Designer Embodied Carbon (EC) Calculation - Civil & Electrical	
Build Table Most Contributing Materials 1%>. Embodied Carbon A1-5	
Project Name:	**Parkside Colliery Diversion.**
Project Scope:	**25kV C.S.E Replacement and new 25kV cables. Divert 25kV cables to Network Rail due to redevelopment of ex colliery site. This calculation is purely the works within the Substations.**

Project Embodied Carbon Breakdown and Totals t(Co2e):	
Total A1-5w	43.23
A5a	1.29
Total A1-5 t(CO2e)	**44.53**

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)	£184,949.00

Structural timber: in Tonnes, (To Calculate Sequstration Value)	0
Sequestration Value t(CO2e):	0

Design Values													
Embodied Carbon t(CO2e)					ECF kg(CO2e/kg)			Embodied Carbon t(CO2e)				Total EC t(CO2e)	Notes/ Comments
Stage of works	**Material**	**Units values to input in conversion to tonnes cell**	**Conversion to Tonnes**	**Quantity(t)**	**A1-3**	**A4**	**A5w**	**A1-3**	**A4**	**A5w**	**A1-5w**	**A1-5w**	
Foundation Excavation & Backfill	**Soil assumed 5% cement content.** 1m3 = 1.9 tonnes of clay soil. Ref:	**input value in m3** (in 'conversion to tonnes' cell)	59.2	137.4624	0.0610	0.005	0.004452	8.3852	0.6873	0.612	9.684501	**Foundation Excavation & Backfill** 9.684501005	
Foundation	**Asphalt, 8% (Bitumen) binder content** (by mass) weighted @ 2322kg / m3	**input value in m3** (in 'conversion to tonnes' cell)	0	0	0.0860	0.005	0.005777	0	0	0	0	**Foundation** 0	
	PVC Pipes (Waste water) weight @ 0.72kg / m	**input value in meters** (in 'conversion to tonnes' cell)	0	0	3.2300	0.005	0.172409	0	0	0	0	0	
	Concrete Kerb 26.74 linear meters per m3	**input value in m3** (in 'conversion to tonnes' cell)	0	0	0.1880	0.005	0.00211	0	0	0	0	0	
	Limestone Aggregate, 2650kg/m3	**input value in m3** (in 'conversion to tonnes' cell)	21	55.65	0.0050	0.005	0.001484	0.2783	0.2783	0.0826	0.6390846	0.6390846	
Reinforced Concrete	**Ready mix concrete 32/40**. 2350kg / m3	**input value in m3** (in 'conversion to tonnes' cell)	50	117.5	0.1320	0.005	0.008215	15.51	0.5875	0.9653	17.0627625	**Reinforced Concrete** 17.0627625	
	Rebar (New) weighted @ H10 = 0.62kg / m	**input value in kg** (in 'conversion to tonnes' cell)	0	0	2.7700	0.032	0.14946	0	0	0	0	0	
	Rebar (New) weighted @ H12 = 0.89kg / m	**input value in kg** (in 'conversion to tonnes' cell)	200	0.2	2.7700	0.032	0.14946	0.554	0.0064	0.0299	0.590292	0.590292	
	Rebar (New) weighted @ H20 = 2.47kg / m	**input value in kg** (in 'conversion to tonnes' cell)	2400	2.4	2.7700	0.032	0.14946	6.648	0.0768	0.3587	7.083504	7.083504	
Steel works	**Stainless Steel Windposts Grade 304** weighted @ 37.5kg / m	**input value in meters** (in 'conversion to tonnes' cell)	0	0	6.1500	0.032	0.062	0	0	0	0	**Steel works** 0	
	Steel General (New) weighted @ 7900kg / m3 (contractor weights for materials on steel is a must)	**input value in kg** (in 'conversion to tonnes' cell)	1500	1.5	2.8900	0.032	0.0294	4.335	0.048	0.0441	4.4271	4.4271	
	Mild Steel Fencing weighted @ 25kg per linear meter	**input value in meters** (in 'conversion to tonnes' cell)	24	0.6	1.5300	0.005	0.01553	0.918	0.003	0.0093	0.930318	0.930318	
Superstructure	**Clay Brick** (2000kg / m3)	**input value in kg** (in 'conversion to tonnes' cell)	0	0	0.2400	0.005	0.06575	0	0	0	0	**Superstructure** 0	
	Louvres RSH5700 edition / weighted @ 25kg/m2 (Assumed alluminium frame)	**input value in kg** (in 'conversion to tonnes' cell)	0	0	12.7900	0.032	0.1284	0	0	0	0	0	
	Mineral wool insulation, Rockwool RW3, weighted at 60kg/m3	**input value in kg** (in 'conversion to tonnes' cell)	0	0	1.2800	0.005	0.069059	0	0	0	0	0	
	Autoclaved Aerated Concrete Block 600kg / m3	**input value in kg** (in 'conversion to tonnes' cell)	0	0	0.3750	0.005	0.0995	0	0	0	0	0	
Roof	**Timber truss** weight @ 3kg / m	**input value in kg** (in 'conversion to tonnes' cell)	0	0	0.4200	0.005	0.12847	0	0	0	0	**Roof** 0	
	Concrete roof tiles weighted @ 3kg / m2	**input value in kg** (in 'conversion to tonnes' cell)	0	0	0.1000	0.005	0.00123	0	0	0	0	0	
	Concrete Roof Columns weighted @ 355kg / m	**input value in meters** (in 'conversion to tonnes' cell)	0	0	0.1880	0.005	0.00211	0	0	0	0	0	
	PVC Pipes (weight @ 0.72kg / m)	**input value in meters** (in 'conversion to tonnes' cell)	0	0	3.2300	0.005	0.172409	0	0	0	0	0	
Cable Excavation & Backfill	**Soil assumed 5% cement content.** 1m3 = 1.9 tonnes of clay soil. Ref: (https://coolconversion.com/volume-mass-construction/~1-cubic-meter-of-clay-soil~to~tonne)	**input value in m3** (in 'conversion to tonnes' cell)	2.8	5.32	0.0610	0.005	0.004452	0.3245	0.0266	0.0237	0.37480464	**Excavation & Backfill** 0.37480464	10% of materials are removed for new cables and ducts
Cables	**Cable Ducts PVC-3 Phases -**ave weight 3.3kg / m	**input value in meters** (in 'conversion to tonnes' cell)	34	0.1122	3.2300	0.005	0.172409	0.3624	0.0006	0.0193	0.38231129	0.38231129	
	Single Core Cable 33kV - 3 Phases : ave weight @ 15.6kg/m	**input value in meters** (in 'conversion to tonnes' cell)	34	0.5304	3.8100	0.032	0.0386	2.0208	0.017	0.0205	2.05827024	**Cables** 2.05827024	Until manufacturers ECF values are available the ECF value for New Copper is used for Power Cables. Multicore cables are assumed to be 80% copper, 20% PVC by weight. 33kV ECF used as information unavailable for 25kV.
	Single Core Cable 6.6 / 11kV - 3 Phases : ave weight @ 13.6kg/m	**input value in meters** (in 'conversion to tonnes' cell)	0	0	3.8100	0.032	0.0386	0	0	0	0	0	
	Muiltlicore Cable : ave weight @ 1.5kg/m	**input value in meters** (in 'conversion to tonnes' cell)	0	0	3.7000	0.032	0.0375	0	0	0	0	0	
Transformers	**Transformer 33kV**	**input value in Tonnes** (in 'conversion to tonnes' cell)	0	0		0.16	0.00178	0	0	0	0	**Transformers** 0	
	Transformer 132kV	**input value in Tonnes** (in 'conversion to tonnes' cell)	0	0		0.16	0.00178	0	0	0	0	0	
	Transformer EAT	**input value in Tonnes** (in 'conversion to tonnes' cell)	0	0		0.16	0.00178	0	0	0	0	0	
Switchgear	**33kV Switchgear:** ave weight 730kg	**input value in Tonnes** (in 'conversion to tonnes' cell)	0	0	3.5429	0.5173	0.0407815	0	0	0	0	**Switchgear** 0	
	Protection Panels: ave weight 260kg	**input value in Tonnes** (in 'conversion to tonnes' cell)	0	0	3.0300	0.16	0.03208	0	0	0	0	0	
	Switch Gear 3	**input value in Tonnes** (in 'conversion to tonnes' cell)	0	0		0.16	0.00178	0	0	0	0	0	
	Switch Gear 4	**input value in Tonnes** (in 'conversion to tonnes' cell)	0	0		0.16	0.00178	0	0	0	0	0	
	Switch Gear 5	**input value in Tonnes** (in 'conversion to tonnes' cell)	0	0		0.16	0.00178	0	0	0	0	0	
	Switch Gear 6	**input value in Tonnes** (in 'conversion to tonnes' cell)	0	0		0.16	0.00178	0	0	0	0	0	

Calculation Notes:	
Weight of structural Timber (Excluding temp works)	tonnes
Weight of Temporary Timber (formworks, Assumed reuse)	tonnes
Foundation -Trench Excavations	At Length[**5**] m x Width[**5**] m x Depth[**3**] m = [**59.4**] m3
Cables - Trench Excavations	At Length[**34**] m x Width[**0.9**] m x Depth[**0.9**] m = [**28**] m3
Power Cable circuit lengths	[34] meter length

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**

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 and what they indicate.				
Low		**Medium**		**High**
0	12.5	25	37.5	50
The **notes table** to the left can be used to help **breakdown** and **review calculations.** The **structural timber** values in **tonnes** can be used to **calculate** the **sequestration value**, this is used to calculate the **amount** of **carbon storage throughout the builds life cycle Example: 20 tonnes of structural timer x -1.64 kg(CO2e) = -32.8t(CO2e).** For more information see notes calculation A1-5 on the tab below.				

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& Ceil colour formatting:	**The Institution of Structural Engineers 'How to calculate embodied carbon'.**
	A brief guide to calculating embodied carbon (istructe.org)

Project Photographs / Drawings