Designer Embodied Carbon (EC) Calculation - Civil & Electrical

Build Table Most Contributing Materials 1%>. Embodied Carbon A1-5

Project Name:	**Atheron - PPG 33kV Replacement.**
Project Scope:	**3 x 1c 400mm2 Cu XLPE 33kV Cable - Single Circuit. Route Length 3700m.**

Project Embodied Carbon Breakdown and Totals t(Co2e):	
Total A1-5w	408.03
ASa	7.65
Total A1-5 t(CO2e)	**415.68**

Note: Total A1-5w t(CO2e): Type 1&2 + Type 3&4 = Ans

Note: Total A1-5t(CO2e): Total A1-5w + ASa = Ans

Calculation Date:	**18/09/2024**
Project Code:	**50018511**
Project Completed in Financial Year:	**FY24**
Estimated Cost of Cable Works (£): (To Estimate ASa)	£1,092,628.00

Roadway	From	To			UNMADE GROUND IMPORTED MAT. (m)	Road Type 1&2 Imported Material (m)	Road Type 3&4 Imported Material (m)	Total
Grounds of Atherton BSP	Existing Cable Tails / Cable Box	Jubilee Park			60			60
Jubilee Park	Grounds of Atherton BSP	Leigh Road				130	815	130
Leigh Road	Jubilee Park	Westborne Ave						815
Westborne Ave	Leigh Road	Atherleigh Ave				96		96
Atherleigh Way	Westborne Ave	Westborne Ave					17	17
Westborne Ave	Atherleigh Way	Kirkhall Lane				355		355
Kirkhall Lane	Westborne Ave	West Leigh Lane					65	65
West Leigh Lane	Kirkhall Lane	Net Pan Lane				567		567
Net Pan Lane	West Leigh Lane	Leigh Road				995		995
Leigh Road	Net Pan Lane	Coal Pit Lane					545	545
Caol Pit Lane	Leigh Lane	Joint on to Existing 3 x 1c 500mm2 Cu Cable					55	55
								0
								0
								0
								0
								0
		Total			60	2,143	1,497	3,700
		Desktop Contigency			0	0	0	0
					60	2143	1,497	3,700

Road & Cable Calculations Table

		Cable Type & Excavation	Cable\Duct Number	Units values to input in conversion to tonnes cell	Conversion to tonnes	Quantity (t)	ECF kg(CO2e/kg) A1-3	ECF kg(CO2e/kg) A4	ECF kg(CO2e/kg) A5w	Embodied Carbon t(CO2e) A1-3	Embodied Carbon t(CO2e) A4	Embodied Carbon t(CO2e) A5w	Embodied Carbon t(CO2e) A1-5w	Total EC t(CO2e)	A1-5w	Notes / Comments
Type 1&2	Low & High Voltage	Asphalt, 8% (Bitumen) binder content (by mass) weight @ 2322kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	85.72	199.04184	0.086	0.005	0.006	17.1175982	0.9952092	1.14988	19.26267215	**Binder/ Suface Course layer (Tarmac)**	19.26267215	
		Ready mix concrete 32/40. 2350kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	154.3	362.605	0.132	0.005	0.008	47.86386	1.813025	2.9788	52.65568508	**Base layer (Concrete)**	52.65568508	
		Ready Mix Expanding Foam Concrete weight @ 4.5kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	0	0	0.188	0.005	0.011	0	0	0	0			
		Engineering MOT		**input value in m3** (in 'conversion to tonnes' cell)	180	270	0.005	0.005	0.001	1.35	1.35	0.40068	3.10068			
		Aggregate, 1500kg/m3 Note: aggregate density will change per m3 based on type and mm to dust of material.		**input value in m3** (in 'conversion to tonnes' cell)	0	0	0.005	0.005	0.001	0	0	0	0	**Sub - base layer (Aggregate / MOT / DTP)**	6.250787136	
		Sand, 1600kg/m3		**input value in m3** (in 'conversion to tonnes' cell)	171.44	274.304	0.005	0.005	0.001	1.37152	1.37152	0.40707	3.150107136			
		Waste material content. 1m3 = 1.43 tonnes.		**input value in m3** (in 'conversion to tonnes' cell)	685.76	980.6368		0.005	0.001	0	4.903184	1.1954	6.098580259	**Excavations & Backfill layer**	8.225478259	
		Soil assumed 5% cement content. 1m3 = 1.9 tonnes of clay soil.		**input value in m3** (in 'conversion to tonnes' cell)	180	342		0.005	0.001	0	1.71	0.4169	2.126898			
		Cable Ducts PVC weight @ 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**	24.09685571	
		Cable Ducts PVC weight @ 150mm dia 3.3kg / m	1	**input value in meters** (in 'conversion to tonnes' cell)	2143	7.0719	3.23	0.005	0.172	22.842237	0.0353595	1.21928	24.09685571			
		Cable Ducts PVC weight @ 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) : weight @5.2kg/m	3	**input value in meters** (in 'conversion to tonnes' cell)	2143	33.4308	3.81	0.032	0.039	127.371348	1.0697856	1.29043	129.7315625	**Cables**	129.7315625	Until manufacturers ECF values are available the ECF value for New Copper is used for Power Cables
		Cable 6.6 / 11kV (New) : weight @ 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 t(CO2e)	240.2230408	

Road & Cable Calculations Table

		Cable Type & Excavation	Cable\Duct Number	Units values to input in conversion to tonnes cell	Conversion to tonnes	Quantity (t)	ECF kg(CO2e/kg) A1-3	ECF kg(CO2e/kg) A4	ECF kg(CO2e/kg) A5w	Embodied Carbon t(CO2e) A1-3	Embodied Carbon t(CO2e) A4	Embodied Carbon t(CO2e) A5w	Embodied Carbon t(CO2e) A1-5w	Total EC t(CO2e)	A1-5w	Notes / Comments
Type 3 & 4	Low & High Voltage	Asphalt, 8% (Bitumen) binder content (by mass) weight @ 2322kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	59.88	139.04136	0.086	0.005	0.006	11.957557	0.6952068	0.80324	13.4560057	**Binder/ Suface Course layer (Tarmac)**	13.4560057	
		Ready mix concrete 32/40. 2350kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	107.78	253.283	0.132	0.005	0.008	33.433356	1.266415	2.08072	36.78049085	**Base layer (Concrete)**	36.78049085	
		Ready Mix Expanding Foam Concrete weight @ 4.5kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	0	0	0.188	0.005	0.011	0	0	0	0			
		Engineering MOT		**input value in m3** (in 'conversion to tonnes' cell)	125.75	188.625	0.005	0.005	0.001	0.943125	0.943125	0.27992	2.1661695			
		Aggregate, 1500kg/m3 Note: aggregate density will change per m3 based on type and mm to dust of material.		**input value in m3** (in 'conversion to tonnes' cell)	0	0	0.005	0.005	0.001	0	0	0	0	**Sub - base layer (Aggregate / MOT / DTP)**	4.366687644	
		Sand, 1600kg/m3		**input value in m3** (in 'conversion to tonnes' cell)	119.76	191.616	0.005	0.005	0.001	0.95808	0.95808	0.28436	2.200518144			
		Waste material content. 1m3 = 1.43 tonnes.		**input value in m3** (in 'conversion to tonnes' cell)	479	684.97		0.005	0.001	0	3.42485	0.83498	4.25982843	**Excavations & Backfill layer**	5.745703005	
		Soil assumed 5% cement content. 1m3 = 1.9 tonnes of clay soil.		**input value in m3** (in 'conversion to tonnes' cell)	125.75	238.925		0.005	0.001	0	1.194625	0.29125	1.485874575			
		Cable Ducts PVC weight @ 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**	16.8329412	
		Cable Ducts PVC weight @ 150mm dia 3.3kg / m	1	**input value in meters** (in 'conversion to tonnes' cell)	1497	4.9401	3.23	0.005	0.172	15.956523	0.0247005	0.85172	16.8329412			
		Cable Ducts PVC weight @ 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) : weight @ 5.2kg/m	3	**input value in meters** (in 'conversion to tonnes' cell)	1497	23.3532	3.81	0.032	0.039	88.97569	0.7473024	0.90143	90.62442792	**Cables**	90.62442792	Until manufacturers ECF values are available the ECF value for New Copper is used for Power Cables
		Cable 6.6 / 11kV (New) : weight @ 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 t(CO2e)	167.8062563	

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

Key:

A1-3	Caculation are based on **Embodied Carbon Factors (ECF)** to **Extract & Manufacture** the material Calculated as: **Tonnes x ECF kg(CO2e/kg) = Embodied Carbon t(CO2e). Sourced IstructE**
A4	Calculation based on **kg of CO2e produced** by Distance travelled in **km.** ECF based on: **Tonnes x ECF kg(CO2e/kg) = Embodied Carbon t(CO2e).** Distances referenced from **IStructE: Locally sourced within 50km = 0.005kg(CO2e) / Nationally Sourced within 320km = 0.32kg(CO2e) / European sourced within 1500km = 0.16kg(CO2e): Sourced IstructE**
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 = Distance Travelled = Distance travelled forwaste material taken to Ianfill (C2) = Co2 used for processing disposal (C3-4) = A5w /** Example, assumed waste of concrete is : **0.053 x (A1-3 x x A4 x C2 x C3-4) = A5w : Sourced IStructE**
5a	Typical assumed **costat stage A1-5 of build is 50% so: 700kg(CO2e) per £100,000** so: **0.7 x (cost of build ÷100,000)= Ans t(CO2e). Soruced IstructE**

Note:

Please fill in all relavent **cells highlighted** in **GREY** -
Profile Depths for Type 1&2:
layer = **100mm**
180mm
Backfill = **210mm**
Sand layer = **200mm** (+/-30mm)
Waste = **Estimate 80% of total Excavated material**
Profile Depths for Type 3&4:
100mm
MOT = **275mm**
Backfill = **275mm**
Sand layer = **200mm** (+/- 30mm)
Material Waste = **Estimate 80% of total Excavated material**

Tarmac top
Concrete layer =
MOT = **210mm**

Material
Tarmac top layer =
Concrete layer = **50mm**

Key: **Designer to fill in all cells highlighted in light grey**

Calculating for Cable & Ducts note:

When **adding** in **cable lengths** in meters, the calculation **must** include **cable numbers** for the table to **calulate** the **embodied carbon factor**

The 'Embodied Carbon t(CO2e)' 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 and what they indicate.

Low		Medium		High
0	12.5	25	37.5	50

Reference note:	**Calculations & Embodied Carbon factors for materials used in the tableare sourced from the Brisa (ICE) & IstructE**
Ref for material Embodied Carbon Factors:	**A BSRIA guide: Hammond.G etal., 'Embodied Carbon', , The inventory of Cabon and Energy , (ICE).**
	Embodied Carbon - The Inventory of Carbon and Energy (ICE) (greenbuildingencyclopaedia.uk)
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