Designer Embodied Carbon (EC) Calculation - Civil & Electrical

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

Project Name:	**Spring Garden ST - Burrow Beck T11 & T12 33kV Fluid Filled Cable Overlay**
Project Scope:	**33kV Double Circuit 400mm2 AL XLPE. Route Length 3060m.**

Project Embodied Carbon Breakdown and Totals t(CoZe):	
Total A1-5w	859.70
ASa	8.02
Total A1-5 t(CO2e)	**867.71**

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:	**50019390**
Project Completed in Financial Year:	**FY24**
Estimated Cost of Cable Works£): (To Estimate ASa)	£1.145,226.00

Roadway	From	To			UNMADE GROUND SELECTED EXC. MAT (m)	Footpath Imported Material (m)	Road Type 1&2 Imported Material (m)	Road Type 3&4 Imported Material (m)	Total
SOUTH ROAD (VERGE) (387778:461223)	JOINT ONTO EXISTING 33kV CABLES (IN VERGE - ASHTON ROAD)	THE POINTER					353		353
THE POINTER (347939:460988)	SOUTH ROAD	FOOTPATH IN GREAVES PARK					43		43
FOOTPATH IN GREAVES PARK (347973:460951)	THE POINTER	GREAVES PARK				155			155
GREAVES ROAD (347965:460799)	FOOTPATH IN GREAVES PARK	SCOTFORTH ROAD					481		481
SCOTFORTH ROAD (348008:460331)	GREAVES ROAD	GROUND OF BURROW BECK SUBSTATION					1,980		1,980
GROUND OF BURROW BECK SUBSTATION (347913:458397)	SCOTFORTH ROAD	SWITCHGEAR AT BURROW BECK						48	48
		Total			**0**	**155**	**2,857**	**48**	**3,060**
		Desktop Contigency	**0%**		0	0	2,857	0	0
					0	155	3,098	48	3,060

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
Type 1 & 2	Low & High Voltage	**Asphalt, 8% (Bitumen) binder content** (by mass) weighted @ 2322kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	114	264.708	0.086	0.005	0.006	22.764888	1.32354	1.52922	25.61764612	**Binder/ Suface Course layer (Tarmac)**	25.61764612	
		Ready mix concrete 32/40. 2350kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	205.7	483.395	0.132	0.005	0.008	63.80814	2.416975	3.97109	70.19620493	**Base layer (Concrete)**	70.19620493	
		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)	240	360	0.005	0.005	0.001	1.8	1.8	0.53424	4.13424	**Sub - base layer (Aggregate / MOT / DTP)**	8.33462784	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)	228.6	365.76	0.005	0.005	0.001	1.8288	1.8288	0.54279	4.20038784			
		Waste material content. 1m3 = 1.43 tonnes.		**input value in m3** (in 'conversion to tonnes' cell)	914	1307.02		0.005	0.001	0	6.5351	1.59328	8.12835738	**Excavations & Backfill layer**	10.96422138	
		Soil assumed 5% cement content. 1m3 = 1.9 tonnes of clay soil.		**input value in m3** (in 'conversion to tonnes' cell)	240	456		0.005	0.001	0	2.28	0.55586	2.835864			
		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**	64.25078559	
		Cable Ducts PVC weighted @ 150mm dia 3.3kg / m	2	**input value in meters** (in 'conversion to tonnes' cell)	2857	18.8562	3.23	0.005	0.172	60.905526	0.094281	3.25098	64.25078559			
		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 @ 2.78kg/m	6	**input value in meters** (in 'conversion to tonnes' cell)	2857	47.65476	12.79	0.16	0.13	609.50438	7.6247616	6.17987	623.3090113	**Cables**	623.3090113	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 t(CO2e)	802.6724971	

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
Footpath, Type 3 & 4	Low & High Voltage	**Asphalt, 8% (Bitumen) binder content** (by mass) weighted @ 2322kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	8.1	18.8082	0.086	0.005	0.006	1.6175052	0.094041	0.10865	1.820201171	**Binder/ Suface Course layer (Tarmac)**	1.820201171	
		Ready mix concrete 32/40. 2350kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	14.6	34.31	0.132	0.005	0.008	4.52892	0.17155	0.28186	4.98232665	**Base layer (Concrete)**	4.98232665	
		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)	17	25.5	0.005	0.005	0.001	0.1275	0.1275	0.03784	0.292842	**Sub - base layer (Aggregate / MOT / DTP)**	0.59050728	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)	16.2	25.92	0.005	0.005	0.001	0.1296	0.1296	0.03847	0.29766528			
		Waste material content. 1m3 = 1.43 tonnes.		**input value in m3** (in 'conversion to tonnes' cell)	65	92.95		0.005	0.001	0	0.46475	0.11331	0.57805605	**Excavations & Backfill layer**	0.77892975	
		Soil assumed 5% cement content. 1m3 = 1.9 tonnes of clay soil.		**input value in m3** (in 'conversion to tonnes' cell)	17	32.3		0.005	0.001	0	0.1615	0.03937	0.2008737			
		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**	4.565246578	
		Cable Ducts PVC weighted @ 150mm dia 3.3kg / m	2	**input value in meters** (in 'conversion to tonnes' cell)	203	1.3398	3.23	0.005	0.172	4.327554	0.006699	0.23099	4.565246578			
		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 @ 2.78kg/m	6	**input value in meters** (in 'conversion to tonnes' cell)	203	3.38604	12.79	0.16	0.13	43.3074516	0.5417664	0.4391	44.28831967	**Cables**	44.28831967	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 t(CO2e)	57.0255311	

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**

Calculating for Cable & Ducts note:

When **adding** in **cable lengths** in meters, the calculation **must** include **cable numbers** for the table to **caluiate** 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

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**

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