.7
22-26 tonne LGV	2,100	735	1.9	0.0001	0.0002	2.0	0.5
Total	13,650	3,780	10	0.0003	0.001	10	2.8

Notes

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Assumptions

Number of delivery journeys by 5 tonne LGV:	630
Average length of a 5 tonne LGV journey:	5 km
Number of delivery journeys by 5-22 tonne LGV:	210
Average length of a 5-22 tonne LGV journey:	40 km
Number of delivery journeys by 22-26 tonne LGV:	420
Average length of a 22-26 tonne LGV journey:	5 km
Fuel efficiency of 5 tonne lorries:	0.22 l/km
Fuel efficiency of 5-22 tonne lorries:	0.28 l/km
Fuel efficiency of 22-26 tonne lorries:	0.35 l/km
CO ₂ emissions per litre of diesel consumed:	2.63 kgCO ₂ /litre (Defra 2005)
CH ₄ emissions for an average diesel LGV:	0.07 gCH ₄ /litre (IPCC 1996)
N ₂ O emissions for an average diesel LGV:	0.24 gN ₂ O/litre (IPCC 1996)
Global warming potential (in CO ₂ equivalents) of CH ₄ :	23 (IPCC 2001)
Global warming potential (in CO ₂ equivalents) of N ₂ O:	296 (IPCC 2001)

C. Minibus Emissions

source of emissions:	delivery mileage	Total fuel consumed (litres)	CO ₂ emitted (t)	CH ₄ emitted (t)	N ₂ O emitted (t)	CO ₂ emissions (tonnes)	equivalent C emissions (tonnes)
minibus	25,200	8,820	23.2	0.00062	0.0021	23.8	6.5
Total	25,200	8,820	23	0.001	0.002	24	6.5

Notes

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Assumptions

Number of delivery journeys by the minibus:	1260
Average length of a minibus journey:	20 km
Fuel efficiency of minibus:	0.35 l/km
CO ₂ emissions per litre of diesel consumed:	2.63 kgCO ₂ /litre (Defra 2005)
CH ₄ emissions for an average diesel LGV:	0.07 gCH ₄ /litre (IPCC 1996)
N ₂ O emissions for an average diesel LGV:	0.24 gN ₂ O/litre (IPCC 1996)
Global warming potential (in CO ₂ equivalents) of CH ₄ :	23 (IPCC 2001)
Global warming potential (in CO ₂ equivalents) of N ₂ O:	296 (IPCC 2001)

D. Site vehicle and Equipment

source of emissions:	Total fuel consumed (litres)	CO ₂ emitted (t)	equivalent C emissions (tonnes)
	17,920	47.1	12.9
Total	17,920	47	13

Notes

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Assumptions

Working hours of the Concrete Pump:	180 hours
Fuel consumption of the Concrete Pump:	25 litres/hour
Working hours of the Bulldozer:	40 hours
Fuel consumption of the Bulldozer:	30 litres/hour
Working hours of the Shovel Digger:	16 hours
Fuel consumption of the Shovel Digger:	30 litres/hour
Working hours of the Dumper:	10 hours
Fuel consumption of the Dumper:	20 litres/hour
Working hours of the Roller:	10 hours
Fuel consumption of the Roller:	30 litres/hour
Working hours of the Autocrane:	320 hours
Fuel consumption of the Autocrane:	25 litres/hour
Working hours of the Cutter:	360 hours
Fuel consumption of the Cutter:	3 litres/hour
Working hours of the Tremorer:	360 hours
Fuel consumption of the Tremorer:	3 litres/hour
Working hours of the Aggregate:	360 hours
Fuel consumption of the Aggregate:	3 litres/hour
CO ₂ emissions per litre of diesel consumed:	2.63 kgCO ₂ /litre (Defra 2005)

E. Site Energy Consumption - Electricity

Source of emissions	Total estimated consumption (kWh)				equivalent C emissions (tonnes)	
		CO ₂ emitted (t)	CH ₄ emitted (t)	N ₂ O emitted (t)	CO ₂ emissions (tonnes)	
Electricity consumption	<i>80,000</i>	35	0.0004	0.0005	35.1	9.6
Total	80,000	35	0.0004	0.0005	35	10

Notes

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Assumptions

CO ₂ emissions for electricity - Bulgaria:	0.437 kgCO ₂ /kWh (WBCSD 2005)
CH ₄ emissions for electricity - Bulgaria:	0.005 gCH ₄ /kWh (derived from IPCC 1996 and DTI 2001)
N ₂ O emissions for electricity - Bulgaria:	0.006 gN ₂ O/kWh (derived from IPCC 1996 and DTI 2001)
Global warming potential (in CO ₂ equivalents) of CH ₄ :	23 (IPCC 2001)
Global warming potential (in CO ₂ equivalents) of N ₂ O:	296 (IPCC 2001)

F. Landfilled Waste

Source of emissions	Weight of		CH ₄ emitted (t)	total CO ₂ equiv. (t)	total C equiv. (t)
	waste (m ³)	CH ₄ generated (t)			
Landfilled waste	<i>7,140</i>	0	0	0	0.0
Total	7,140	0	0	0	0

Data collection period:

All figures in italics are supplied by the client

Assumptions

All waste generated during the construction was inert

Methane generated from landfilled inert waste: 0 tCH₄/t waste (see below)

Methane emitted from landfilled inert waste: 0 tCH₄/t waste (see below)

To calculate carbon emissions from commercial waste the following parameters were used:

Degradable organic C content (DOC) of inert waste (doc):	0% (Smith et al 2001)
Carbon content of paper and card is equivalent to DOC content	
Proportion of dissimilable DOC (di):	60% (Brown et al 1999)
Proportion of dissimilable DOC decaying to methane (dm):	50% (IPCC 1996)
Methane oxidation factor (ox):	10% (Brown et al 1999)
Average landfill gas collection efficiency for UK landfills (gc):	63% (Smith et al 2001)
Global warming potential of CH ₄ :	23 (IPCC 2001)

Notes

CH₄ generated (mg) = mass x doc x dm x di x 16/12

CH₄ emitted = mg x (1-gc) x (1-ox)

16/12 is the conversion factor carbon to CH₄

44/12 is the conversion factor carbon to CO₂

Summary of Emissions by General Activity

Source of emissions	CO ₂		Percentage of Total (%)
	emissions (tonnes)	equivalent C emissions (tonnes)	
Materials - Lifecycle emissions	3,288	896.6	96.6%
Deliveries	10	2.8	0.3%
Minibus	24	6.5	0.7%
Site Vehicles and Equipment	47	12.9	1.4%
Site energy consumption - electricity	35	9.6	1.0%
Landfilled waste	0	0	0.0%
Total	3,404	928	100%