Designer Embodied Carbon (EC) Calculation - Civil & Electrical	
Build Table Most Contributing Materials 1%>. Embodied Carbon A1-5	
Project Name:	New Mills 33kV Switchgear Replacement.
Project Scope:	33kV Switchgear Replacement using Siemens NX+. Unused existing room converted to a switchroom.

Project Embodied Carbon Breakdown and Totals t(Co2e):	
Total A1-5w	53.70
A5a	0.17
Total A1-5 t(CO2e)	**53.87**

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

Calculation Date:	**18/09/2024**
Project Code:	**80017608**
Project Completed in Financial Year:	**FY24**
Estimated Cost of Civil Build(£): (To Estimate A5a)	£24,030.00

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

Design Values														Notes/ Comments
Embodied Carbon t(CO2e)					ECF kg(CO2e/kg)			Embodied Carbon t(CO2e)				Total EC t(CO2e)		
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)	1.4	3.2508	0.061	0.005	0.004452	0.1983	0.0163	0.0145	0.22902536	**Foundation Excavation & Backfill**	0.229025362	
Foundation	Asphalt, 8% (Bitumen) binder content (by mass) weight @ 2322kg / m3	**input value in m3** (in 'conversion to tonnes' cell)	0	0	0.086	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	3.23	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	0.188	0.005	0.00211	0	0	0	0		0	
	Limestone Aggregate, 2650kg/m3	**input value in m3** (in 'conversion to tonnes' cell)	1.9	5.035	0.005	0.005	0.001484	0.0252	0.0252	0.0075	0.05782194		0.05782194	
Reinforced Concrete	**Ready mix concrete 32/40**. 2350kg / m3	**input value in m3** (in 'conversion to tonnes' cell)	0	0	0.132	0.005	0.008215	0	0	0	0	**Reinforced Concrete**	0	
	Rebar (New) weight @ H10 = 0.62kg / m	**input value in kg** (in 'conversion to tonnes' cell)	0	0	2.77	0.032	0.14946	0	0	0	0		0	
	Rebar (New) weight @ H12 = 0.89kg / m	**input value in kg** (in 'conversion to tonnes' cell)	0	0	2.77	0.032	0.14946	0	0	0	0		0	
	Rebar (New) weight @ H20 = 2.47kg / m	**input value in kg** (in 'conversion to tonnes' cell)	0	0	2.77	0.032	0.14946	0	0	0	0		0	
Steelwork	Stainless Steel Windposts Grade 304 weight @ 37.5kg / m	**input value in meters** (in 'conversion to tonnes' cell)	0	0	6.15	0.032	0.062	0	0	0	0	**Steelwork**	0	
	Steel General (New) weight @ 7900kg / m3 (contractor weights for materials on steel is a must)	**input value in kg** (in 'conversion to tonnes' cell)	1520	1.52	2.89	0.032	0.0294	4.3928	0.0486	0.0447	4.486128		4.486128	
	Mild Steel Fencing weight @ 25kg per linear meter	**input value in meters** (in 'conversion to tonnes' cell)	10	0.25	1.53	0.005	0.01553	0.3825	0.0013	0.0039	0.3876325		0.3876325	
Superstructure	**Clay Brick** (2000kg / m3)	**input value in kg** (in 'conversion to tonnes' cell)	0	0	0.24	0.005	0.06575	0	0	0	0	**Superstructure**	0	
	Louvres RSH5700 edition / weight @ 25kg/m2 (Assumed alluminium frame)	**input value in kg** (in 'conversion to tonnes' cell)	0	0	12.79	0.032	0.1284	0	0	0	0		0	
	Mineral wool insulation, Rockwool RW3, weight at 60kg/m3	**input value in kg** (in 'conversion to tonnes' cell)	0	0	1.28	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	0.375	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	0.42	0.005	0.12847	0	0	0	0	**Roof**	0	
	Concrete roof tiles weight @ 3kg / m2	**input value in kg** (in 'conversion to tonnes' cell)	0	0	0.1	0.005	0.00123	0	0	0	0		0	
	Concrete Roof Columns weight @ 355kg / m	**input value in meters** (in 'conversion to tonnes' cell)	0	0	0.188	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	3.23	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)	462	87.78	0.061	0.005	0.004452	5.3546	0.4389	0.3908	6.18427656	**Excavation & Backfill**	6.18427656	Assumed removal of 10% of excavation
Cables	**Cable Ducts PVC-3 Phases** -ave weight 3.3kg / m	**input value in meters** (in 'conversion to tonnes' cell)	385	1.2705	3.23	0.005	0.172409	4.1037	0.0064	0.219	4.32911313		4.329113135	Until manufacturers ECF values are available the ECF value for New Copper is used for Power Cables. Multicore cables are assummed to be 80% copper, 20% PVC by weight.
	Single Core Cable 33kV - 3 Phases : ave weight @ 15.6kg/m	**input value in meters** (in 'conversion to tonnes' cell)	385	6.006	3.81	0.16	0.03988	22.883	0.961	0.2395	24.0833393		24.08333928	
	Single Core Cable 6.6 / 11kV - 3 Phases : av weight @ 13.6kg/m	**input value in meters** (in 'conversion to tonnes' cell)	0	0	3.81	0.032	0.0386	0	0	0	0		0	
	Muilticore Cable : av weight @ 1.5kg/m	**input value in meters** (in 'conversion to tonnes' cell)	430	0.645	3.7	0.032	0.0375	2.3865	0.0206	0.0242	2.4313275		2.4313275	
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)	7	2.415	3.5429	0.5173	0.0407818	8.556	1.2493	0.0985	9.90381473	**Switchgear**	9.903814728	ECF based on manufacturer's values for similar switchgear.
	Protection Panels: ave weight 260kg	**input value in Tonnes** (in 'conversion to tonnes' cell)	2	0.52	3.03	0.032	0.0308	1.5756	0.0166	0.016	1.608256		1.608256	
		input value in Tonnes (in 'conversion to tonnes' cell)	0	0		0.16	0.00178	0	0	0	0		0	
		input value in Tonnes (in 'conversion to tonnes' cell)	0	0		0.16	0.00178	0	0	0	0		0	
		input value in Tonnes (in 'conversion to tonnes' cell)	0	0		0.16	0.00178	0	0	0	0		0	
		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[**1.3**] m x Width[**1.2**] m x Depth[**0.9**] m = [**1.4**] m3
Cables - Trench Excavtions	At Length[385] m x Width[1.2] m x Depth[1] m = [462] m3
Power Cable circuit lengths	[55] meter lengths x No. of cables [**7**]

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 Emobdied 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)

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**

Project Photographs / Drawings