Designer Embodied Carbon (EC) Calculation - Civil & Electrical

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

Project Name:	**Parkside**
Project Scope:	**25kV Cable Diversion to Network Rail Feeder Station due to redvelopment of ex Colliery Site. Route Length 680m.**

Project Embodied Carbon Breakdown and Totals t(CoZe):	
Total A1-5w	138.76
ASa	1.42
Total A1-5 t(CO2e)	**140.18**

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

Note: Total A1-5t(CO2e): Total A1-5w + A5a = Ans

Calculation Date:	**18/09/2024**
Project Code:	**50019804**
Project Completed in Financial Year:	**FY24**
Estimated Cost of Civil Build(£): (To Estimate A5a)	£202,596.00

Roadway	CH Start (m)	CH End (m)	PRIVATE ROAD Imported Material (m)	Footpath Imported Material (m)	Road Type 1	Road Type 2	Road Type 4	Verge / Soft Landscape	Total	CROSS SECTION	USRN	COMMENTS
Woodland Area (Parkside Colliery)	0	288						288	288	A-A	N/A	JB -3/4 -(CH -117m) JB 4/5 (CH - 286m)
Newton Park Drive	288	320					32		32	B-B	37501363	JB - 5/6 - (CH - 325m) JB - 6A - (CH- 680m)
Network Rail (Private Road)	320	680	360						360		N/A	
Total			**360**				**32**	**288**	**680**			

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)	Total EC t(CO2e) A1-5w	Notes / Comments
Private Road & Road Type 4	Low & High Voltage	**Asphalt, 8% (Bitumen) binder content** (by mass) weighted @ 2322kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	38.1	88.4682	0.086	0.005	0.006	7.6082652	0.442341	0.51108	8.561686991	**Binder/ Suface Course layer (Tarmac)**	8.561686991	
		Ready mix concrete 32/40. 2350kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	69	162.15	0.132	0.005	0.008	21.4038	0.81075	1.33205	23.54661225	**Base layer (Concrete)**	23.54661225	
		Ready Mix Expanding Foam Concrete weighted @ 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)	80.7	121.05	0.005	0.005	0.001	0.60525	0.60525	0.17964	1.3901382	**Sub - base layer (Aggregate / MOT / DTP)**	2.80129212	Depth of soil to be calculated @ 50% imported and 50% backfill
		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			
		Sand, 1600kg/m3		**input value in m3** (in 'conversion to tonnes' cell)	76.8	122.88	0.005	0.005	0.001	0.6144	0.6144	0.18235	1.41115392			
		Waste material content. 1m3 = 1.43 tonnes.		**input value in m3** (in 'conversion to tonnes' cell)	307.3	439.439		0.005	0.001	0	2.197195	0.53568	2.732871141	**Excavations & Backfill layer**	3.686430411	
		Soil assumed 5% cement content. 1m3 = 1.9 tonnes of clay soil.		**input value in m3** (in 'conversion to tonnes' cell)	80.7	153.33		0.005	0.001	0	0.76665	0.18691	0.95355927			
		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**	23.40153983	
		Cable Ducts PVC weighted @ 150mm dia 3.3kg / m	4	**input value in meters** (in 'conversion to tonnes' cell)	392	5.1744	3.23	0.005	0.172	16.713312	0.025872	0.89211	17.63129713			
		Cable Ducts PVC weighted @ 100mm dia 2.16kg / m	2	**input value in meters** (in 'conversion to tonnes' cell)	392	1.69344	3.23	0.005	0.172	5.4698112	0.0084672	0.29196	5.770242697			
		Cable 33kV (New) : weighted @ 5.22kg/m	4	**input value in meters** (in 'conversion to tonnes' cell)	392	8.18496	3.81	0.032	0.039	31.184698	0.26191872	0.31594	31.76255578	**Cables**	31.76255578	Until manufacturers ECF values are available the ECF value for New Copper is used for Power Cables. 33kV Cable Info used as not available for 25kV.
		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 t(CO2e)	93.76011737	

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)	Total EC t(CO2e) A1-5w	Notes / Comments
Verge / Soft Landscape	Low & High Voltage	**Asphalt, 8% (Bitumen) binder content** (by mass) weighted @ 2322kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	0	0	0.086	0.005	0.006	0	0	0	0	**Binder/ Suface Course layer (Tarmac)**	0	
		Ready mix concrete 32/40. 2350kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	0	0	0.132	0.005	0.008	0	0	0	0	**Base layer (Concrete)**	0	
		Ready Mix Expanding Foam Concrete weighted @ 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)	0	0	0.005	0.005	0.001	0	0	0	0			
		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)	115.2	172.8	0.005	0.005	0.001	0.864	0.864	0.25644	1.9844352	**Sub - base layer (Aggregate / MOT / DTP)**	2.4070464	Depth of soil to be calculated @ 50% imported and 50% backfill
		Sand, 1600kg/m3		**input value in m3** (in 'conversion to tonnes' cell)	23	36.8	0.005	0.005	0.001	0.184	0.184	0.05461	0.4226112			
		Waste material content. 1m3 = 1.43 tonnes.		**input value in m3** (in 'conversion to tonnes' cell)	79.2	113.256		0.005	0.001	0	0.56628	0.13806	0.704339064	**Excavations & Backfill layer**	2.056100904	
		Soil assumed 5% cement content. 1m3 = 1.9 tonnes of clay soil.		**input value in m3** (in 'conversion to tonnes' cell)	114.4	217.36		0.005	0.001	0	1.0868	0.26496	1.35176184			
		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**	17.19296804	
		Cable Ducts PVC weighted @ 150mm dia 3.3kg / m	4	**input value in meters** (in 'conversion to tonnes' cell)	288	3.8016	3.23	0.005	0.172	12.279168	0.019008	0.65543	12.95360605			
		Cable Ducts PVC weighted @ 100mm dia 2.16kg / m	2	**input value in meters** (in 'conversion to tonnes' cell)	288	1.24416	3.23	0.005	0.172	4.0186368	0.0062208	0.2145	4.23361981			
		Cable 33kV (New) : weighted @ 3.66kg/m	4	**input value in meters** (in 'conversion to tonnes' cell)	288	6.015744	3.81	0.032	0.039	22.919985	0.192503808	0.23221	23.34469617	**Cables**	23.34469617	Until manufacturers ECF values are available the ECF value for New Copper is used for Power Cables. 33kV Cable Info used as not available for 25kV.
		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 t(CO2e)	45.00081151	

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(COe) / 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** x **Distance Travelled** x **Distance travelled forwaste material taken to lanfill (C2)** x **C02 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
210mm
210mm
layer = **200mm** (+/-300mm)
Waste = **Estimate 80% of total Excavated material**

Profile Depths for Type 3&4:
= **100mm**
MOT = **275mm**
Backfill = **275mm**
Sand layer = **200mm** (+/- 300mm)
Material Waste = **Estimate 80% of total Excavated material**

Tarmac top
Concrete layer =
MOT =
Backfill =
Sand
Material
Tarmac top layer
Concrete layer = **50mm**

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**

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

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 for each material 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