

Designer Embodied Carbon (EC) Calculation - Civil & Electrical	
Build Table Most Contributing Materials 1%+, Embodied Carbon A1-5	
Project Name:	Kellogg T11 Replacement.
Project Scope:	Transformer T11 replacement due to faulted transformer. In Situ replacement with foundations modifications and new louvred wall. 23MVA 33kV/6.6kV Transformer.

Project Embodied Carbon Breakdown and Totals (CO2e):		Calculation Date:	18/09/2024
Total A1-5w	140.35	Project Code:	60002316
Asa	1.69	Project Completed In Financial Year:	FY24
Total A1-5 (CO2e)	142.04	Estimated Cost of Civil Build(E): (To Estimate Asa)	£240,804.00

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

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

Design Values											Notes/ Comments		
Stage of works	Material	Units values to input in conversion to tonnes cell	Conversion to Tonnes	Quantity(t)	ECF kg(CO2e/kg)			Embodied Carbon (CO2e)				Total EC (CO2e)	
					A1-3	A4	A5w	A1-3	A4	A5w	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)	11	25.542	0.061	0.005	0.004452	1.5581	0.1277	0.1137	1.79948498	1.799484984	Foundation Excavation & Backfill
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	0	Foundation
	PVC Pipes (Waste water) weight @ 0.72kg / m	input value in meters (in 'conversion to tonnes' cell)	10	0.0072	3.23	0.005	0.172409	0.0233	4E-05	0.0012	0.02453334	0.024533345	Foundation
	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	Foundation
Reinforced Concrete	Limestone Aggregate, 2650kg/m3	input value in m3 (in 'conversion to tonnes' cell)	5	13.25	0.005	0.005	0.001484	0.0683	0.0683	0.0197	0.152163	0.152163	Reinforced Concrete
	Ready mix concrete 32/40, 2350kg / m3	input value in m3 (in 'conversion to tonnes' cell)	8.6	20.21	0.132	0.005	0.008215	2.6677	0.1011	0.166	2.93479515	2.93479515	Reinforced Concrete
	Rebar (New) weight @ H10 = 0.62kg / m	input value in kg (in 'conversion to tonnes' cell)	250	0.25	2.77	0.032	0.14946	0.6925	0.008	0.0374	0.737865	0.737865	Reinforced Concrete
Steelwork	Rebar (New) weight @ H12 = 0.86kg / m	input value in kg (in 'conversion to tonnes' cell)	0	0	2.77	0.032	0.14946	0	0	0	0	0	Reinforced Concrete
	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	Reinforced Concrete
	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	0	Steelwork
Superstructure	Steel General (New) weight @ 7900kg / m3 (contractor weights for materials on steel is a must)	input value in kg (in 'conversion to tonnes' cell)	4000	4	2.89	0.032	0.0294	11.56	0.126	0.1176	11.8056	11.8056	Steelwork
	Mild Steel Fencing weight @ 25kg per linear meter	input value in meters (in 'conversion to tonnes' cell)	0	0	1.53	0.005	0.01553	0	0	0	0	0	Steelwork
	Clay Brick (2000kg / m3)	input value in kg (in 'conversion to tonnes' cell)	0	0	0.24	0.005	0.00576	0	0	0	0	0	Superstructure
Roof	Louvers RSH5700 edition / weight @ 25kg/m2 (Assumed aluminium frame)	input value in kg (in 'conversion to tonnes' cell)	850	0.85	12.79	0.032	0.1284	10.872	0.0272	0.1091	11.00784	11.00784	Superstructure
	Mineral wool insulation, Rockwool RW3, weight at 60kg/m3	input value in kg (in 'conversion to tonnes' cell)	0	0	1.28	0.005	0.006909	0	0	0	0	0	Superstructure
	Autoclaved Aerated Concrete Block 600kg / m3	input value in kg (in 'conversion to tonnes' cell)	0	0	0.375	0.005	0.00995	0	0	0	0	0	Superstructure
Cable Excavation & Backfill	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	0	Roof
	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	Roof
	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	Roof
Cables	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	Roof
	Soil assumed 5% cement content. 1m3 = 1.9 tonnes of clay soil. Ref: (https://co2conversion.com/volume-mass-construction-1-cubic-meter-of-clay-soil-to-tonne)	input value in m3 (in 'conversion to tonnes' cell)	4.4	0.836	0.061	0.005	0.004452	0.051	0.0042	0.0037	0.05889787	0.058897872	Excavation & Backfill
	Cable Ducts PVC-3 Phases -ave weight 3.3kg / m	input value in meters (in 'conversion to tonnes' cell)	55	0.1815	3.23	0.005	0.172409	0.5882	0.0009	0.0013	0.61844473	0.618444734	Cables
Transformers	Single Core Cable 33kV - 3 Phases : ave weight @ 15.6kg/m	input value in meters (in 'conversion to tonnes' cell)	11	0.1716	3.81	0.032	0.0386	0.6538	0.0055	0.0096	0.66591096	0.66591096	Cables
	Single Core Cable 6.6 / 11kV - 3 Phases : av weight @ 13.6kg/m	input value in meters (in 'conversion to tonnes' cell)	44	0.5984	3.81	0.032	0.0386	2.2799	0.0191	0.0231	2.32215104	2.32215104	Cables
	Multicore Cable : av weight @ 1.5kg/m	input value in meters (in 'conversion to tonnes' cell)	150	0.225	3.7	0.032	0.0375	0.8325	0.0072	0.0084	0.8481375	0.8481375	Cables
Switchgear	Transformer 33kV	input value in Tonnes (in 'conversion to tonnes' cell)	38.73	38.73	2.67	0.032	0.0272	103.41	1.284	1.0535	105.701916	105.701916	Transformers
	Transformer 132kV	input value in Tonnes (in 'conversion to tonnes' cell)	0	0	0.16	0.00178	0	0	0	0	0	0	Transformers
	Transformer EAT	input value in Tonnes (in 'conversion to tonnes' cell)	0	0	0.16	0.00178	0	0	0	0	0	0	Transformers
Switchgear	33kV Switchgear: ave weight 730kg	input quantity (in 'conversion to tonnes' cell)	0	0	3.5429	0.173	0.0407815	0	0	0	0	0	Switchgear
	Protection Panels: ave weight 260kg	input quantity (in 'conversion to tonnes' cell)	2	0.52	3.03	0.16	0.03208	1.5756	0.0832	0.0167	1.6754816	1.6754816	Switchgear
	Switch Gear 3	input value in Tonnes (in 'conversion to tonnes' cell)	0	0	0.16	0.00178	0	0	0	0	0	0	Switchgear
	Switch Gear 4	input value in Tonnes (in 'conversion to tonnes' cell)	0	0	0.16	0.00178	0	0	0	0	0	0	Switchgear
	Switch Gear 5	input value in Tonnes (in 'conversion to tonnes' cell)	0	0	0.16	0.00178	0	0	0	0	0	0	Switchgear
Switch Gear 6	input value in Tonnes (in 'conversion to tonnes' cell)	0	0	0.16	0.00178	0	0	0	0	0	0	Switchgear	

Calculation Notes:	
Weight of structural Timber (Excluding temp works)	tonnes
Weight of Temporary Timber (formworks, Assumed reuse)	tonnes
Foundation -Trench Excavations	A1 Length[4] m x Width[2.75] m x Depth[1] m = [11] m3
Cables - Trench Excavations	A1 Length[11] m x Width[0.4] m x Depth[1] m = [4.4] m3
Power Cable circuit lengths	[11] m lengths x No. of cables [5]

Key:	Designer to fill in all cells highlighted in light grey
Low	Medium
0	12.5
25	37.5
50	60

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 build's life cycle. Example: 20 tonnes of structural timber x -1.54 kg(CO2e) = -32.8kg(CO2e). For more information see notes calculation A1-5 on the tab below.

Reference notes:	Calculations & Embodied Carbon factors for materials used in the table are sourced from the B'risa (ICE) & IstrucIE
The Embodied Carbon (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.	ABSRIA guide: Hammond G et al., 'Embodied Carbon', The Inventory of Carbon and Energy, (ICE).
Ref for material Embodied Carbon Factors	Embodied Carbon: The Inventory of Carbon and Energy, (ICE) (https://www.istruc.ie/ice/)
Ref for calculating Embodied Carbon A1-5s Cell colour formatting	The Institution of Structural Engineers 'How to calculate embodied carbon', A brief guide to calculating embodied carbon, (istruc.ie)

Key:	Important note: All materials calculated in above sheet, includes only imported materials
A1-3	Calculation are based on Embodied Carbon Factors (ECF) to Extract & Manufacture the material Calculated as: Tonnes x ECF kg(CO2e/kg) = Embodied Carbon (CO2e). Sourced IstrucIE
A4	Calculation based on kg of CO2e produced by Distance travelled in km. ECF based on: Tonnes x ECF kg(CO2e/kg) = Embodied Carbon (CO2e). Distances referenced from IstrucIE: Locally sourced within 50km = 0.005kg(CO2e) / Nationally Sourced within 320km = 0.32kg(CO2e) / European sourced within 1500km = 0.16kg(CO2e). Sourced IstrucIE
A5w	Calculation based on the Waste Factor (WF) of Materials. So brick has a waste factor of 20%, Steel 1% etc... Material WF/(Material ECF x Distance Travelled x Distance travelled for waste material taken to landfill (C2) x CO2 used for processing disposal (C3-4) = A5w / Example, assumed waste of concrete is : 0.053 x (A1-3 x A4 x C2 x C3-4) = A5w - Sourced IstrucIE
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 (CO2e). Sourced IstrucIE

