

Designer Embodied Carbon (EC) Calculation - Civil & Electrical

Build Table Most Contributing Materials 1%+, Embodied Carbon A1-5

Project Name:	Hindley Green - PPG 33kV Gas Filled Cable Replacement
Project Scope:	33kV Solid Cable - Single Circuit 630mm ² AL XLPE, Route Length 1870m.

Project Embodied Carbon Breakdown and Totals (CO ₂ e)		Calculation Date:	18/09/2024	
Total A1-5w	373.01	Note: Total A1-5w (CO ₂ e): Type 182 + Type 384 + Asa	Project Code:	50021911
Asa	2.55		Project Completed in Financial Year:	FY24
Total A1-5 (CO ₂ e)	375.56	Note: Total A1-5 (CO ₂ e): Total A1-5w + Asa + Ans	Estimated Cost of Cable Works (1): (To Estimate Asa)	£364,948.00

Roadway	From	To	FOOTPATH IMPORTED MAT. (m)	Road Type 182 Imported Material (m)	Road Type 384 Imported Material (m)	Total
Low Pt Lane (363176 - 402226)	Joint Position	Leigh Road A578		57	832	889
Leigh Road A578 (353816 - 402226)	Low Pt Lane	Thomas Street		510	56	566
Thomas Street (364001 - 402268)	Leigh Road A578	East Street		56	162	218
Leigh Street (433556 - 403176)	Thomas Street	Asherton Road		85		85
Asherton Road (363900 - 403220)	Leigh Road A578	Footpath	52	80		132
Footpath (363416 - 403220)	Footpath	Braceon Drive		34		34
Footpath (363416 - 403220)	Footpath	Hindley Green Sub Grounds				0
Braceon Drive (363370 - 403210)	Braceon Drive	Joint Position				0
Total			52	924	994	1,870
Desktop Contingency			0	0	0	0
%			2.7	4.9	5.3	10.0

Road & Cable Calculations Table															
Footpath, Type 182	Cable Type & Excavation	Cable/Duct Number	Units values to input in conversion to tonnes cell	Conversion to tonnes	Quantity (t)	ECF kg(CO ₂ e/kg)				Embodied Carbon (CO ₂ e)	Notes / Comments				
						A1-3	A4	A5w	A1-5w						
Low & High Voltage	Asphalt, 8% (Bitumen) binder content (by mass) weighted @ 232kg / m ³		Input value in m ³ (in 'conversion to tonnes' cell)	35	81.27	0.086	0.005	0.006	6.98922	0.49036	0.4695	7.9550679	Binder/ Surface Course layer (Tarmac)	7.8550679	
	Ready mix concrete 32/40, 235kg / m ³		Input value in m ³ (in 'conversion to tonnes' cell)	63	148.05	0.132	0.005	0.008	19.5428	0.74025	1.21623	21.4990875	Base layer (Concrete)	21.4990875	
	Ready Mix Expanding Foam Concrete weighted @ 4.5kg / m ³		Input value in m ³ (in 'conversion to tonnes' cell)	0	0	0.188	0.005	0.011	0	0	0	0			
	Engineering MOT		Input value in m ³ (in 'conversion to tonnes' cell)	73.6	110.4	0.005	0.005	0.001	0.552	0.552	0.16383	1.2678336	Sub - base layer (Aggregate / MOT / DTP)	2.5540416	Depth of soil to be calculated @ 50% imported and 50% backfill
	Aggregate, 1500kg/m ³ Note: aggregate density will change per m ³ based on type and mm to dust of material.		Input value in m ³ (in 'conversion to tonnes' cell)	0	0	0.005	0.005	0.001	0	0	0	0			
	Sand, 1600kg/m ³		Input value in m ³ (in 'conversion to tonnes' cell)	70	112	0.005	0.005	0.001	0.56	0.56	0.16621	1.286208			
	Waste material content, 1m ³ = 1.43 tonnes.		Input value in m ³ (in 'conversion to tonnes' cell)	280	400.4	0.005	0.001	0	2.002	0.49929	2.490876	2.490876	Excavations & Backfill layer	3.3597526	
	Soil assumed 5% cement content, 1m ³ = 1.9 tonnes of clay soil.		Input value in m ³ (in 'conversion to tonnes' cell)	73.6	139.84	0.005	0.001	0	0.6952	0.17048	0.9695496	0.9695496			
	Cable Ducts PVC weighted @ 200mm dia, 4.44kg / m	0	Input value in meters (in 'conversion to tonnes' cell)	0	0	3.23	0.005	0.172	0	0	0	0			
	Cable Ducts PVC weighted @ 150mm dia, 3.3kg / m	1	Input value in meters (in 'conversion to tonnes' cell)	876	2.898	3.23	0.005	0.172	9.337284	0.014494	0.4984	9.850137937	Cable Ducts	9.850137937	
	Cable Ducts PVC weighted @ 100mm dia, 2.16kg / m	0	Input value in meters (in 'conversion to tonnes' cell)	0	0	3.23	0.005	0.172	0	0	0	0			
	Cable 33kV (New) : weighted @ 3.77kg/m	3	Input value in meters (in 'conversion to tonnes' cell)	876	9.90756	12.79	0.16	0.13	128.71764	1.5852096	1.28481	129.5877144	Cables	129.5877144	Until manufacturers ECF values are available the ECF value for New Aluminium is used for Power Cables.
Cable 6.6 / 11kV (New) : weighted @ 1.7kg/m	0	Input value in meters (in 'conversion to tonnes' cell)	0	0	3.81	0.032	0.039	0	0	0	0				
A1-5w (CO ₂ e)											174.715784				

Road & Cable Calculations Table															
Type 3 & 4	Cable Type & Excavation	Cable/Duct Number	Units values to input in conversion to tonnes cell	Conversion to tonnes	Quantity (t)	ECF kg(CO ₂ e/kg)				Embodied Carbon (CO ₂ e)	Notes / Comments				
						A1-3	A4	A5w	A1-5w						
Low & High Voltage	Asphalt, 8% (Bitumen) binder content (by mass) weighted @ 232kg / m ³		Input value in m ³ (in 'conversion to tonnes' cell)	39.76	92.3272	0.086	0.005	0.006	7.9397939	0.4618136	0.53336	8.934715873	Binder/ Surface Course layer (Tarmac)	8.934715873	
	Ready mix concrete 32/40, 235kg / m ³		Input value in m ³ (in 'conversion to tonnes' cell)	71.57	168.1895	0.132	0.005	0.008	22.201014	0.5404475	1.38188	24.42363824	Base layer (Concrete)	24.42363824	
	Ready Mix Expanding Foam Concrete weighted @ 4.5kg / m ³		Input value in m ³ (in 'conversion to tonnes' cell)	0	0	0.188	0.005	0.011	0	0	0	0			
	Engineering MOT		Input value in m ³ (in 'conversion to tonnes' cell)	83.5	125.25	0.005	0.005	0.001	0.62625	0.62625	0.18587	1.438371	Sub - base layer (Aggregate / MOT / DTP)	2.8991358	Depth of soil to be calculated @ 50% imported and 50% backfill
	Aggregate, 1500kg/m ³ Note: aggregate density will change per m ³ based on type and mm to dust of material.		Input value in m ³ (in 'conversion to tonnes' cell)	0	0	0.005	0.005	0.001	0	0	0	0			
	Sand, 1600kg/m ³		Input value in m ³ (in 'conversion to tonnes' cell)	79.5	127.2	0.005	0.005	0.001	0.836	0.836	0.18876	1.4607948			
	Waste material content, 1m ³ = 1.43 tonnes.		Input value in m ³ (in 'conversion to tonnes' cell)	318	454.74	0.005	0.001	0	2.2737	0.55433	2.82602906	2.82602906	Excavations & Backfill layer	3.81467241	
	Soil assumed 5% cement content, 1m ³ = 1.9 tonnes of clay soil.		Input value in m ³ (in 'conversion to tonnes' cell)	83.5	158.65	0.005	0.001	0	0.79325	0.19239	0.98564435	0.98564435			
	Cable Ducts PVC weighted @ 200mm dia, 4.44kg / m	0	Input value in meters (in 'conversion to tonnes' cell)	0	0	3.23	0.005	0.172	0	0	0	0			
	Cable Ducts PVC weighted @ 150mm dia, 3.3kg / m	1	Input value in meters (in 'conversion to tonnes' cell)	994	3.282	3.23	0.005	0.172	10.595046	0.016401	0.56554	11.176983	Cable Ducts	11.176983	
	Cable Ducts PVC weighted @ 100mm dia, 2.16kg / m	0	Input value in meters (in 'conversion to tonnes' cell)	0	0	3.23	0.005	0.172	0	0	0	0			
	Cable 33kV (New) : weighted @ 3.77kg/m	3	Input value in meters (in 'conversion to tonnes' cell)	994	11.24214	12.79	0.16	0.13	143.78887	1.7887424	1.45788	147.0435937	Cables	147.0435937	Until manufacturers ECF values are available the ECF value for New Aluminium is used for Power Cables.
Cable 6.6 / 11kV (New) : weighted @ 1.7kg/m	0	Input value in meters (in 'conversion to tonnes' cell)	0	0	3.81	0.032	0.039	0	0	0	0				
A1-5w (CO ₂ e)											198.292739				

Important note: All materials calculated in above sheet, includes only imported materials

Key:	Material	Description	Notes
A1-3	Calculation based on Embodied Carbon Factors (ECF) to Extract & Manufacture the material. Calculated as: Tonnes x ECF kg(CO ₂ e/kg) = Embodied Carbon (CO ₂ e). Sourced IStructE		
A4	Calculation based on kg of CO ₂ e produced by Distance travelled in km. ECF based on: Tonnes x ECF kg(CO ₂ e/kg) = Embodied Carbon (CO ₂ e). Distances referenced from IStructE: Locally sourced within 50km = 0.905kg(CO ₂ e) / Nationally Sourced within 320km = 0.32kg(CO ₂ e) / European sourced within 1500km = 0.16kg(CO ₂ e). Sourced IStructE	Calculating for Cable & Ducts note:	
A5w	Calculation based on the Waste Factor (WF) of Materials. So brick has a waste factor of 20%, Steel 1% etc. ... Material WF x Material ECF x Distance Travelled x Distance travelled for waste material taken to landfill (C2) x CO ₂ used for processing disposal (C3-4) = A5w / Example, assumed waste of concrete is: 0.653 x A1-3 x A4 x C2 x C3-4 = A5w : Sourced IStructE	When adding in cable lengths in meters, the calculation must include cable numbers for the table to calculate the embodied carbon factor	
5a	Typical assumed costal stage A1-5 of build is 50% so: 700kg(CO ₂ e) per £100,000 so: 0.7 x (cost of build + 100,000) = Ans (CO ₂ e). Sourced IStructE	Designer to fill in all cells highlighted in light grey	Reference note: Calculations & Embodied Carbon factors for materials used in the tables sourced from the Brica (CE) & IStructE
Note:	Please fill in all relevant cells highlighted in GREY - Tarmac Concrete	The 'Embodied Carbon (CO ₂ e)' cells are using a traffic light system to indicate low-high contributing materials. Below this cell in an example of how the colour format works for each material and what they indicate.	Ref for material Embodied Carbon Factors: A BSRIA guide: Hammond G et al., 'Embodied Carbon', 'The Inventory of Carbon and Energy', (ICE) Carbon and Energy (ICE), (www.metalindustry.com/ice/ice.html)
	Profile Depths for Type 182: top layer = 100mm layer = 180mm MOT = 210mm Backfill = 210mm Sand layer = 200mm (+/- 300mm) Material Waste = Estimate 80% of total Excavated material Profile Depths for Type 384: layer = 100mm Backfill = 275mm Sand layer = 200mm (+/- 300mm) Material Waste = Estimate 80% of total Excavated material	Ref for calculating Embodied Carbon A1-5 & Cell colour formatting: The Institution of Structural Engineers 'How to calculate embodied carbon', A brief guide to calculating embodied carbon (istructe.org)	

Project Photographs / Drawings

