Designer Embodied Carbon (EC) Calculation - Civil & Electrical

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

Project Name:	**Burnley BSP - Heasandford Nt2**
Project Scope:	**33kV Solid Cable - Single Circuit 400mm2 CU XLPE. Route Length 765m.**

Project Embodied Carbon Breakdown and Totals t(CoZe):	
Total A1-Sw	77.01
ASa	2.07
Total A1-S t(CO2e)	**79.08**

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

Note: Total A1-St(CO2e): Total A1-Sw + ASa = Ans

Calculation Date:	**18/09/2024**
Project Code:	**50022052**
Project Completed in Financial Year:	**FY24**
Estimated Cost of Cable Works(£): (To Estimate ASa)	£295,950.00

Roadway	From	To				Verge / Soft Landscape Inported MAT. (m)	Road Type 1&2 Imported Material (m)	Road Type 3&4 Imported Material (m)	Total
Ground of Burnley BSP	Joint Bay Location 1A	Widow Hill Road				75		110	75
Widow Hill Road	Grounds of Burnley BSP	Eatern Avenue							110
Eastern Avenue	Widow Hill Road	Eastern Ave - Joint Bay Location 2/3					527		527
Bancroft Road	Eastern Ave - Joint Bay Location 2/3	Heasandford Primary							
Grounds of Heasandford Primary	Bancroft Road	Pilot / Fibre Entry Point				15		38	53
		Total				**90**	**527**	**148**	**765**
		Desktop Contigency	**0%**			0	0	0	0
						90	527	148	765

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)			Embodied Carbon t(CO2e)				Total EC t(CO2e)		Notes / Comments
							A1-3	A4	A5w	A1-3	A4	A5w	A1-5w		A1-5w	
Type 1&2	Low & High Voltage	**Asphalt, 8% (Bitumen) binder conten**t (by mass) weighted @ 2322kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	21.08	48.94776	0.086	0.005	0.006	4.2095074	0.2447388	0.28277	4.73701737	**Binder/ Suface Course layer (Tarmac)**	4.73701737	
		Ready mix concrete 32/40. 2350kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	37.9	89.065	0.132	0.005	0.008	11.75658	0.445325	0.73167	12.93357398	**Base layer (Concrete)**	12.93357398	
		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)	44.27	66.405	0.005	0.005	0.001	0.332025	0.332025	0.09855	0.76259502	**Sub - base layer (Aggregate / MOT / DTP)**	1.5379947	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)	42.2	67.52	0.005	0.005	0.001	0.3376	0.3376	0.1002	0.7753968			
		Waste material content. 1m3 = 1.43 tonnes.		**input value in m3** (in 'conversion to tonnes' cell)	168.64	241.1552		0.005	0.001	0	1.205776	0.29397	1.499744189	**Excavations & Backfill layer**	2.022842936	
		Soil assumed 5% cement content. 1m3 = 1.9 tonnes of clay soil.		**input value in m3** (in 'conversion to tonnes' cell)	44.27	84.113		0.005	0.001	0	0.420565	0.10253	0.523098747			
		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**	5.925824992	
		Cable Ducts PVC weighted @ 150mm dia 3.3kg / m	1	**input value in meters** (in 'conversion to tonnes' cell)	527	1.7391	3.23	0.005	0.172	5.617293	0.0086955	0.29984	5.925824992			
		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 @ 5.2kg/m	3	**input value in meters** (in 'conversion to tonnes' cell)	527	8.2212	3.81	0.16	0.04	31.322772	1.315392	0.32786	32.96602546	**Cables**	32.96602546	Until manufacturers ECF values are available the ECF value for New Copper 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)	60.12327943	

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)			Embodied Carbon t(CO2e)				Total EC t(CO2e)		Notes / Comments
							A1-3	A4	A5w	A1-3	A4	A5w	A1-5w		A1-5w	
Type 3 & 4	Low & High Voltage	**Asphalt, 8% (Bitumen) binder conten**t (by mass) weighted @ 2322kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	5.92	13.74624	0.086	0.005	0.006	1.1821766	0.0687312	0.07941	1.330319868	**Binder/ Suface Course layer (Tarmac)**	1.330319868	
		Ready mix concrete 32/40. 2350kg / m3		**input value in m3** (in 'conversion to tonnes' cell)	10.66	25.051	0.132	0.005	0.008	3.306732	0.125255	0.20579	3.637780965	**Base layer (Concrete)**	3.637780965	
		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)	12.43	18.645	0.005	0.005	0.001	0.093225	0.093225	0.02767	0.21411918			
		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)**	0.4309371	
		Sand, 1600kg/m3		**input value in m3** (in 'conversion to tonnes' cell)	11.8	18.88	0.005	0.005	0.001	0.0944	0.0944	0.02802	0.21681792			Depth of soil to be calculated @ 50% imported and 50% backfill
		Waste material content. 1m3 = 1.43 tonnes.		**input value in m3** (in 'conversion to tonnes' cell)	47.36	67.7248		0.005	0.001	0	0.338624	0.08256	0.421180531	**Excavations & Backfill layer**	0.568054654	
		Soil assumed 5% cement content. 1m3 = 1.9 tonnes of clay soil.		**input value in m3** (in 'conversion to tonnes' cell)	12.43	23.617		0.005	0.001	0	0.118085	0.02879	0.146874123			
		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)	148	0.4884	3.23	0.005	0.172	1.577532	0.002442	0.0842	1.664178556	**Cable Ducts**	1.664178556	
		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 @ 5.22kg/m	3	**input value in meters** (in 'conversion to tonnes' cell)	148	2.3088	3.81	0.16	0.04	8.796528	0.369408	0.09207	9.258010944		9.258010944	Until manufacturers ECF values are available the ECF value for New Copper 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)	16.88928209	

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** 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 **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 notes:	**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)

Note:

Please fill in all relavent **cells highlighted** in GREY -

Profile Depths for Type 1&2: Tarmac
top layer = **100mm** Concrete
layer = **180mm**
MOT = **210mm**
Backfill = **210mm**
Sand layer = **200mm** (+/-300mm)
Material Waste = **Estimate 80% of total Excavated material**

Profile Depths for Type 3&4: Tarmac top
layer = **100mm** Concrete layer =
50mm MOT = **275mm**
Backfill = **275mm**
Sand layer = **200mm** (+/- 300mm)
Material Waste = **Estimate 80% of total Excavated material**

Project Photographs / Drawings