highways england

European Union
European Regional Development Fund

A30 Chiverton to Carland Cross
Environmental Statement

Volume 6 Document Ref 6.4 ES Appendix 14.1 Carbon assessment assumptions

HA551502-ARP-EAQ-SW-RP-LE-000008

C01 | A3

22/08/18

Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)
APFP Regulation 5(2)(a)

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14.1 Carbon assessment supporting information

14.1.1 This appendix presents all assumptions made in the quantification of the capital carbon assessment, presented in Volume 6 Document Ref. 6.2 ES Chapter 14.

Table 14-1 Carbon assessment assumptions

ARUP

Job No.	Sheet No.	Rev.
256019-91		

Member/Location

Job Title: A30 Chiverton to Carland Cross

Drg. Ref.

Calculation

Made by: QL Date: 18/07/2018 Chd.: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
200			**SITE CLEARANCE**				
	200.001	Site Clearance	Site Clearance - General site clearance (open field)	59.67	ha	Assume there is no material carbon emssion in general site clearance	
	200.002	Site Clearance	Site Clearance - General site clearance (medium wooded)	59.67	ha	Assume there is no material carbon emssion in general site clearance	
	200.006	Site Clearance	Site Clearance - Demolition - Individual building or structure (Residential structure)	6.00	nr	Assume there is no material carbon emssion in demolition	
			Sub Total				
300			**FENCING**				
	300.001	Fencing	Badger Fencing	22,441.00	m	Assume badger fencing is a type of *steel/wire/chain fence (includes posts)*	HE Carbon tool: Fencing > Fence > Steel/wire/chain fence (includes posts)
	300.002	Fencing	Fencing - Environmental Barriers (Absorptive and Reflective) - Environmental / Noise barriers; All Types- including foundations - > 2.0m high	809.00	m	Assume fencing is a type of *Timber noise barrier*	HE Carbon tool: Fencing > Noise Barrier > Timber barrier 2m
	300.003	Fencing	Otter Fencing	5,981.00	m	Assume otter fencing is a type of *steel/wire/chain fence (includes posts)*	HE Carbon tool: Fencing > Fence > Steel/wire/chain fence (includes posts)
			Sub Total				
400			**ROAD RESTRAINT SYSTEMS**				
			Barriers				
	400.001	Road Restraint Systems	Road Restraint Systems - N2 Safety Barrier- Safety barrier containment performance class N2 working width class W4 designed to be impacted on one side only straight or curved exceeding 120m radius (TCB)	15,828.00	m	Assume Steel RRS barrier single sided	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier single sided
	400.004	Road Restraint Systems	Road Restraint Systems - N2 Safety Barrier - Safety barrier containment performance class N2 working width class W1 designed to be impacted on both sides straight or curved exceeding 120m (VCB)	13,800.00	m	Assume Steel RRS barrier double sided	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
			Terminals				
	400.006	Road Restraint Systems	Road Restraint Systems - Terminals - Terminal section containment performance class P4 permanent lateral displacement zone class D.1.2 designed to be impacted on one side only (TCB)	74.00	no	Assume the terminal section is equivalent to 1m Steel RRS barrier single sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier single sided
	400.007	Road Restraint Systems	Road Restraint Systems - Terminals - Terminal section containment performance class P1 permanent lateral displacement zone class D.1.2 designed to be impacted on one side only (TCB)	74.00	no	Assume the terminal section is equivalent to 1m Steel RRS barrier single sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier single sided
	400.008	Road Restraint Systems	Road Restraint Systems - Terminals - Terminal section containment performance class P1 permanent lateral displacement zone class D.1.2 designed to be impacted on both sides (TCB)	3.00	no	Assume the terminal section is equivalent to 1m Steel RRS barrier single sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
	400.009	Road Restraint Systems	Road Restraint Systems - Terminals - Terminal section containment performance class P4 permanent lateral displacement zone class D.1.2 designed to be impacted on both side (TCB)	3.00	no	Assume the terminal section is equivalent to 1m Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
			Connections				
	400.010	Road Restraint Systems	Road Restraint Systems - H2 Safety Barrier - Connection to existing systems containment performance class H2 working width W2 (VCB)	2.00	no	Assume the terminal section is equivalent to 1m Steel RRS barrier single sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier single sided
			Pedestrian Guardrail				
	400.011	Road Restraint Systems	Road Restraint Systems - Pedestrian Guardrails - P3-Pedestrian	690.00	m	Assume the pedestrian guardrail is equivalent to Steel RRS barrier single sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier single sided
	400.012	Road Restraint Systems	Structures - Road Restraint Systems excluding safety fencing - Vehicle parapets	117.00	m	Assume the road restraint system excluding safety fencing is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
	400.013	Road Restraint Systems	Emergency Crossing Points - Concrete Barrier	2.00	no	Assume each of the concrete barrier has 2m3 concrete Assume the type of concrete is C32/40	Bath Inventory of Carbon and Energy (ICE) database: Concrete > 32/40 Mpa
			Sub Total				
500			**DRAINAGE**				
	500.002	Drainage	Drainage - Drains - Diameter <300mm - In trench: Depth to invert >1.5m but <=2.5m [225mm dia]	4,170.00	m	Assume *precast concrete circular pipework* with 225mm diameter	HE Carbon Tool: Drainage > Precast concrete circular pipework >225mm
	500.003	Drainage	Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >1.5m but <=2.5m - (300mm dia)	4,170.00	m	Assume precast concrete circular pipework with 300mm diameter	HE Carbon Tool: Drainage > Precast concrete circular pipework >300mm
	500.005	Drainage	Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >1.5m but <=2.5m - (450mm dia)	4,170.00	m	Assume precast concrete circular pipework with 450mm diameter	HE Carbon Tool: Drainage > Precast concrete circular pipework >450mm
	500.006	Drainage	Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >1.5m but <=2.5m - (525mm dia)	4,170.00	m	Assume precast concrete circular pipework with 600mm diameter	HE Carbon Tool: Drainage > Precast concrete circular pipework >600mm
	500.007	Drainage	Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert >1.5m but <=2.5m - (600mm dia)	4,170.00	m	Assume precast concrete circular pipework with 600mm diameter	HE Carbon Tool: Drainage > Precast concrete circular pipework >600mm
	500.013	Drainage	Drainage - Drains - Fin Drain - Type 6: Depth not exceeding 1.5m	20,850.00	m	1. Assume the fin drain is Plastic pipework (PVC) with 300mm diameter. 2. Assume the fin drain has a layer of cotton fabric 3. Assume the density of cotton fabric is 1540 Kg/m3 3. The CO2 output for fin drain is the sum of carbon emission from PVC pipe work and cotton fabric	1. HE Carbon Tool: Drainage > Plastic pipe work (PVC) > 300mm diameter 2. Fabric density: Table 1 of: http://cdn.intechopen.com/pdfs/12238/InTech-Mechanical_properties_of_fabrics_made_from_cotton_and_biodegradable_yarns_bamboo_spf_pla_in_weft.pdf 3. Bath Inventory of Carbon and Energy (ICE) database: Summary Table > Miscellaneous > Cotton, Fabric
	500.014	Drainage	Drainage - Filter Drains - Diameter <300mm - In trench: Depth to invert <=1.5m - (150mm dia)	13,188.00	m	1. Assume the fin drain is Plastic pipework (PVC) with 300mm diameter. 2. Assume the fin drain has a layer of cotton fabric 3. Assume the density of cotton fabric is 1540 Kg/m3 3. The CO2 output for fin drain is the sum of carbon emission from PVC pipe work and cotton fabric	1. HE Carbon Tool: Drainage > Plastic pipe work (PVC) > 300mm diameter 2. Fabric density: Table 1 of: http://cdn.intechopen.com/pdfs/12238/InTech-Mechanical_properties_of_fabrics_made_from_cotton_and_biodegradable_yarns_bamboo_spf_pla_in_weft.pdf 3. Bath Inventory of Carbon and Energy (ICE) database: Summary Table > Miscellaneous > Cotton, Fabric
	500.015	Drainage	Drainage - Filter Drains - Diameter <300mm - In trench: Depth to invert <=1.5m - (225mm dia)	13,188.00	m	1. Assume the fin drain is Plastic pipework (PVC) with 300mm diameter. 2. Assume the fin drain has a layer of cotton fabric 3. Assume the density of cotton fabric is 1540 Kg/m3 3. The CO2 output for fin drain is the sum of carbon emission from PVC pipe work and cotton fabric	1. HE Carbon Tool: Drainage > Plastic pipe work (PVC) > 300mm diameter 2. Fabric density: Table 1 of: http://cdn.intechopen.com/pdfs/12238/InTech-Mechanical_properties_of_fabrics_made_from_cotton_and_biodegradable_yarns_bamboo_spf_pla_in_weft.pdf 3. Bath Inventory of Carbon and Energy (ICE) database: Summary Table > Miscellaneous > Cotton, Fabric
	500.016	Drainage	Drainage - Drains - Extra over excavation for excavation in Hard Material in drainage	1,407.38	m3	Assume there is no material carbon emssion in extra excavation	
	500.018	Drainage	Drainage - Chambers & Gullies - Precast Concrete Chambers - <=1050mm dia - Depth to uppermost surface of base slab not exceeding 1.5 (1050mm dia)	329.00	no	1. Assume Precast concrete inspection chamber>1000mm diameter, 1.2m - 3m depth 2. Assume The conversion factor for 1500mm dia chamber is equivalent to factor of 1.05*conversion factor for 1000mm dia chamber	HE Carbon Tool: Drainage > Precast concrete inspection chambers > 1000mm diameter, 1.2m - 3m depth
	500.019	Drainage	Drainage - Chambers & Gullies - Precast Concrete Chambers - <=1050mm dia - Depth to uppermost surface of base slab not exceeding 1.5 (1050mm dia) + V Gratine	519.00	no	1. Assume Precast concrete inspection chamber>1000mm diameter, 1.2m - 3m depth 2. Assume The conversion factor for 1500mm dia chamber is equivalent to factor of 1.05*conversion factor for 1000mm dia chamber	HE Carbon Tool: Drainage > Precast concrete inspection chambers > 1000mm diameter, 1.2m - 3m depth
	500.020	Drainage	Drainage - Chambers & Gullies - Gully - Trapped	83.00	no	Assume Precast concrete gully pots	HE Carbon Tool: Drainage > Gullies > Precast concrete gully pots
	500.021	Drainage	Drainage - Headwalls - In reinforced concrete: Pipe >=900mm	101.00	no	1. Assume 4000kg concrete per headwall 2. Assume 1.5% of the concrete volume is steel reinforcement 3. Assume the density of concrete is 2400 kg/m3 4. Assume the density of reinforcement is 7850 kg/m3 5. The CO2 output for drainage headwall is the sum of carbon emission from concrete and reinforcement	1. The assumption of mass of headwall is based on Conversation with Salma Hussein [with Tom Beales Ferguson on 22nd December] 2. Bath Inventory of Carbon and Energy (ICE) database > Concrete > C32/40 (32/40 Mpa) > 0% (using CEM I) 3. Bath Inventory of Carbon and Energy (ICE) database >Steel > Bar & rod
	500.023	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.024	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.025	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.026	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.027	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.028	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.029	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.030	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.031	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.032	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.033	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.034	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.035	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.036	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.037	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.038	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.039	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.040	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.041	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
	500.042	Drainage	Drainage - Balancing Pond (Variable Size)	1.00	no	Assume there is no lining in the pound which means no carbon emission for making balancing pounds	Reference conversation between Tom Beales Ferguson and Salma Hussein on 22/12/2017
			Sub Total				
600			**EARTHWORKS**				
			Excavation				
		Earthworks	Earthworks - Topsoil Strip, Store Dispose - Excavation of acceptable material Class 5A - Generally	180,000.00	m3		
		Earthworks	Earthworks - Excavation of acceptable material excluding Class 5A in: Cutting and other excavation [Excavator and road truck]	1,086,497.00	m3		
		Earthworks	Earthworks - Excavation of unacceptable material in bulk - U1A in - Cutting and other excavation	54,325.00	m3		
		Earthworks	Earthworks - Excavation of unacceptable material in bulk - U2 in - Cutting and other excavation	2,859.00	m3		
		Earthworks	Earthworks - Extra over excavation for excavation in Hard Material in - Cutting and other excavation	114,368.00	m3		
		Earthworks	Earthworks - Excavation of soft spots and other voids: Below cuttings or under embankments (provisional) (where vol < 25.0m3)	13,237.00	m3		
		Earthworks	Earthworks - Filling of soft spots and other voids - Below cuttings or under embankments - with Acceptable material	13,237.00	m3		
			Processing of Material				
		Earthworks	Earthworks - Processing unacceptable material U1A into acceptable material	84,410.00	m3		
			Deposition				
		Earthworks	Earthworks - Deposition of acceptable material - Embankment and other areas of fill [Road trucks] [Haul distance>4km and <=5km]	1,364,053.00	m3		
			Disposal				
		Earthworks	Earthworks - Disposal of material - Unacceptable material Class U1A	11,408.00	m3		
		Earthworks	Earthworks - Disposal of material - Unacceptable material Class U2	3,002.00	m3		
			Import				
		Earthworks	Earthworks - Imported acceptable material class 6F - Embankments & other areas of fill (Classes 6F1, 6F2, 6F3, 6F4 AND 6F5)	11,976.00	m3		
			Compaction				
		Earthworks	Earthworks - Compaction of acceptable material in embankments and other areas of fill (Imported material and cut to fill - haul by truck)	1,029,428.00	m3		
			Topsoil Place				
		Earthworks	Earthworks - Topsoil place - >100mm thick: To surfaces sloping more than 10deg to the horizontal	1,200,000.00	m2		
			Preparation & Completion				
		Earthworks	Earthworks - Soil preparation - Geotextiles	798,400.00	m2		
		Earthworks	Earthworks - Completion of formation and sub-formation - Sub-formation: Material other than Class 1C, 6B or rock in cuttings	400,928.00	m2		
		Earthworks	Earthworks - Completion of formation and sub-formation - Formation: Class 6B materials	397,472.00	m2		
			Existing Pavement				
	0600.10.6.4.00.00.00.	Earthworks	Earthworks - Breaking up and perforation of redundant pavements - Breaking up of redundant - unreinforced slab construction	53,000.00	m2		
			Sub Total				
600.01			**EARTHWORKS - LE1.5.11 Heath and Moorland (translocation)**				

ARUP	Job No. 256019-91	Sheet No.	Rev.
	Member/Location		
Job Title: A30 Chiverton to Carland Cross	Drg. Ref.		
Calculation	Made by: QL	Date: 18/07/2018	Chd.: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
			Excavation Mainline				
	600.001	Earthworks	Earthworks - Topsoil Strip, Store Dispose - Excavation of acceptable material Class 5A - Generally	1,200.00	m3		
			Deposition				
	600.007	Earthworks	Earthworks - Deposition of acceptable material - Embankment and other areas of fill (Road trucks) [Haul distance>7km and <=8km]	1,200.00	m3		
			Compaction & Completion				
	600.015	Earthworks	Earthworks - Compaction of acceptable material in embankments and other areas of fill (Imported material and cut to fill - haul by truck)	1,200.00	m3		
	600.016	Earthworks	Earthworks - Topsoil place - >100mm thick: To surfaces sloping more than 10dec to the horizontal	8,000.00	m2		
			Sub Total				
700			PAVEMENT				
			New Construction				
	700.001	Pavements	Pavements - Sub-base type 1 unbound mixture: In carriageway, hardshoulder and hardstrip	159,163.08	m3	1. Assume the subbase type 1 is equivalent to natural aggregate 2. Assume the density of subbase type 1 is 2000 kg/m3	1. HE Carbon Tool: Bulk Material > Fill and aggregate> General fill/aggregate 2. Aggregate density: HE Carbon Tool > Material Density > Quarried/Recycled aggregate
	700.002	Pavements	Pavements - Base - Dense bitumen macadam (DBM50): In carriageway, hardshoulder and hardstrip	75,479.36	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
	700.003	Pavements	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	21,575.87	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
	700.004	Pavements	Pavements - Surface course - Close graded macadam - Thin - In carriageway, hardshoulder and hardstrip 10mm agg, 60PSV	14,505.25	m3	1. Assume the density of close graded macadam is 2300 kg/m3 2. Assume the close graded macadam (DBM50) has same carbon factor as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
			Resurfacing				
	700.005	Pavements	Pavements - Cold Milling (50mm)	7,226.00	m2	Assume there is no capital carbon emission for cold milling as it removes top asphalt (carbon emission in operating the plant only)	
	700.006	Pavements	Pavements - Tack Coat	7,226.00	m2	1. Assume the unit weight of tack coat is 0.35 kg/m2 2. Assume tack coat has same carbon factor as asphalt	1. HE Carbon Tool: Bulk Material > Asphalt > General Asphalt 2. Reference email: Unit weight of tack coat: Re Question about Tack Coat [17/01/2018 From Andrew Hibbard to Doreen Lo]
	700.007	Pavements	Pavements - Surface course - Close graded macadam - Thin - In carriageway, hardshoulder and hardstrip 10mm agg, 60PSV	289.04	m3	1. Assume the density of close graded macadam is 2300 kg/m3 2. Assume the close graded macadam (DBM50) has same carbon factor as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
			Physical Islands				
	700.008	Pavements	Pavements - Sub-base type 1 unbound mixture: In carriageway, hardshoulder and hardstrip	141.98	m3	1. Assume the subbase type 1 is equivalent to natural aggregate 2. Assume the density of subbase type 1 is 2000 kg/m3	1. HE Carbon Tool: Bulk Material > Fill and aggregate> General fill/aggregate 2. Aggregate density: HE Carbon Tool > Material Density > Quarried/Recycled aggregate
	700.009	Pavements	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	37.86	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
	700.010	Pavements	Pavements - Surface course - Close graded macadam - Thin - In carriageway, hardshoulder and hardstrip 10mm agg, 60PSV	25.24	m3	1. Assume the density of close graded macadam is 2300 kg/m3 2. Assume the close graded macadam (DBM50) has same carbon factor as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
			Grasscrete				
	700.010	Pavements	Grasscrete- C28/35 concrete	5088.17	m2	1. Assume GC2 Grasscrete, 11.5m2 covered per 1m3 concrete, i.e. 0.087m3 concrete required per 1m2 grasscrete 2. Assume the density of the concrete is 25kN/m3	1. Density of C28/35 concrete: common engineering practice 2. HE Carbon Tool: Bulk Material > Ready mix concrete>C28/35 3. Grasscrete properties: https://cms.esi.info/Media/documents/77737_150063104967 4.pdf
	700.010	Pavements	Grasscrete- PVC former	5088.17	m2	Assume the density of the former is 1050kg/m3	1. Density of 3mm thick polystyrene former: http://www.bpf.co.uk/Plastipedia/Polymers/GPPS.aspx 2. Bath Inventory of Carbon and Energy (ICE) database: Plastics>General Purpose Polystyrene
	700.010	Pavements	Grasscrete- Steel Bar Reinforcement - A393- 200mm x 200mm x 10mm dia.	5088.17	m2	Assume the density of the reinforcement steel mesh is 6.16kg/m2	1. Density of rebar: http://kbrebar.co.uk/mesh-reinforcement/ 2.HE Carbon Tool: Bulk Material > Reinforcement steel > Steel bar and rod 3. Grasscrete properties: https://cms.esi.info/Media/documents/77737_150063104967 4.pdf
		Pavements	Self-Binding Gravel				
	0600.20.10.00.00.00	Earthworks	Earthworks - Imported acceptable material other than class 6F - Embankments & other areas of fill (Classes 1,2,3,6,7 and 9)	1432.6033	m3		
			Sub Total				
1100			KERBS, FOOTWAYS AND PAVED AREAS				
	1100.001	Kerbs	Kerbs, Footways and Paved Areas - Footways and Paved Areas - Concrete or Asphalt paving (Concrete paving)	5,000.00	m2	1. Assume the thickness of concrete paving is 50mm 2. Assume the concrete paving is Pre-cast concrete	1. Thickness of concrete paving: http://www.diy.com/departments/grey-british-standard-d50-paving-slab-l-900mm-w-600mm/35831_BQ.prd 2. HE Carbon Tool: Civil Structures & Retaining walls > Pre-Cast Concrete > General concrete
	1100.002	Kerbs	Kerbs, Footways And Paved Areas - Linear drainage channel systems	18,374.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
	1100.003	Kerbs	Kerbs, Footways And Paved Areas - Kerbs - Precast Concrete - Straight or curved exceeding 12m radius	9,867.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
			Sub Total				
1200			TRAFFIC SIGNS AND ROAD MARKINGS				
	1200.004	Traffic Signs	Traffic Signs And Road Markings - Laying - Continuous lines	82,800.00	m	1. Assume the road marking paint is thermoplastic 2. Assume the width of road continuous marking is 150mm 3. Assume the thickness of thermoplastic marking is 2mm 4. Assume the density thermoplastic road marking is 2150 kg/m3	1. Width of the road marking: Traffic Signs Manual > Chapter 5 Road Marking > Table 4-5 Edge of carriageway markings: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223667/traffic-signs-manual-chapter-05.pdf 2. Density of the paint: http://www.alharamain.com/prod01.htm 3. HE Carbon tool: Road pavement > Road marking > Thermoplastic road marking
	1200.005	Traffic Signs	Traffic Signs And Road Markings - Laying - Intermittent lines	41,400.00	m	1. Assume the road marking paint is thermoplastic 2. Assume the length of road marking lines excludes the blank spaces between lines 3. Assume the width of intermittent marking is 200mm 4. Assume the thickness of thermoplastic marking is 2mm 5. Assume the density thermoplastic road marking is 2150 kg/m3	
	1200.007	Traffic Signs	Traffic Signs And Road Markings - Road Studs - One way	20,700.00	no		0 HE Carbon Tool: Street Furniture & Electrical Equipment > Road Studs > Any type
	1200.011	Traffic Signs	Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - <0.5m2 in area	17.00	no	Assume the traffic sign area is 0.5m2 and it is made of steel	HE Carbon Tool: Road Pavement > Traffic signs > Steel
	1200.013	Traffic Signs	Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >1.0m2 but <=2m2 in area	16.00	no	Assume the traffic sign area is 2m2 and it is made of steel	HE Carbon Tool: Road Pavement > Traffic signs > Steel
	1200.014	Traffic Signs	Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >3.0m2 but <=4m2 in area	53.00	no	Assume the traffic sign area is 4m2 and it is made of steel	HE Carbon Tool: Road Pavement > Traffic signs > Steel
	1200.015	Traffic Signs	Traffic Signs And Road Markings - Permanent traffic signs - Lit Signs - >5m2 but <10m2 in area	53.00	no	Assume the traffic sign area is 10m2 and it is made of steel	HE Carbon Tool: Road Pavement > Traffic signs > Steel
	1200.016	Traffic Signs	Traffic Signs And Road Markings - Permanent traffic signs - Lit Signs - >10m2 but <15m2 in area	9.00	no	Assume the traffic sign area is 15m2 and it is made of steel	HE Carbon Tool: Road Pavement > Traffic signs > Steel
	1200.017	Traffic Signs	Traffic Signs And Road Markings - Permanent traffic signs - Lit Signs - >15m2 but <20m2 in area	5.00	no	Assume the traffic sign area is 20m2 and it is made of steel	HE Carbon Tool: Road Pavement > Traffic signs > Steel
	1200.018	Traffic Signs	Traffic Signs And Road Markings - Permanent traffic signs - Lit Signs - >20m2 but <25m2 in area	6.00	no	Assume the traffic sign area is 25m2 and it is made of steel	HE Carbon Tool: Road Pavement > Traffic signs > Steel
	1200.019	Traffic Signs	Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >25m2 in area (>25m2 but <=50m2)	18.00	no	Assume the traffic sign area is 50m2 and it is made of steel	HE Carbon Tool: Road Pavement > Traffic signs > Steel
	1200.020	Traffic Signs	Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >25m2 in area (>50m2)	8.00	no	Assume the traffic sign area is 50m2 and it is made of steel	HE Carbon Tool: Road Pavement > Traffic signs > Steel
			Sub Total				
1400			ELECTRICAL WORK FOR LIGHTING AND SIGNS				
	1400.003	Electric Work	Electrical Work For Road Lighting And Traffic Signs - Cable & Duct - Duct (1 no 100 diameter - In trench depth not exceeding 1.5m)	6,517.50	m	1. Assume it is a type of Plastic cable ducting 2. The diameter of the ducting is 150mm (more conservative) as there is no 100mm option	HE Carbon Tool: Street Furniture & Electrical Equipment > Plastic cable ducting
			Temporary Traffic Signals - Chiverton Junction				
	1400.14.05.00.00.05	Electric Work	Electrical Work For Road Lighting And Traffic Signs - Trench for duct - width not exceeding 300mm - depth not exceeding 1.5m - in verges and central reserves	1,000.00	m		
	1400.14.10.00.00.90	Electric Work	Electrical Work For Road Lighting And Traffic Signs - Cable & Duct - Duct (1 no 100 diameter - In trench depth not exceeding 1.5m)	1,000.00	m	1. Assume it is a type of Plastic cable ducting 2. The diameter of the ducting is 150mm (more conservative) as there is no 100mm option	HE Carbon Tool: Street Furniture & Electrical Equipment > Plastic cable ducting
			Sub Total				
1500			Motorways Communications and Technology				
			A30 Carland Cross to Chiverton - Provision of new NRTS services	1.00	no.	Assume there is no material carbon emssion in provision of new NRTS services	
			Sub Total				
1600			Piling and Embedded Retaining Walls				
			Sheet Piles				
	1600.001	Piling & RW	Piling And Embedded Retaining Walls - Steel Sheet Piles - Establishment of piling plant - Of steel sheet piles	1.00	item	Assume establishment of piling plant has no carbon emission	
	1600.002	Piling & RW	Piling and Embedded Retaining Walls - Steel Sheet Piles - Supply Steel Sheet Piles	600.00	m2	1. The steel sheet pile is assumed to be AZ 37-700 2. The density of the AZ 37-700 steel sheet pile is 177 kg/m²	HE Carbon Tool: Civil Structure & Retaining Walls > Piling > Steel piles
	1600.003	Piling & RW	Piling And Embedded Retaining Walls - Steel Sheet Piles - Driving Steel Sheet Piles - exceeding 10 metres but not exceeding 15 metres in length in main construction	600.00	m2	Assume driving steel sheet pile has no carbon emission	
	1600.004	Piling & RW	Piling And Embedded Retaining Walls - Steel Sheet Piles - Cutting or burning off surplus length Steel Sheet Piles	20.00	m	Assume cutting or burning off surplus length Steel Sheet Piles has no carbon emission	
	1600.005	Piling & RW	Piling And Embedded Retaining Walls - Cast in Place Piles - Moving piling plant - Of bored cast-in-place piles	4.00	no	Assume moving piling plant has no carbon emission	
	1600.006	Piling & RW	Piling And Embedded Retaining Walls - Steel Sheet Piles - Extra over for supply of Steel Sheet Piles - Corner pile	60.00	m	Assume extra over for supply of steel sheet piles has no carbon emission	
			Facing Units				
	1600.007	Piling & RW	Structural Concrete - Precast concrete - Facing units	100.00	m2	Assume the thickness of facing unit concrete is 200mm.	
			Pile Cap (Sheet Piles)				
	1600.008	Piling & RW	Structural Concrete - In situ concrete ST - ST5	5.00	m3		HE Carbon Tool: Bulk Material > Ready mix concrete > C20/25 (ST5)
	1600.009	Piling & RW	Structural Concrete - Surface Finish of Concrete-Formwork - Class F2 - Horizontal more than 300mm wide	20.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
	1600.010	Piling & RW	Piling And Embedded Retaining Walls - Contiguous Bored Pile Walls - Reinforcement for Contiguous Bored Pile Walls - 12mm <dia.<=25mm <=12m in length	0.75	t		HE Carbon Tool: Bulk Material > Reinforcement steel > Steel bar and rod
			Cast in Place Piles				
			Setup				
	1600.011	Piling & RW	Piling And Embedded Retaining Walls - Cast in Place Piles - Establishment of piling plant - of bored cast-in-place piles	1.00	item	Assume establishment of piling plant has no carbon emission	
	1600.012	Piling & RW	Piling And Embedded Retaining Walls - Cast in Place Piles - Moving piling plant - Of bored cast-in-place piles	2.00	no	Assume moving piling plant has no carbon emission	
			Piling				
	1600.013	Piling & RW	Piling And Embedded Retaining Walls - Cast in Place Piles - Vertical - >600mm dia but <=900 mm dia	340.00	m	1. Assume the concrete type is C32/40 2. Assume the diameter of the pile is 900mm 3. Assume the density of concrete is 2400 kg/m3	HE Carbon Tool: Bulk Materials > Ready mix concrete > C32/40
			Reinforcement				
	1600.014	Piling & RW	Piling And Embedded Retaining Walls - Contiguous Bored Pile Walls - Reinforcement for Contiguous Bored Pile Walls - 12mm <dia.<=25mm <=12m in length	28.12	t		HE Carbon Tool: Bulk Material > Reinforcement steel > Steel bar and rod
			Structural Wall / Retaining Wall				
	1600.015	Piling & RW	Structural Concrete - Surface Finish of Concrete-Formwork - Class F1 - Vertical more than 300mm wide	124.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
	1600.016	Piling & RW	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	100.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Reinforcement				
	1600.017	Piling & RW	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm; <=12m in length	37.53	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod

ARUP	Job No. 256019-91	Sheet No.	Rev.
	Member/Location		
Job Title: A30 Chiverton to Carland Cross	Drg. Ref.		
Calculation	Made by: CL	Date: 18/07/2018	Chd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
			Concrete				
	1600.018	Piling & RW	Structural Concrete - In situ concrete ST - ST4	208.50	m3		HE Carbon Tool: Bulk Material > Ready mix concrete > C16/20 [Gen 3, ST 4]
			Back of Wall Drainage				
	1600.019	Drainage	Drainage - Drains - Filter Drains - Filter material contiguous with filter drain - Type A	20.00	m3	1. Assume the filter materials is equivalent to Felt [Hair and Jute] Underlay in carbon emission 2. Assume the filter density is 160 kg/m3	Bath Inventory of Carbon and Energy (ICE) database: Carpet > Felt (Hair and Jute) Underlay > Embodied Carbon
	1600.020	Drainage	Drainage - Drains - Fin Drain - Type 6: Depth not exceeding 1.5m	20.00	m	1. Assume the fin drain is Plastic pipework (PVC) with 300mm diameter. 2. Assume the fin drain has a layer of cotton fabric 3. Assume the density of cotton fabric is 1540 Kg/m3 3. The CO2 output for fin drain is the sum of carbon emission from PVC pipe work and cotton fabric	1. HE Carbon Tool: Drainage > Plastic pipe work [PVC] > 300mm diameter 2. Fabric density: Table 1 of: http://cdn.intechopen.com/pdfs/12238/InTech-Mechanical_properties_of_fabrics_made_from_cotton_and_biodegradable_yarns_bamboo_spf_pla_in_weft.pdf 3. Bath Inventory of Carbon and Energy (ICE) database: Summary Table > Miscellaneous > Cotton, Fabric
			Sub Total				
3000			LANDSCAPE & ECOLOGY				
	3000.001	Landscape	Landscape & Ecology - Ground preparation and cultivation - Final cultivations: Surfaces sloping at 10deg or less to horizontal	349,963.52	m2	Assume there is no carbon emission in geound preparation and cultivation, maintenance, mulching, planting, and seeding &turfing.	
	3000.002	Landscape	Landscape & Ecology - Ground preparation and cultivation - Final preparation of soils: Surfaces sloping at 10deg or less to horizontal	349,963.52	m2		
	3000.003	Landscape	Landscape & Ecology - Maintenance - Total weed control (generally) - Surfaces sloping at 10deg or less to horizontal	349,963.52	m2		
	3000.004	Landscape	Landscape & Ecology - Mulching - Organic mulching in planting areas - Surfaces sloping at 10deg or less to horizontal	349,963.52	m2		
	3000.005	Landscape	Landscape & Ecology - Planting - Shrubs - Surfaces sloping at 10deg or less to horizontal	59,566.00	no		
	3000.006	Landscape	Landscape & Ecology - Planting - Trees - Surfaces sloping at 10deg or less to horizontal	2,850.00	no		
	3000.007	Landscape	Landscape & Ecology - Seeding and turfing - By hydraulic seeding: Surfaces sloping more than 10deg to horizontal	174,981.76	m2		
	3000.008	Landscape	Landscape & Ecology - Seeding and turfing - By hydraulic seeding: Surfaces sloping at 10deg or less to horizontal	174,981.76	m2		
	3000.009	Landscape	Cornish Hedge with Turf	5,290.42	m	1. Assume Cornish hedges has a trapezoid shape; dimension: top width=0.75m, bottom width=1.5m, height=1.5m 2.Assume Rock density is 2730 [kg/m^3], Earth fill density is 1600 [kg/m^3], the Cornish hedges is made of 75% rock+25% earth fill and the density is calculated based on this assumption	1. Reference doc: KEY of fence drawings descriptions: badger fence-wooden post and 4 rail with welded mesh stapled to timber 2. Reference link: Rock density: https://www.britannica.com/science/rock-geology 3. Reference link: Earth fill density: https://www.engineeringtoolbox.com/earth-soil-weight-d_1349.html Rammed earth density is taken for more conservative calculation 4. HE Carbon tool: Bulk Material>Fill and aggregate> General fill/aggregate
	3000.010	Landscape	Cornish Hedge with Hedgerow	10,084.82	m		
	3000.011	Landscape	Management of Retained Vegetation	21,884.42	m2	Assume there is no carbon emission in management of retained vegetation	
			Sub Total				
99.04			DRAINAGE - Over the Edge Drainage Swales				
			Subsurface Drainage				
			Surface Drainage				
			Swales				
		Drainage	Drainage - Filter Drains - Diameter <300mm - In trench: Depth to invert <=1.5m - (225mm dia)	1,428.20	m	1. Assume the fin drain is Plastic pipework (PVC) with 300mm diameter. 2. Assume the fin drain has a layer of cotton fabric 3. Assume the density of cotton fabric is 1540 Kg/m3 3. The CO2 output for fin drain is the sum of carbon emission from PVC pipe work and cotton fabric	1. HE Carbon Tool: Drainage > Plastic pipe work [PVC] > 300mm diameter 2. Fabric density: Table 1 of: http://cdn.intechopen.com/pdfs/12238/InTech-Mechanical_properties_of_fabrics_made_from_cotton_and_biodegradable_yarns_bamboo_spf_pla_in_weft.pdf 3. Bath Inventory of Carbon and Energy (ICE) database: Summary Table > Miscellaneous > Cotton, Fabric
		Drainage	Drainage - Drains - Excavation of soft spots and other voids	2,799.00	m3	Assume there is no material carbon emission associated with this	
		Drainage	Drainage - Drains - Filling of soft spots - Type of fill - Pipe bedding material	2,799.00	m3	Assume there is no material carbon emission associated with this	
			Balancing Ponds				
			Cross Carriageway Drains for Superelevation				
			Sub Total				
99.06			EARTHWORKS - Mainline - Over the Edge Drainage Swales				
			Earthworks from Swales				
		Earthworks	Earthworks - Soil preparation - Geotextiles	14,284.00	m2		
			Earthworks - Excavation of acceptable material excluding Class 5A in: New watercourses	27,153.00	m3		
			Earthworks - Excavation of unacceptable material in bulk - U1A in - New watercourses	770.00	m3		
			Earthworks - Excavation of unacceptable material in bulk - U2 in - New watercourses	70.00	m3		
			Disposal				
		Earthworks	Earthworks - Disposal of material - Unacceptable material Class U1A	770.00	m3		
		Earthworks	Earthworks - Disposal of material - Unacceptable material Class U2	70.00	m3		
			Intercepting Ditches				
		Earthworks	Earthworks - Excavation of acceptable material excluding Class 5A in: Intercepting ditches	4,800.00	m3		
			Sub Total				
99.12			KERBS, FOOTWAYS AND PAVED AREAS - Mainline - Over the Edge Drainage Swales				
			Concrete Channel in Central Reserve				
		Kerbs	Kerbs, Footways And Paved Areas - Linear drainage channel systems	714.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
			Sub Total				
99.3			LANDSCAPE & ECOLOGY - Mainline - Over the Edge Drainage Swales				
			Vegetation to Swales				
			Landscape & Ecology - Ground preparation and cultivation - Final cultivations: Surfaces sloping at 10deg or less to horizontal	14,284.00	m2	Assume there is no carbon emission in geound preparation and cultivation, maintenance, mulching, planting, and seeding &turfing.	
			Landscape & Ecology - Ground preparation and cultivation - Final preparation of soils: Surfaces sloping at 10deg or less to horizontal	14,284.00	m2		
			Landscape & Ecology - Maintenance - Total weed control (generally) - Surfaces sloping at 10deg or less to horizontal	14,284.00	m2		
			Landscape & Ecology - Seeding and turfing - By hydraulic seeding: Surfaces sloping more than 10deg to horizontal	14,284.00	m2		
			Temporary Fencing whilst vegetation establishes				
			Landscape & Ecology - Special Ecological Measures - Newt Fencing	14,282.00	m	1. Assume the temporary newt fencing is made of plastic Polythene and wood stake 2. Assume the height of the newt fencing plastic Polythene is 1 m 3. Assume the density of Polythene is 900 kg/m3 4. Assume the thickness of Polythene is 1 mm 5. Assume the spacing of the wooden stake is 2 m 6. Assume the dimension of the wooden stake is 37*37*1200mm 7. Assume the density of wood stake is 600 kg/m3	1. Component of newt fencing: https://en.wikipedia.org/wiki/Newt_fencing 2. Height of the newt fencing plastic Polythene: https://www.wildlifefencing.co.uk/product.php?productid=4&cat=1&page=1 3. Dimension of wood stake: https://www.wildlifefencing.co.uk/product.php?productid=14&cat=9&page=1 4. Carbon factor of polythene: Bath Inventory of Carbon and Energy (ICE) database > Plastics > General Polythene 5. Carbon factor of wood stake: Bath Inventory of Carbon and Energy (ICE) database > Timber > General
		Landscape	Plastic Polythene	14,282.00	m		
		Landscape	Wood Stake	7,141.00	no.		
			Sub Total				
C			Culverts				
			Culvert - 900mm & 1200mm dia				
	5.1	Culvert	Structural Concrete - Precast Concrete - Box culverts - Box culvert 1200mm< height <=1800mm (excl headwalls)	1,233.00	m	Assume the carbon factor for precast concrete box culvert is equivalent to Precast concrete circular pipework, with 1800mm diameter by applying square to circle perimeter ratio (4/π)	HE Carbon Tool: Drainage > Precast concrete circular pipework > 1800mm diameter
	5.2	Culvert	Box culvert headwall 1200mm< height <=1800mm (single cell)	34.00	no.	1. Assume 4000kg concrete per headwall 2. Assume 1.5% of the concrete volume is steel reinforcement 3. Assume the density of concrete is 2400 kg/m3 4. Assume the density of reinforcement is 7850 kg/m3 5. The CO2 output for drainage headwall is the sum of carbon emission from concrete and reinforcement	1. The assumption of mass of headwall is based on Conversation with Salma Hussein [with Tom Beales Ferguson on 22nd December] 2. Bath Inventory of Carbon and Energy (ICE) database > Concrete > C32/40 (32/40 Mpa) > 0% (using CEM I) 3. Bath Inventory of Carbon and Energy (ICE) database >Steel > Bar & rod
			Culvert - DC03				
Wrong BoQ, corrected	5.11	Culvert	Structural Concrete - Precast Concrete - Box culverts - Box culvert 1800mm< height <=2400mm (excl headwalls)	179.00	m	1. Assume 4000kg concrete per headwall 2. Assume 1.5% of the concrete volume is steel reinforcement 3. Assume the density of concrete is 2400 kg/m3 4. Assume the density of reinforcement is 7850 kg/m3 5. The CO2 output for drainage headwall is the sum of carbon emission from concrete and reinforcement	1. The assumption of mass of headwall is based on Conversation with Salma Hussein [with Tom Beales Ferguson on 22nd December] 2. Bath Inventory of Carbon and Energy (ICE) database > Concrete > C32/40 (32/40 Mpa) > 0% (using CEM I) 3. Bath Inventory of Carbon and Energy (ICE) database >Steel > Bar & rod
Wrong BoQ, corrected	5.12	Culvert	Box culvert headwall 1800mm< height <=2400mm (single cell)	4.00	no.	Assume the carbon factor for precast concrete box culvert is equivalent to Precast concrete circular pipework, with 2400mm diameter by applying square to circle perimeter ratio (4/π)	HE Carbon Tool: Drainage > Precast concrete circular pipework > 1800mm diameter
			Sub Total				
S			STRUCTURES				
			Bridges				
	NOT WBS	Carland Cross Underbridge A	Carland Cross underbridge A	1.00	no.		
	NOT WBS	Carland Cross Underbridge B	Carland Cross underbridge B	1.00	no.		1.From the CO2 emissions graph of Lynsay Hughes' PhD, the overbridge carbon emission value is calculated by averaging the over-bridge1&2 data [(1.7+1.35)/2=1.525tonnes/m2 deck] and the underbridge value is read as 1.85 tonnes/m2 deck
			Underpass				
	NOT WBS	Trevalso Farm Underpass	Trevalso Farm Underpass	448	m2		2.The CO2 emission values only include material and transportation CO2 emissions values (excluded construction factor) 3.The CO2 emission factor includes CO2 produced from transport 4. Reference method: Lynsay Hughes' PhD thesis 5. Reference dimension email: RE: Draft Summary for environmental 5 [17/01/2018 from Lucy Stephenson to Doreen Lu]
	NOT WBS	Newlyn Downs Underpass	Newlyn Downs Underpass	157.5	m2		
	NOT WBS	Chiverton WCH underpass	Chiverton WCH underpass	280	m2		
	NOT WBS	Church Lane	Church Lane	152	m2		
			Sub Total				
S-01			Chiverton Cross Junction Underbridge - West				
			Bridge Name:				
			Pad Foundations				
		Chiverton Cross Underbridge - West	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2 sulphate resisting	288.00	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material > Ready mix concrete > C32/40
		Chiverton Cross Underbridge - West	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: >12m in length	31.68	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Chiverton Cross Underbridge - West	Structural Concrete - Surface Finish of Concrete-Formwork - Class F1 - Vertical more than 300mm wide	140.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Earthworks	Earthworks - Excavation of acceptable material excluding Class 5A in: Cuttine and other excavation (Excavator and road truck)	288.00	m3		
			Abutment				
		Chiverton Cross Underbridge - West	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	337.50	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood

ARUP

Job No.	Sheet No.	Rev.
256019-91		

Member/Location:

Job Title: A30 Chiverton to Carland Cross

Org. Ref.:

Calculation:

Made by: CJL Date: 18/07/2018 Chkd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
		Chiverton Cross Underbridge - West	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2 sulphate resisting	168.75	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material > Ready mix concrete > C32/40
		Chiverton Cross Underbridge - West	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	30.38	t		0 HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Earthworks	Earthworks - Imported acceptable material other than class 6F - Free Draining Fill to Structures	36.00	m3		0
		Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	1,440.00	m3		0
			Bridge Deck				
		Chiverton Cross Underbridge - West	Precast Concrete Pretensioned Prestressed member (beams) - W14	198.00	m	1. Assume the type of this precast concrete member is U beam (U12) with self weight: 18.6 kN/m 2. Assume this pre-cast concrete member is a type of general concrete	1. Conversation with Gemma James [with Doreen Lu on 15th January] 2. Shay Murtagh: Technical Manual: Prestressed Concrete Beams 3. HE Carbon Tool: Civil Structures > Precast concrete > General concrete
		Chiverton Cross Underbridge - West	Precast Concrete Beams - Placing	11.00	no	Assume placing precast concrete beam has no carbon emission	0
		Chiverton Cross Underbridge - West	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	208.55	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
		Chiverton Cross Underbridge - West	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: >12m in length	33.37	t		0 HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Chiverton Cross Underbridge - West	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	56.80	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Chiverton Cross Underbridge - West	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	576.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
		Chiverton Cross Underbridge - West	Kerbs, Footways And Paved Areas - Combined drainage and kerb blocks	36.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
		Chiverton Cross Underbridge - West	Structural Concrete - In situ concrete ST - ST1	18.00	m3		0 HE Carbon Tool: Bulk Material > Ready mix concrete > C6/8 (Gen 0, ST1)
		Chiverton Cross Underbridge - West	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Horizontal more than 300mm wide	32.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Chiverton Cross Underbridge - West	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	36.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Chiverton Cross Underbridge - West	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	6.48	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
		Chiverton Cross Underbridge - West	Structures - Road Restraint Systems excluding safety fencing - Vehicle parapets	36.00	m	Assume the road restraint system excluding safety fencing is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
			Pavement				
		Chiverton Cross Underbridge - West	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	28.08	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
		Chiverton Cross Underbridge - West	Pavements - Surface course - Close graded macadam - Thin - In carriageway, hardshoulder and hardstrip 14mm agg. 60PSV	23.40	m3	1. Assume the density of surface course is 2300 kg/m3 2. Assume the close graded macadam as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
		Chiverton Cross Underbridge - West	Traffic Signs And Road Markings - Laying - Continuous lines	36.00	m	1. Assume the road marking paint is thermoplastic 2. Assume the width of road continuous marking is 150mm 3. Assume the thickness of thermoplastic marking is 2mm 4. Assume the density thermoplastic road marking is 2150 kg/m3	1. Width of the road marking: Traffic Signs Manual > Chapter 5 Road Marking > Table 4-5 Edge of carriageway markings: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223667/traffic-signs-manual-chaptar-05.pdf 2. Density of the paint: http://www.alharamain.com/prod01.htm 3. HE Carbon tool: Road pavement > Road marking > Thermoplastic road marking
		Chiverton Cross Underbridge - West	Traffic Signs And Road Markings - Laying - Intermittent lines	36.00	m	1. Assume the road marking paint is thermoplastic 2. Assume the length of road marking lines excludes the blank spaces between lines 3. Assume the width of intermittent marking is 200mm 4. Assume the thickness of thermoplastic marking is 2mm 5. Assume the density thermoplastic road marking is 2150 kg/m3	0
			Sub Total				
S-01/6			Marazamvose Green Bridge				
			VARIABLES				
			GENERAL				
			STANDARD OVERBRIDGE DETAILS				
			Piles				
			Abutment Base				
			Abutment Plinth				
			End Walls on Abutment Base				
			Abutment Wing Walls				
	600		EARTHWORKS				
	700		PAVEMENT				
			Pavement on approach to overbridge				
	1700		STRUCTURAL CONCRETE				
			Piles				
			Abutments				
			Pile Caps/Pad Footings				
			Piers				
			Deck				
			Deck Pavement				
	1800		STEELWORK FOR STRUCTURES				
			Factor applied for girder spacing				
			Variables for painting of structural steel				
			Cast in Place Piles				
			Bored Concrete Piles				
	S 1600.10.00.00.00.30	Marazamvose Green Bridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Establishment of piling plant - of bored cast-in-place piles	1.00	item	Assume establishment of piling plant has no carbon emission	
	S 1600.10.00.05.00.30.	Marazamvose Green Bridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Moving piling plant - Of bored cast-in-place piles	36.00	no	Assume moving piling plant has no carbon emission	
	S 1600.10.10.00.00.15.	Marazamvose Green Bridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Vertical - >900 mm dia (1050mm diameter)	750.00	m	1. Assume the concrete type is C32/40 2. Assume the diameter of the pile is 1050 mm 3. Assume the density of concrete is 2400 kg/m3	HE Carbon Tool: Bulk Materials > Ready mix concrete > 32/40
	S 1600.10.25.05.00.10	Marazamvose Green Bridge	Cast in Place Piles - Proof loading of vertical piles - Dynamic load	1.00	no	1. Assume additional 4 no. 900mm Piles of 15m length acting as anchor piles 2. Assume the concrete type is C32/40	HE Carbon Tool: Bulk Materials > Ready mix concrete > 32/40
			Steel Reinforcement				
	S 1600.10.15.05.00.00.	Marazamvose Green Bridge	Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel helical reinforcement nominal size: 12mm and under	25.98	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
	S 1600.10.15.00.10.00.	Marazamvose Green Bridge	Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel bar reinforcement nominal size - Over 25mm dia, >12m in length	129.89	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Series 2500: Special Structures				
	S 2500.10.10.10.00.00.	Marazamvose Green Bridge	Special Structures - Special Structures - Earth retaining structure	406.00	m2	1. Assume the earth retaining structure is consist of concrete panel facing, steel strap and earthwork fill 2. Assume the volume of earthwork fill is included in the earthwork section	Reference email: Type of earthwork retaining structure: RE: Earth Retaining Structure [30/01/2018 From Lucy Stephenson to Doreen Lu]
		Marazamvose Green Bridge				1. Assume the thickness of the concrete panel is 200mm 2. Assume the type of concrete is C32/40	Reference email: assumptions to the concrete panel and steel strap: RE: Earth Retaining Structure [06/02/2018 From Lucy Stephenson to Doreen Lu]
		Marazamvose Green Bridge				1. Assume the volume of steel strap is assumed to be 3% of the volume of concrete panel 2. The density of steel is 8000kg/m3	
			Abutment				
			Earthworks				
	0600.05.10.00.00.00.	Earthworks	Earthworks - Excavation of acceptable material excluding class 5A in - Structural foundations: 0< depth <=6m	1,443.00	m3		0
	R2 0600.10.02.00.00.05.	Earthworks	Earthworks - Extra over excavation for excavation in Hard Material in: Structural foundations	144.30	m3		0
	0600.18.08.00.00.00.	Earthworks	Earthworks - Disposal of material - Acceptable material excluding Class 5A	1,443.00	m3		0
	NOT WBS	Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	783.00	m3		0
	NOT WBS	Earthworks	Earthworks - Compaction of acceptable material to structures	783.00	m3		0
			Imported Fill for Reinforced Soil Walls				0
	R2 0600.20.10.00.00.10.	Earthworks	Earthworks - Imported acceptable material other than class 6F - Reinforced earth structures (Classes 6 and 7)	2,077.60	m3		0
	R2 0600.22.12.00.00.10.	Earthworks	Earthworks - Compaction of fill in reinforced earth structures	2,077.60	m3		0
			Structural Concrete				0

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Job No.	Sheet No.	Rev.
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Member/Location

Job Title: A30 Chiverton to Carland Cross

Drg. Ref.

Calculation

Made by: CL Date: 18/07/2018 Chkd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
	S 1700.10.00.00.00.20.	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength <=25N/mm2: In blinding 75mm or less in thickness				HE Carbon Tool: Bulk Material >Ready mix concrete > C20/25 (ST5)
	S 1700.10.00.00.00.15.	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2	229.70	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material >Ready mix concrete > C32/40
			Formwork >300				0
	S 1700.50.10.00.10.10.	Marazanvose Green Bridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	388.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Steel Reinforcement				0
	S 1700.60.20.05.00.00.00.	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	19.40	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
	S 1700.60.20.05.10.00.00.	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	26.50	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Waterproofing for Structures				0
	S 2000.00.00.00.00.00.00.	Marazanvose Green Bridge	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	286.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
	S 2000.00.00.15.00.00.	Marazanvose Green Bridge	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	130.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Brickwork, Blockwork and Stonework				0
	S 2400.10.10.10.70.	Marazanvose Green Bridge	Brickwork, Blockwork & Stonework - With battered face	110.00	m2	Assume the standard brick size is 215*102*65mm	Stand brick size in UK: https://wienerberger.co.uk/about-us/size-matters
			Spread Footing or Pile Cap				#N/A
			Earthworks				0
	0600.05.10.00.00.00.	Earthworks	Earthworks - Excavation of acceptable material excluding class 5A in - Structural foundations: 0< depth <=6m	608.00	m3		0
	R2 0600.10.02.00.00.05.	Earthworks	Earthworks - Extra over excavation for excavation in Hard Material in: Structural foundations	60.80	m3		0
	0600.18.08.00.00.00.	Earthworks	Earthworks - Disposal of material - Acceptable material excluding Class 5A	608.00	m3		0
	NOT WBS	Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	504.00	m3		0
	NOT WBS	Earthworks	Earthworks - Compaction of acceptable material to structures	504.00	m3		0
			Structural Concrete				0
	S 1700.10.00.00.00.00.	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength <=25N/mm2: In blinding 75mm or less in thickness	7.80	m3	Assume the type of concrete is C20/25 (ST 5)	HE Carbon Tool: Bulk Material >Ready mix concrete > C20/25 (ST5)
	S 1700.10.00.00.00.15.	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2	104.00	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material >Ready mix concrete > C32/40
			Formwork >300				0
	S 1700.50.10.00.10.10.	Marazanvose Green Bridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	68.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Steel Reinforcement				0
	S 1700.60.20.05.00.00.00.	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	5.20	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
	S 1700.60.20.05.10.00.00.	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	15.60	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Waterproofing for Structures				0
	S 2000.00.00.00.00.00.00.	Marazanvose Green Bridge	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	172.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Piers				
			Structural Concrete				0
	S 1700.10.00.00.00.20.	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	321.75	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Formwork >300				0
	S 1700.50.10.00.10.10.	Marazanvose Green Bridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	478.50	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
	S 2000.00.00.15.00.00.	Marazanvose Green Bridge	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	44.80	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Steel Reinforcement				0
	S 1700.60.20.05.00.00.00.	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	16.09	tonne	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
	S 1700.60.20.05.10.00.00.	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	48.26	tonne	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Waterproofing for Structures				0
	S 2000.00.00.00.00.00.00.	Marazanvose Green Bridge	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	102.80	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
	S 2000.00.00.15.00.00.	Marazanvose Green Bridge	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	239.25	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Pier Strengthening				
			Earthworks				
	0600.05.10.00.00.00.	Marazanvose Green Bridge	Earthworks - Excavation of acceptable material excluding class 5A in - Structural foundations: 0< depth <=6m	-	m3		
	0600.18.08.00.00.00.	Marazanvose Green Bridge	Earthworks - Disposal of material - Acceptable material excluding Class 5A	-	m3		
	NOT WBS	Import	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	-	m3		
	NOT WBS	Marazanvose Green Bridge	Earthworks - Compaction of acceptable material to structures	-	m3		
			Structural Concrete				0
	S 1700.10.00.00.00.20.	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	-	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Formwork >300				0
	S 1700.50.10.00.10.10.	Marazanvose Green Bridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	-	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Steel Reinforcement				0
	S 1700.60.20.05.00.00.00.	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	-	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
	S 1700.60.20.05.10.00.00.	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	-	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Superstructure				0
			Steelwork for Structures				0
	S 1800.10.00.00.10.00.00.	Marazanvose Green Bridge	Structural Steelwork - Fabrication of Steelwork - Fabrication of main members - Plated girders	112.00	t	Assume the plate girders is made of general steel	Bath Inventory of Carbon and Energy (ICE) database: Steel > General Steel Embodied Carbon > UK Typical
	S 1800.20.05.05.00.00.05.	Marazanvose Green Bridge	Structural Steelwork - Erection of Steelwork - Permanent erection: Substructure	112.00	t	Assume erection of steelwork has no carbon emission	0
			Bearings				0
	S 2100.00.01.00.00.00.00.	Marazanvose Green Bridge	Bearings, joints and sealing of gaps - Bearing - Bearing	30.00	no	1. Assume the Bearing has 1800mm long, 1800mm wide and 1300mm thick 2. Assume the Bearing is made of steel and the density of steel is 8000 kg/m3	1. Density of steel: HE Carbon tool: Material Density > Steel: general 2. Bath Inventory of Carbon and Energy (ICE) database: Steel > General Steel
	S 2100.00.01.10.00.00.00.	Marazanvose Green Bridge	Bearings, joints and sealing of gaps - Bearing - Installation of bearing	30.00	no	Assume no carbon emission in installing bearings	0
			Protection of Steelwork against Corrosion				

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Member/Location

Job Title: A30 Chiverton to Carland Cross

Calculation

Drg. Ref.

Made by: CJL Date: 18/07/2018 Chd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
	S 1900.10.0 0.00.00.0 00	Marazanvose Green Bridge	Structures - Protection of Steelwork Against Corrosion - Organic Protective System	1,572.48	m2	1. Assume the thickness of the paint is 2mm 2. Assume the density of organic protective system paint is 880kg/m3	1. General paint density: https://www3.epa.gov/ttnchie1/ap42/ch04/final/c4s02_2a.pdf 2. Bath Inventory of Carbon and Energy (ICE) database: Paint > General Paint
			Structural Concrete				
			Deck				
	S 1700.10.0 0.00.00.0 20	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	189.28	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Parapet Upstand				
	S 1700.10.0 0.00.00.0 70	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	25.20	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			End Screen				0
	S 1700.10.0 0.00.00.0 20	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	14.30	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Verge Footway				
	S 1700.10.0 0.00.00.0 20	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	45.36	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Formwork >300				
	S 1700.50.1 0.00.10.0 00	Marazanvose Green Bridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Horizontal more than 300mm wide	72.80	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			External Longitudinal Slab Edge				
	S 1700.50.1 0.00.10.0 10	Marazanvose Green Bridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	78.40	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Internal Longitudinal Slab Edge				
	S 1700.50.1 0.00.10.0 10	Marazanvose Green Bridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	50.40	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			End Screen				
	S 1700.50.1 0.00.10.0 10	Marazanvose Green Bridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	66.40	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Permanent formwork >300				
	S 1700.50.1 0.05.10.0 00	Marazanvose Green Bridge	Structural Concrete - Surface Finish of Concrete - Formwork - Permanent formwork >300 - Class F3 - Horizontal more than 300mm wide	560.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Steel Reinforcement				
			Deck				
	S 1700.60.2 0.05.10.0 00	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	11.38	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Parapet Upstand				0
	S 1700.60.2 0.05.10.0 00	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	1.58	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			End Screen				
	S 1700.60.2 0.05.10.0 00	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	0.89	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Deck				0
	S 1700.60.2 0.05.10.0 00	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	34.13	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Parapet Upstand				0
	S 1700.60.2 0.05.10.0 00	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	4.73	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			End Screen				0
	S 1700.60.2 0.05.10.0 00	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	2.68	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Waterproofing for Structures				0
	S 2000.00.0 0.00.00.0 00	Marazanvose Green Bridge	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	746.30	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Bridge Expansion Joints and Sealing of Gaps				0
	S 2100.00.1 0.01.01.0 00	Marazanvose Green Bridge	Bearings, joints and sealing of gaps - Bridge deck expansion joints - Expansion joint	2.00	no	1. Assume each expansion joint is 300mm wide, 30mm thick and 10m long 2. Assume each expansion joint is made of steel 3. Assume the density of steel is 8000 kg/m3	1. Density of steel: HE Carbon tool: Material Density > Steel: general 2. Bath Inventory of Carbon and Energy (ICE) database: Steel > General Steel
	S 2100.00.2 0.01.00.0 00	Marazanvose Green Bridge	Structures - Bearings, Joints and Sealing of Gaps - Sealing of Gaps - Joint filler board	6.50	m2	1. Assume the joint filler board is made of PE (polyethylene) foam 2. Assume the thickness of the joint filler board is 50mm 3. Assume the density of the joint filler board is 110 kg/m3	1. The material and thickness of joint filler board: http://www.bridgeforum.org/bof/meetings/bof34/Inspection%20Guidance%20for%20Expansion%20Joints%20Vol%201%20v01a.pdf 2. Bath Inventory of Carbon and Energy (ICE) database: Plastic > General Polyethylene
	S 2100.00.2 0.02.00.0 00	Marazanvose Green Bridge	Structures - Bearings, Joints and Sealing of Gaps - Sealing of Gaps - Joint sealant	26.00	metre	1. Assume the type of the joint sealant is silicone 2. Assume the density of silicone is 8.5lbs/gal = 848 kg/m3 3. Assume the thickness of the sealant is 10mm 4. Assume the width of the sealant is 30mm 5. Assume the carbon factor for silicone sealant is same as epoxide resin sealant	1. The type of joint sealant: Section 9.1.3 of https://www.wsdot.wa.gov/publications/manuals/fulltext/M23-50/Chapter9.pdf 2. Density of Silicone sealant: http://multimedia.3m.com/mws/media/1077020J/3mtm-super-silicone-pn-08661-08662-08663-08664.pdf 3. Bath Inventory of Carbon and Energy (ICE) database: Sealants & Adhesives > Epoxide Resin
			Safety Barriers				0
	S 0400.15.1 0.10.10	Marazanvose Green Bridge	Structures - Road Restraint Systems excluding safety fencing - Vehicle parapets	128.00	m	Assume the road restraint system excluding safety fencing is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
	0400.10.4 0.10.20.0 10	Marazanvose Green Bridge	Road Restraint Systems - Transitions - Transition to bridge parapets	4.00	no	1. Assume the transition is equivalent to 2m of bridge parapet 2. Assume the bridge parapet is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
			Pedestrian Guardrail				
	R1 0400.30.2 5.00.00.0 00	Marazanvose Green Bridge	Road Restraint Systems - Pedestrian Guardrails - P3-Pedestrian	64.00	m	Assume the pedestrian guardrail is equivalent to Steel RRS barrier single sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier single sided
			Pavement				
			Surface Course				
	R2 0700.14.0 5.40.00.0 00	Marazanvose Green Bridge	Pavements - Surface course - Close graded macadam in carriageway, hardshoulder and hardstrip	84.00	m3	1. Assume the density of close graded macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
			Regulating Course				
	R2 0700.15.1 0.05.00.0 00	Marazanvose Green Bridge	Pavements - Regulating course - Dense bitumen macadam (DBM50) with 14mm aggregate	50.40	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
			Rolling Block				
	S 1700.50.1 0.00.10.0 05	Marazanvose Green Bridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3: 300mm wide or less at any inclination	16.23	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
	S 1700.10.0 0.00.00.0 15	Marazanvose Green Bridge	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2	12.51	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material >Ready mix concrete > C32/40
	S 1700.60.2 0.05.00.0 00	Marazanvose Green Bridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	0.63	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Kerbs, Channels, Edgings, Combined Kerb and Drainage Blocks and Linear Drainage Channel Systems				
	R1 1100.10.0 0.15.00.0 00	Marazanvose Green Bridge	Kerbs, Footways And Paved Areas - Combined drainage and kerb blocks	128.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
			Waterproofing for Structures				
	S 2000.00.0 0.15.00.0 00	Marazanvose Green Bridge	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	746.30	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Sub Total				
S-01/7			Tolpreggan Accommodation bridge East				
			VARIABLES				
			GENERAL				
			STANDARD OVERBRIDGE DETAILS				
			Piles				
			Abutment Base				
			Abutment Plinth				
			End Walls on Abutment Base				
			Abutment Wing Walls				
	600		EARTHWORKS				
	700		PAVEMENT				

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Member/Location

Job Title: A30 Chiverton to Carland Cross

Calculation

Drg. Ref.

Made by: CL Date: 18/07/2018 Chkd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
			Pavement on approach to overbridge				
	1700		STRUCTURAL CONCRETE				
			Piles				
			Abutments				
			Pile Caps/Pad Footings				
			Piers				
			Deck				
			Deck Pavement				
	1800		STEELWORK FOR STRUCTURES				
			Factor applied for girder spacing				
			Variables for painting of structural steel				
			Cast in Place Piles				
			Bored Concrete Piles				
	S 1600.10.0 0.00.00.0 30.	Tolgroggan Accommodation Bridge East	Piling And Embedded Retaining Walls - Cast in Place Piles - Establishment of piling plant - of bored cast-in-place piles	1.00	item	Assume establishment of piling plant has no carbon emission	0
	S 1600.10.0 0.05.00.0 30	Tolgroggan Accommodation Bridge East	Piling And Embedded Retaining Walls - Cast in Place Piles - Moving piling plant - Of bored cast-in-place piles	6.00	no	Assume moving piling plant has no carbon emission	0
	S 1600.10.1 0.00.00.0 15.	Tolgroggan Accommodation Bridge East	Piling And Embedded Retaining Walls - Cast in Place Piles - Vertical - >900 mm dia (1050mm diameter)	150.00	m	1. Assume the concrete type is C32/40 2. Assume the diameter of the pile is 1050 mm 3. Assume the density of concrete is 2400 kg/m3	HE Carbon Tool: Bulk Materials > Ready mix concrete > 32/40
	S 1600.10.2 5.05.00.0 10.	Tolgroggan Accommodation Bridge East	Cast in Place Piles - Proof loading of vertical piles - Dynamic load	1.00	no	1. Assume additional 4 no. 900mm Piles of 15m length acting as anchor piles 2. Assume the concrete type is C32/40	HE Carbon Tool: Bulk Materials > Ready mix concrete > 32/40
			Steel Reinforcement				
	S 1600.10.1 5.05.00.0 00.	Tolgroggan Accommodation Bridge East	Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel helical reinforcement nominal size: 12mm and under	5.20	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
	S 1600.10.1 5.00.10.0 00.	Tolgroggan Accommodation Bridge East	Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel bar reinforcement nominal size - Over 25mm dia, >12m in length	25.98	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Series 2500: Special Structures				
	S 2500.10.1 0.10.10.0 00	Tolgroggan Accommodation Bridge East	Special Structures - Special Structures - Earth retaining structure	308.00	m2	1. Assume the earth retaining structure is consist of concrete panel facing, steel strap and earthwork fill 2. Assume the volume of earthwork fill is included in the earthwork section	Reference email: Type of earthwork retaining structure: RE: Earth Retaining Structure [30/01/2018 From Lucy Stephenson to Doreen Lu]
		Tolgroggan Accommodation Bridge East				1. Assume the thickness of the concrete panel is 200mm 2. Assume the type of concrete is C32/40	Reference email: assumptions to the concrete panel and steel strap: RE: Earth Retaining Structure [06/02/2018 From Lucy Stephenson to Doreen Lu]
		Tolgroggan Accommodation Bridge East				1. Assume the volume of steel strap is assumed to be 3% of the volume of concrete panel 2. The density of steel is 8000kg/m3	
			Abutment				
			Earthworks				
	0600.05.1 0.00.00.0 00.	Earthworks	Earthworks - Excavation of acceptable material excluding class 5A in - Structural foundations: 0< depth <=6m	1,714.00	m3		
	R2 0600.10.0 2.00.00.0 05.	Earthworks	Earthworks - Extra over excavation for excavation in Hard Material in: Structural foundations	171.40	m3		
	0600.18.0 8.00.00.0 00.	Earthworks	Earthworks - Disposal of material - Acceptable material excluding Class 5A	1,714.00	m3		
	NOT WBS	Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	1,110.00	m3		
	NOT WBS	Earthworks	Earthworks - Compaction of acceptable material to structures	1,110.00	m3		
			Imported Fill for Reinforced Soil Walls				
	R2 0600.20.1 0.00.00.0 10.	Earthworks	Earthworks - Imported acceptable material other than class 6F - Reinforced earth structures (Classes 6 and 7)	1,391.60	m3		
	R2 0600.22.1 2.00.00.0 10.	Earthworks	Earthworks - Compaction of fill in reinforced earth structures	1,391.60	m3		
			Structural Concrete				
	S 1700.10.0 0.00.00.0 00.	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength <=25N/mm2: In blinding 75mm or less in thickness	7.70	m3	Assume the type of concrete is C20/25 (ST 5)	HE Carbon Tool: Bulk Material >Ready mix concrete > C20/25 (ST5)
	S 1700.10.0 0.00.00.0 15.	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2	153.30	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material >Ready mix concrete > C32/40
			Formwork >300				
	S 1700.50.1 0.00.10.0 10	Tolgroggan Accommodation Bridge East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	415.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Steel Reinforcement				
	S 1700.60.2 0.05.00.0 00.	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	11.30	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
	S 1700.60.2 0.05.10.0 00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	19.30	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Waterproofing for Structures				
	S 2000.00.0 0.00.00.0 00.	Tolgroggan Accommodation Bridge East	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	279.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
	S 2000.00.0 0.15.00.0 00.	Tolgroggan Accommodation Bridge East	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	60.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Brickwork, Blockwork and Stonework				
	S 2400.10.1 0.10.10.0 70.	Tolgroggan Accommodation Bridge East	Brickwork, Blockwork & Stonework - With battered face	105.00	m2	Assume the standard brick size is 215*102*65mm	Stand brick size in UK: https://wienerberger.co.uk/about-us/size-matters
			Spread Footing or Pile Cap				
			Earthworks				
	0600.05.1 0.00.00.0 00.	Earthworks	Earthworks - Excavation of acceptable material excluding class 5A in - Structural foundations: 0< depth <=6m	-	m3		
	R2 0600.10.0 2.00.00.0 05.	Earthworks	Earthworks - Extra over excavation for excavation in Hard Material in: Structural foundations	-	m3		
	0600.18.0 8.00.00.0 00.	Earthworks	Earthworks - Disposal of material - Acceptable material excluding Class 5A	-	m3		
	NOT WBS	Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	-	m3		
	NOT WBS	Earthworks	Earthworks - Compaction of acceptable material to structures	-	m3		
			Structural Concrete				
	S 1700.10.0 0.00.00.0 00.	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength <=25N/mm2: In blinding 75mm or less in thickness	-	m3		
	S 1700.10.0 0.00.00.0 15.	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2	-	m3		
			Formwork >300				
	S 1700.50.1 0.00.10.0 10	Tolgroggan Accommodation Bridge East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	-	m2		
			Steel Reinforcement				
	S 1700.60.2 0.05.00.0 00.	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	-	tonne		
	S 1700.60.2 0.05.10.0 00.	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	-	tonne		
			Waterproofing for Structures				
	S 2000.00.0 0.00.00.0 00.	Tolgroggan Accommodation Bridge East	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	-	m2		
			Piers				
			Structural Concrete				

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Job Title: A30 Chiverton to Carland Cross

Calculation

Drg. Ref.

Made by: CL Date: 18/07/2018 Chd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
	S 1700.10.00.00.20	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	-	m3		
			Formwork >300				
	S 1700.50.10.00.10	Tolgroggan Accommodation Bridge East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	-	m2		
	S 2000.00.00.15.00.00	Tolgroggan Accommodation Bridge East	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	-	m2		
			Steel Reinforcement				
	S 1700.60.20.05.00.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	-	t		
	S 1700.60.20.05.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	-	t		
			Waterproofing for Structures				
	S 2000.00.00.00.00.00	Tolgroggan Accommodation Bridge East	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	-	m2		
	S 2000.00.00.15.00.00	Tolgroggan Accommodation Bridge East	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	123.75	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Pier Strengthening				
			Earthworks				
	0600.05.10.00.00.00	Earthworks	Earthworks - Excavation of acceptable material excluding class 5A in - Structural foundations: 0< depth <=6m	-	m3		
	0600.18.08.00.00.00	Earthworks	Earthworks - Disposal of material - Acceptable material excluding Class 5A	-	m3		
	NOT WBS	Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	-	m3		
	NOT WBS	Earthworks	Earthworks - Compaction of acceptable material to structures	-	m3		
			Structural Concrete				
	S 1700.10.00.00.20	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	-	m3		
			Formwork >300				
	S 1700.50.10.00.10	Tolgroggan Accommodation Bridge East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	-	m2		
			Steel Reinforcement				
	S 1700.60.20.05.00.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	-	t		
	S 1700.60.20.05.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	-	t		
			Superstructure				
			Steelwork for Structures				
	S 1800.10.00.00.10	Tolgroggan Accommodation Bridge East	Structural Steelwork - Fabrication of Steelwork - Fabrication of main members - Plated girders	111.00	t	Assume the plate girders is made of general steel	Bath Inventory of Carbon and Energy (ICE) database: Steel > General Steel Embodied Carbon > UK Typical
	S 1800.20.05.00.00.05	Tolgroggan Accommodation Bridge East	Structural Steelwork - Erection of Steelwork - Permanent erection: Substructure	111.00	t	Assume erection of steelwork has no carbon emission	0
			Bearings				
	S 2100.00.00.00.00.00	Tolgroggan Accommodation Bridge East	Bearings, joints and sealing of gaps - Bearing - Bearing	4.00	no	1. Assume the Bearing has 1800mm long, 1800mm wide and 1300mm thick 2. Assume the Bearing is made of steel and the density of steel is 8000 kg/m3	1. Density of steel: HE Carbon tool: Material Density > Steel: general 2. Bath Inventory of Carbon and Energy (ICE) database: Steel > General Steel
	S 2100.00.00.10.00.00	Tolgroggan Accommodation Bridge East	Bearings, joints and sealing of gaps - Bearing - Installation of bearing	4.00	no	Assume no carbon emission in installing bearings	0
			Protection of Steelwork against Corrosion				
	S 1900.10.00.00.00.00	Tolgroggan Accommodation Bridge East	Structures - Protection of Steelwork Against Corrosion - Organic Protective System	1,093.25	m2	1. Assume the thickness of the paint is 2mm 2. Assume the density of organic protective system paint is 880kg/m3	1. General paint density: https://www3.epa.gov/ttnchie1/ap42/ch04/final/c4s02_2a.pdf 2. Bath Inventory of Carbon and Energy (ICE) database: Paint > General Paint
			Structural Concrete				
			Deck				
	S 1700.10.00.00.00.20	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	78.91	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Parapet Upstand				
	S 1700.10.00.00.00.20	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	21.60	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			End Screen				
	S 1700.10.00.00.00.20	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	13.32	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Verge Footway				
	S 1700.10.00.00.00.20	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	38.88	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Formwork >300				
	S 1700.50.10.00.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Horizontal more than 300mm wide	57.60	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			External Longitudinal Slab Edge				
	S 1700.50.10.00.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	67.20	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Internal Longitudinal Slab Edge				
	S 1700.50.10.00.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	43.20	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			End Screen				
	S 1700.50.10.00.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	61.22	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Permanent formwork >300				
	S 1700.50.10.00.00.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Surface Finish of Concrete - Formwork - Permanent formwork >300 - Class F3 - Horizontal more than 300mm wide	192.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Steel Reinforcement				
			Deck				
	S 1700.60.20.05.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	4.50	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Parapet Upstand				
	S 1700.60.20.05.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	1.35	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			End Screen				
	S 1700.60.20.05.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	0.83	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Deck				
	S 1700.60.20.05.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	13.50	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Parapet Upstand				
	S 1700.60.20.05.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	4.05	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			End Screen				
	S 1700.60.20.05.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	2.50	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Waterproofing for Structures				

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Member/Location

Job Title: A30 Chiverton to Carland Cross

Drg. Ref.

Calculation

Made by: CL Date: 18/07/2018 Chkd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
	S 2000.00.00.00.00.00	Tolgroggan Accommodation Bridge East	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	303.24	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Bridge Expansion Joints and Sealing of Gaps				
	S 2100.00.10.01.01.00	Tolgroggan Accommodation Bridge East	Bearings, joints and sealing of gaps - Bridge deck expansion joints - Expansion joint	2.00	no	1. Assume each expansion joint is 300mm wide, 30mm thick and 10m long 2. Assume each expansion joint is made of steel 3. Assume the density of steel is 8000 kg/m3	1. Density of steel: HE Carbon tool: Material Density > Steel: general 2. Bath Inventory of Carbon and Energy (ICE) database: Steel > General Steel
	S 2100.00.20.01.00.00	Tolgroggan Accommodation Bridge East	Structures - Bearings, Joints and Sealing of Gaps - Sealing of Gaps - Joint filler board	3.00	m2	1. Assume the joint filler board is made of PE (polyethylene) foam 2. Assume the thickness of the joint filler board is 50mm 3. Assume the density of the joint filler board is 110 kg/m3	1. The material and thickness of joint filler board: http://www.bridgeforum.org/bof/meetings/bof34/Inspection%20Guidance%20for%20Expansion%20Joints%20Vol%201%20v01a.pdf 2. Bath Inventory of Carbon and Energy (ICE) database: Plastic > General Polyethylene
	S 2100.00.20.02.00.00	Tolgroggan Accommodation Bridge East	Structures - Bearings, Joints and Sealing of Gaps - Sealing of Gaps - Joint sealant	12.00	metre	1. Assume the type of the joint sealant is silicone 2. Assume the density of silicone is 8.5lbs/gal = 848 kg/m3 3. Assume the thickness of the sealant is 10mm 4. Assume the width of the sealant is 30mm 5. Assume the carbon factor for silicone sealant is same as epoxide resin sealant	1. The type of joint sealant: Section 9.1.3 of https://www.wsdot.wa.gov/publications/manuals/fulltext/M23-50/Chapter9.pdf 2. Density of Silicone sealant: http://multimedia.3m.com/mws/media/1077020/3mtm-super-silicone-pn-08661-08662-08663-08664.pdf 3. Bath Inventory of Carbon and Energy (ICE) database: Sealants & Adhesives > Epoxide Resin
			Safety Barriers				
	S 0400.15.10.10.10.00	Tolgroggan Accommodation Bridge East	Structures - Road Restraint Systems excluding safety fencing - Vehicle parapets	112.00	m	Assume the road restraint system excluding safety fencing is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
	0400.10.40.10.20.00	Tolgroggan Accommodation Bridge East	Road Restraint Systems - Transitions - Transition to bridge parapets	4.00	no	1. Assume the transition is equivalent to 2m of bridge parapet 2. Assume the bridge parapet is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
			Pedestrian Guardrail				
	R1 0400.30.20.05.00.00.00	Tolgroggan Accommodation Bridge East	Road Restraint Systems - Pedestrian Guardrails - P3-Pedestrian	56.00	m	Assume the pedestrian guardrail is equivalent to Steel RRS barrier single sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier single sided
			Pavement				
			Surface Course				
	R2 0700.14.05.40.00.00	Tolgroggan Accommodation Bridge East	Pavements - Surface course - Close graded macadam in carriageway, hardshoulder and hardstrip	30.00	m3	1. Assume the density of close graded macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
			Reegulating Course				
	R2 0700.15.10.05.00.00	Tolgroggan Accommodation Bridge East	Pavements - Regulating course - Dense bitumen macadam (DBM50) with 14mm aggregate	7.50	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
			Rolling Block				
	S 1700.50.10.00.10.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3: 300mm wide or less at any inclination	8.53	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
	S 1700.10.00.00.00.15	Tolgroggan Accommodation Bridge East	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2	5.78	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material >Ready mix concrete > C32/40
	S 1700.60.20.05.00.00.00	Tolgroggan Accommodation Bridge East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	0.29	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Kerbs, Channels, Edgings, Combined Kerb and Drainage Blocks and, Linear Drainage Channel Systems				
	R1 1100.10.00.15.00.00.00	Tolgroggan Accommodation Bridge East	Kerbs, Footways And Paved Areas - Combined drainage and kerb blocks	112.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
			Waterproofing for Structures				
	S 2000.00.00.15.00.00.00	Tolgroggan Accommodation Bridge East	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	303.24	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Sub Total				
S-01/8			Chybucca Overbridge				
			VARIABLES				
			GENERAL				
			STANDARD OVERBRIDGE DETAILS				
			Piles				
			Abutment Base				
			Abutment Plinth				
			End Walls on Abutment Base				
			Abutment Wing Walls				
	600		EARTHWORKS				
	700		PAVEMENT				
			Pavement on approach to overbridge				
	1700		STRUCTURAL CONCRETE				
			Piles				
			Abutments				
			Pile Caps/Pad Footings				
			Piers				
			Deck				
			Deck Pavement				
	1800		STEELWORK FOR STRUCTURES				
			Factor applied for girder spacing				
			Variables for painting of structural steel				
			Cast in Place Piles				
		0	Bored Concrete Piles				
	S 1600.10.00.00.00.30	Chybucca Overbridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Establishment of piling plant - of bored cast-in-place piles	1.00	item	Assume establishment of piling plant has no carbon emission	0
	S 1600.10.00.05.00.30	Chybucca Overbridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Moving piling plant - Of bored cast-in-place piles	14.00	no	Assume moving piling plant has no carbon emission	0
	S 1600.10.10.00.00.00.15	Chybucca Overbridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Vertical - >900 mm dia (1050mm diameter)	350.00	m	1. Assume the concrete type is C32/40 2. Assume the diameter of the pile is 1050 mm 3. Assume the density of concrete is 2400 kg/m3	HE Carbon Tool: Bulk Materials > Ready mix concrete > 32/40
	S 1600.10.20.05.00.00.10	Chybucca Overbridge	Cast in Place Piles - Proof loading of vertical piles - Dynamic load	1.00	no	1. Assume additional 4 no. 900mm Piles of 15m length acting as anchor piles 2. Assume the concrete type is C32/40	HE Carbon Tool: Bulk Materials > Ready mix concrete > 32/40
			Steel Reinforcement				
	S 1600.10.10.05.00.00.00	Chybucca Overbridge	Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel helical reinforcement nominal size: 12mm and under	12.12	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
	S 1600.10.10.05.00.10.00.05	Chybucca Overbridge	Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel bar reinforcement nominal size - Over 25mm dia, >12m in length	60.61	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Series 2500: Special Structures				
	S 2500.10.10.10.10.00		Special Structures - Special Structures - Earth retaining structure	441.00	m2	1. Assume the earth retaining structure is consist of concrete panel facing, steel strap and earthwork fill 2. Assume the volume of earthwork fill is included in the earthwork section	Reference email: Type of earthwork retaining structure: RE: Earth Retaining Structure [30/01/2018 From Lucy Stephenson to Doreen Lu]
		Chybucca Overbridge				1. Assume the thickness of the concrete panel is 200mm 2. Assume the type of concrete is C32/40	Reference email: assumptions to the concrete panel and steel strap: RE: Earth Retaining Structure [06/02/2018
		Chybucca Overbridge				1. Assume the volume of steel strap is assumed to be 3% of the volume of concrete panel 2. The density of steel is 8000kg/m3	From Lucy Stephenson to Doreen Lu]
			Abutment				
			Earthworks				
	0600.05.10.00.00.00.00	Earthworks	Earthworks - Excavation of acceptable material excluding class SA in - Structural foundations: 0< depth <=6m	1,935.00	m3	0	0
	R2 0600.10.02.00.00.00	Earthworks	Earthworks - Extra over excavation for excavation in Hard Material in: Structural foundations	193.50	m3	0	0
	0600.18.08.00.00.00	Earthworks	Earthworks - Disposal of material - Acceptable material excluding Class SA	1,935.00	m3	0	0
	NOT WBS	Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	1,070.00	m3	0	0
	NOT WBS	Earthworks	Earthworks - Compaction of acceptable material to structures	1,070.00	m3	0	0
			Imported Fill for Reinforced Soil Walls				
	R2 0600.20.10.00.00.00.10	Earthworks	Earthworks - Imported acceptable material other than class 6F - Reinforced earth structures (Classes 6 and 7)	2,322.60	m3	0	0
	R2 0600.22.12.00.00.00.10	Earthworks	Earthworks - Compaction of fill in reinforced earth structures	2,322.60	m3	0	0
			Structural Concrete				

ARUP	Job No. 256019-91	Sheet No.	Rev.
	Member/Location		
Job Title: A30 Chiverton to Carland Cross	Drg. Ref.		
Calculation	Made by: CL	Date: 18/07/2018	Chkd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
	S 1700.10.0 0.00.00.0 00.	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength <=25N/mm2: In blinding 75mm or less in thickness	14.10	m3	Assume the type of concrete is C20/25 (ST 5)	HE Carbon Tool: Bulk Material >Ready mix concrete > C20/25 (ST5)
	S 1700.10.0 0.00.00.0 15.	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2	264.70	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material >Ready mix concrete > C32/40
			Formwork >300				
	S 1700.50.1 0.00.10.0 10.	Chybucca Overbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	449.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Steel Reinforcement				
	S 1700.60.2 0.05.00.0 00.	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	22.70	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
	S 1700.60.2 0.05.10.0 00.	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	30.30	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Waterproofing for Structures				
	S 2000.00.0 0.00.00.0 00.	Chybucca Overbridge	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	324.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
	S 2000.00.0 0.15.00.0 00.	Chybucca Overbridge	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	155.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Brickwork, Blockwork and Stonework				
	S 2400.10.1 0.10.10.0 70.	Chybucca Overbridge	Brickwork, Blockwork & Stonework - With battered face	149.00	m2	Assume the standard brick size is 215*102*65mm	Stand brick size in UK: https://wienerberger.co.uk/about-us/size-matters
			Spread Footing or Pile Cap				
			Earthworks				
	0600.05.1 0.00.00.0 00.	Earthworks	Earthworks - Excavation of acceptable material excluding class 5A in - Structural foundations: 0< depth <=6m	-	m3		
	R2 0600.10.0 2.00.00.0 05.	Earthworks	Earthworks - Extra over excavation for excavation in Hard Material in: Structural foundations	-	m3		
	0600.18.0 8.00.00.0 00.	Earthworks	Earthworks - Disposal of material - Acceptable material excluding Class 5A	-	m3		
	NOT WBS	Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	-	m3		
	NOT WBS	Earthworks	Earthworks - Compaction of acceptable material to structures	-	m3		
			Structural Concrete				
	S 1700.10.0 0.00.00.0 00.	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength <=25N/mm2: In blinding 75mm or less in thickness	-	m3		
	S 1700.10.0 0.00.00.0 15.	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2	-	m3		
			Formwork >300				
	S 1700.50.1 0.00.10.0 10.	Chybucca Overbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	-	m2		
			Steel Reinforcement				
	S 1700.60.2 0.05.00.0 00.	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	-	t		
	S 1700.60.2 0.05.10.0 00.	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	-	t		
			Waterproofing for Structures				
	S 2000.00.0 0.00.00.0 00.	Chybucca Overbridge	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	-	m2		
			Pier2				
			Structural Concrete				
	S 1700.10.0 0.00.00.0 20.	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	-	m3		
			Formwork >300				
	S 1700.50.1 0.00.10.0 10.	Chybucca Overbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	-	m2		
	S 2000.00.0 0.15.00.0 00.	Chybucca Overbridge	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	-	m2		
			Steel Reinforcement				
	S 1700.60.2 0.05.00.0 00.	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	-	t		
	S 1700.60.2 0.05.10.0 00.	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	-	t		
			Waterproofing for Structures				
	S 2000.00.0 0.00.00.0 00.	Chybucca Overbridge	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	-	m2		
	S 2000.00.0 0.15.00.0 00.	Chybucca Overbridge	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	280.50	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Pier Strengthening				
			Earthworks				
	0600.05.1 0.00.00.0 00.	Earthworks	Earthworks - Excavation of acceptable material excluding class 5A in - Structural foundations: 0< depth <=6m	-	m3		
	0600.18.0 8.00.00.0 00.	Earthworks	Earthworks - Disposal of material - Acceptable material excluding Class 5A	-	m3		
	NOT WBS	Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	-	m3		
	NOT WBS	Earthworks	Earthworks - Compaction of acceptable material to structures	-	m3		
			Structural Concrete				
	S 1700.10.0 0.00.00.0 20.	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	-	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Formwork >300				
	S 1700.50.1 0.00.10.0 10.	Chybucca Overbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	-	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Steel Reinforcement				
	S 1700.60.2 0.05.00.0 00.	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	-	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
	S 1700.60.2 0.05.10.0 00.	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	-	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Superstructure				
			Steelwork for Structures				
	S 1800.10.0 0.00.10.0 00.	Chybucca Overbridge	Structural Steelwork - Fabrication of Steelwork - Fabrication of main members - Plated girders	135.00	t	Assume the plate girders is made of general steel	Bath Inventory of Carbon and Energy (ICE) database: Steel > General Steel Embodied Carbon > UK Typical
	S 1800.20.0 5.05.00.0 05.	Chybucca Overbridge	Structural Steelwork - Erection of Steelwork - Permanent erection: Substructure	135.00	t	Assume erection of steelwork has no carbon emission	
			Bearings				
	S 2100.00.0 1.00.00.0 00.	Chybucca Overbridge	Bearings, joints and sealing of gaps - Bearing - Bearing	12.00	no	1. Assume the Bearing has 1800mm long, 1800mm wide and 1300mm thick 2. Assume the Bearing is made of steel and the density of steel is 8000 kg/m3	1. Density of steel: HE Carbon tool: Material Density > Steel: general 2. Bath Inventory of Carbon and Energy (ICE) database: Steel > General Steel
	S 2100.00.0 1.10.00.0 00.	Chybucca Overbridge	Bearings, joints and sealing of gaps - Bearing - Installation of bearing	12.00	no	Assume no carbon emission in installing bearings	
			Protection of Steelwork against Corrosion				

ARUP

Job No.	Sheet No.	Rev.
256019-91		

Member/Location

Job Title: A30 Chiverton to Carland Cross

Org. Ref.

Calculation

Made by: CL Date: 18/07/2018 Chd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
	S 1900.10.0 0.000.00 00	Chybucca Overbridge	Structures - Protection of Steelwork Against Corrosion - Organic Protective System	1,460.37	m2	1. Assume the thickness of the paint is 2mm 2. Assume the density of organic protective system paint is 880kg/m3	1. General paint density: https://www3.epa.gov/ttnchie1/ap42/ch04/final/c4s02_2a.pdf 2. Bath Inventory of Carbon and Energy (ICE) database: Paint > General Paint
			Structural Concrete				
			Deck				
	S 1700.10.0 0.000.00 20	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	140.71	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Parapet Upstand				
	S 1700.10.0 0.000.00 20	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	15.30	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			End Screen				
	S 1700.10.0 0.000.00 20	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	25.73	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Verge Footway				
	S 1700.10.0 0.000.00 20	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	27.54	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
			Formwork >300				
	S 1700.50.1 0.000.10 00	Chybucca Overbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Horizontal more than 300mm wide	51.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			External Longitudinal Slab Edge				
	S 1700.50.1 0.000.10 10	Chybucca Overbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	47.60	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Internal Longitudinal Slab Edge				
	S 1700.50.1 0.000.10 10	Chybucca Overbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	30.60	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			End Screen				
	S 1700.50.1 0.000.10 10	Chybucca Overbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	114.49	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Permanent formwork >300				
	S 1700.50.1 0.005.10 00	Chybucca Overbridge	Structural Concrete - Surface Finish of Concrete - Formwork - Permanent formwork >300 - Class F3 - Horizontal more than 300mm wide	408.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
			Steel Reinforcement				
			Deck				
	S 1700.60.2 0.005.10 00	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	8.23	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Parapet Upstand				
	S 1700.60.2 0.005.10 00	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	0.96	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			End Screen				
	S 1700.60.2 0.005.10 00	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	1.61	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Deck				
	S 1700.60.2 0.005.10 00	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	24.70	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Parapet Upstand				
	S 1700.60.2 0.005.10 00	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	2.87	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			End Screen				
	S 1700.60.2 0.005.10 00	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	4.82	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Waterproofing for Structures				
	S 2000.00.0 0.000.00 00	Chybucca Overbridge	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	576.01	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Bridge Expansion Joints and Sealing of Gaps				
	S 2100.00.1 0.01.01.0 00	Chybucca Overbridge	Bearings, joints and sealing of gaps - Bridge deck expansion joints - Expansion joint	2.00	no	1. Assume each expansion joint is 300mm wide, 30mm thick and 10m long 2. Assume each expansion joint is made of steel 3. Assume the density of steel is 8000 kg/m3	1. Density of steel: HE Carbon tool: Material Density > Steel: general 2. Bath Inventory of Carbon and Energy (ICE) database: Steel > General Steel
	S 2100.00.2 0.01.00.0 00	Chybucca Overbridge	Structures - Bearings, Joints and Sealing of Gaps - Sealing of Gaps - Joint filler board	7.75	m2	1. Assume the joint filler board is made of PE (polyethylene) foam 2. Assume the thickness of the joint filler board is 50mm 3. Assume the density of the joint filler board is 110 kg/m3	1. The material and thickness of joint filler board: http://www.bridgeforum.org/bof/meetings/bof34/Inspection%20Guidance%20for%20Expansion%20Joints%20Vol%201%20v01a.pdf 2. Bath Inventory of Carbon and Energy (ICE) database: Plastic > General Polyethylene
	S 2100.00.2 0.02.00.0 00	Chybucca Overbridge	Structures - Bearings, Joints and Sealing of Gaps - Sealing of Gaps - Joint sealant	31.00	metre	1. Assume the type of the joint sealant is silicone 2. Assume the density of silicone is 8.5lbs/gal = 848 kg/m3 3. Assume the thickness of the sealant is 10mm 4. Assume the width of the sealant is 30mm 5. Assume the carbon factor for silicone sealant is same as epoxide resin sealant	1. The type of joint sealant: Section 9.1.3 of https://www.wsdot.wa.gov/publications/manuals/fulltext/M23-50/Chapter9.pdf 2. Density of Silicone sealant: http://multimedia.3m.com/mws/media/1077020J/3mtm-super-silicone-pn-08661-08662-08663-08664.pdf 3. Bath Inventory of Carbon and Energy (ICE) database: Sealants & Adhesives > Epoxide Resin
			Safety Barriers				
	S 0400.15.1 0.10.10	Chybucca Overbridge	Structures - Road Restraint Systems excluding safety fencing - Vehicle parapets	84.00	m	Assume the road restraint system excluding safety fencing is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
	0400.10.4 0.10.20.0 10	Chybucca Overbridge	Road Restraint Systems - Transitions - Transition to bridge parapets	4.00	no	1. Assume the transition is equivalent to 2m of bridge parapet 2. Assume the bridge parapet is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
			Pedestrian Guardrail				
	R1 0400.30.2 5.00.00.0 00	Chybucca Overbridge	Road Restraint Systems - Pedestrian Guardrails - P3-Pedestrian	42.00	m	Assume the pedestrian guardrail is equivalent to Steel RRS barrier single sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier single sided
			Pavement				
			Surface Course				
	R2 0700.14.0 5.40.00.0 00	Chybucca Overbridge	Pavements - Surface course - Close graded macadam in carriageway, hardshoulder and hardstrip	61.63	m3	1. Assume the density of close graded macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
			Regulating Course			0	0
	R2 0700.15.1 0.05.00.0 00	Chybucca Overbridge	Pavements - Regulating course - Dense bitumen macadam (DBM50) with 14mm aggregate	44.68	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
			Rolling Block				
	S 1700.50.1 0.000.10 00	Chybucca Overbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F3: 300mm wide or less at any inclination	18.98	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
	S 1700.10.0 0.000.00 10	Chybucca Overbridge	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2	14.92	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material >Ready mix concrete > C32/40
	S 1700.60.2 0.005.00 00	Chybucca Overbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	0.75	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Kerbs, Channels, Edgings, Combined Kerb and Drainage Blocks and, Linear Drainage Channel Systems				
	R1 1100.10.0 0.15.00.0 00	Chybucca Overbridge	Kerbs, Footways And Paved Areas - Combined drainage and kerb blocks	84.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
			Waterproofing for Structures				
	S 2000.00.0 0.15.00.0 00	Chybucca Overbridge	Waterproofing For Concrete Structures - Surface impregnation to plain surfaces	576.01	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
			Sub Total				
S-02			Chiverton Cross Junction Underbridge - East				
			Bridge Name:				
			Pad Foundations				
		Chiverton Cross Underbridge - East	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2 sulphate resisting	288.00	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material > Ready mix concrete > C32/40
		Chiverton Cross Underbridge - East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: >12m in length	31.68	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Chiverton Cross Underbridge - East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F1 - Vertical more than 300mm wide	140.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Earthworks	Earthworks - Excavation of acceptable material excluding Class 5A in: Cutting and other excavation (Excavator and road truck)	288.00	m3		0

ARUP

Job No.	Sheet No.	Rev.
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Member/Location

Job Title: A30 Chiverton to Carland Cross

Org. Ref.

Calculation

Made by: CL Date: 18/07/2018 Chkd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
			Abutment				0
		Chiverton Cross Underbridge - East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	337.50	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Chiverton Cross Underbridge - East	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2 sulphate resisting	168.75	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material > Ready mix concrete > C32/40
		Chiverton Cross Underbridge - East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	30.38	t		HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Earthworks	Earthworks - Imported acceptable material other than class 6F - Free Draining Fill to Structures	36.00	m3		0
		Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	1,440.00	m3		0
			Bridge Deck				
		Chiverton Cross Underbridge - East	Precast Concrete Pretensioned Prestressed member (beams) - W14	198.00	m	1. Assume the type of this precast concrete member is U beam (U12) with self weight: 18.6 kN/m 2. Assume this pre-cast concrete member is a type of general concrete	1. Conversation with Gemma James [with Doreen Lu on 15th January] 2. Shay Murtagh: Technical Manual: Prestressed Concrete Beams 3. HE Carbon Tool: Civil Structures > Precast concrete > General concrete
		Chiverton Cross Underbridge - East	Precast Concrete Beams - Placing	11.00	no	Assume placing precast concrete beam has no carbon emission	0
		Chiverton Cross Underbridge - East	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	208.55	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
		Chiverton Cross Underbridge - East	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: >12m in length	33.37	tonne	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Chiverton Cross Underbridge - East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	56.80	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Chiverton Cross Underbridge - East	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 dee to the horizontal	576.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
		Chiverton Cross Underbridge - East	Kerbs, Footways And Paved Areas - Combined drainage and kerb blocks	36.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
		Chiverton Cross Underbridge - East	Structural Concrete - In situ concrete ST - ST1	18.00	m3	0	HE Carbon Tool: Bulk Material > Ready mix concrete > C6/8 (Gen 0, ST1)
		Chiverton Cross Underbridge - East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Horizontal more than 300mm wide	32.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Chiverton Cross Underbridge - East	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	36.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Chiverton Cross Underbridge - East	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	6.48	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
		Chiverton Cross Underbridge - East	Structures - Road Restraint Systems excluding safety fencing - Vehicle parapets	36.00	m	Assume the road restraint system excluding safety fencing is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
			Pavement				
		Chiverton Cross Underbridge - East	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	28.08	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
		Chiverton Cross Underbridge - East	Pavements - Surface course - Close graded macadam - Thin - In carriageway, hardshoulder and hardstrip 14mm agg, 60PSV	23.40	m3	1. Assume the density of surface course is 2300 kg/m3 2. Assume the close graded macadam as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
		Chiverton Cross Underbridge - East	Traffic Signs And Road Markings - Laying - Continuous lines	36.00	m	1. Assume the road marking paint is thermoplastic 2. Assume the width of road continuous marking is 150mm 3. Assume the thickness of thermoplastic marking is 2mm 4. Assume the density thermoplastic road marking is 2150 kg/m3	1. Width of the road marking: Traffic Signs Manual > Chapter 5 Road Marking > Table 4-5 Edge of carriageway markings: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223667/traffic-signs-manual-chapter-05.pdf 2. Density of the paint: http://www.alharamain.com/prod01.htm 3. HE Carbon tool: Road pavement > Road marking > Thermoplastic road marking
		Chiverton Cross Underbridge - East	Traffic Signs And Road Markings - Laying - Intermittent lines	36.00	m	1. Assume the road marking paint is thermoplastic 2. Assume the length of road marking lines excludes the blank spaces between lines 3. Assume the width of intermittent marking is 200mm 4. Assume the thickness of thermoplastic marking is 2mm 5. Assume the density thermoplastic road marking is 2150 kg/m3	0
			Sub Total				
S-13			Penny-Come-Quick Underbridge				
			Bridge Name:				
			Pile Foundations				
		Penny-Come-Quick Underbridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Establishment of piling plant - of bored cast-in-place piles	1.00	no	Assume establishment of piling plant has no carbon emission	0
		Penny-Come-Quick Underbridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Moving piling plant - Of bored cast-in-place piles	22.00	no	Assume moving piling plant has no carbon emission	0
		Penny-Come-Quick Underbridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Vertical - >600mm dia but <=900 mm dia	209.94	m3	1. Assume the concrete type is C32/40 2. Assume the diameter of the pile is 900mm 3. Assume the density of concrete is 2400 kg/m3	HE Carbon Tool: Bulk Materials > Ready mix concrete > C32/40
		Penny-Come-Quick Underbridge	Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel bar reinforcement nominal size - 12mm<dia.<=25mm, <12m in length	25.19	tonne	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Penny-Come-Quick Underbridge	Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel helical reinforcement nominal size: 12mm< dia <=25mm	8.40	tonne	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Abutment				
		Penny-Come-Quick Underbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	337.50	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Penny-Come-Quick Underbridge	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2 sulphate resisting	168.75	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material > Ready mix concrete > C32/40
		Penny-Come-Quick Underbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	30.38	tonne	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Earthworks	Earthworks - Imported acceptable material other than class 6F - Free Draining Fill to Structures	33.75	m3	0	0
		Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	1,350.00	m3	0	0
			Bridge Deck				
		Penny-Come-Quick Underbridge	Precast Concrete Pretensioned Prestressed member (beams) - W14	180.00	m	1. Assume the type of this precast concrete member is U beam (U12) with self weight: 18.6 kN/m 2. Assume this pre-cast concrete member is a type of general concrete	1. Conversation with Gemma James [with Doreen Lu on 15th January] 2. Shay Murtagh: Technical Manual: Prestressed Concrete Beams 3. HE Carbon Tool: Civil Structures > Precast concrete > General concrete
		Penny-Come-Quick Underbridge	Precast Concrete Beams - Placing	10.00	no	Assume placing precast concrete beam has no carbon emission	0
		Penny-Come-Quick Underbridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	196.95	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
		Penny-Come-Quick Underbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: >12m in length	31.51	tonne	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Penny-Come-Quick Underbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	52.80	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Penny-Come-Quick Underbridge	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 dee to the horizontal	540.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
		Penny-Come-Quick Underbridge	Kerbs, Footways And Paved Areas - Combined drainage and kerb blocks	36.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
		Penny-Come-Quick Underbridge	Structural Concrete - In situ concrete ST - ST1	18.00	m3	0	HE Carbon Tool: Bulk Material > Ready mix concrete > C6/8 (Gen 0, ST1)
		Penny-Come-Quick Underbridge	Horizontal Formwork	30.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Penny-Come-Quick Underbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	36.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Penny-Come-Quick Underbridge	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	6.48	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
		Penny-Come-Quick Underbridge	Structures - Road Restraint Systems excluding safety fencing - Vehicle parapets	36.00	m	Assume the road restraint system excluding safety fencing is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
			Pavement				
		Penny-Come-Quick Underbridge	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	25.92	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
		Penny-Come-Quick Underbridge	Pavements - Surface course - Close graded macadam - Thin - In carriageway, hardshoulder and hardstrip 14mm agg, 60PSV	21.60	m3	1. Assume the density of surface course is 2300 kg/m3 2. Assume the close graded macadam as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
		Penny-Come-Quick Underbridge	Traffic Signs And Road Markings - Laying - Continuous lines	36.00	m	1. Assume the road marking paint is thermoplastic 2. Assume the width of road continuous marking is 150mm 3. Assume the thickness of thermoplastic marking is 2mm 4. Assume the density thermoplastic road marking is 2150 kg/m3	1. Width of the road marking: Traffic Signs Manual > Chapter 5 Road Marking > Table 4-5 Edge of carriageway markings: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223667/traffic-signs-manual-chapter-05.pdf 2. Density of the paint: http://www.alharamain.com/prod01.htm 3. HE Carbon tool: Road pavement > Road marking > Thermoplastic road marking
		Penny-Come-Quick Underbridge	Traffic Signs And Road Markings - Laying - Intermittent lines	36.00	m	1. Assume the road marking paint is thermoplastic 2. Assume the length of road marking lines excludes the blank spaces between lines 3. Assume the width of intermittent marking is 200mm 4. Assume the thickness of thermoplastic marking is 2mm 5. Assume the density thermoplastic road marking is 2150 kg/m3	0
			Sub Total				#N/A
S-14 & 15			Tresawsen Underbridge				
			Bridge Name:				

ARUP	Job No.	Sheet No.	Rev.
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	Member/Location		
Job Title: A30 Chiverton to Carland Cross	Drg. Ref.		
Calculation	Made by: CL	Date: 18/07/2018	Chkd: TABF

Section No	Item Code	Item Category	Description	Qty	Units	Assumptions	Refs
			Pile Foundations				
		Tresawsen Underbridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Establishment of piling plant - of bored cast-in-place piles	1.00	no	Assume establishment of piling plant has no carbon emission	0
		Tresawsen Underbridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Moving piling plant - Of bored cast-in-place piles	22.00	no	Assume moving piling plant has no carbon emission	0
		Tresawsen Underbridge	Piling And Embedded Retaining Walls - Cast in Place Piles - Vertical - >600mm dia but <=900 mm dia	209.94	m3	1. Assume the concrete type is C32/40 2. Assume the diameter of the pile is 900mm 3. Assume the density of concrete is 2400 kg/m3	HE Carbon Tool: Bulk Materials > Ready mix concrete > C32/40
		Tresawsen Underbridge	Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel bar reinforcement nominal size - 12mm<dia.<=25mm, >12m in length	25.19	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Tresawsen Underbridge	Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel helical reinforcement nominal size: 12mm< dia <=25mm	8.40	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
			Abutment				
		Tresawsen Underbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	540.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Tresawsen Underbridge	Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2 sulphate resisting	162.00	m3	Assume the type of concrete is C32/40	HE Carbon Tool: Bulk Material > Ready mix concrete > C32/40
		Tresawsen Underbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	25.92	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Earthworks	Earthworks - Imported acceptable material other than class 6F - Free Draining Fill to Structures	81.00	m3		
		Earthworks	Earthworks - Imported acceptable material other than class 6F - Fill to Structures (Class 6)	1,080.00	m3		
			Bridge Deck and Base				
		Tresawsen Underbridge	Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	252.00	m3	Assume the type of concrete is C40/50	HE Carbon Tool: Bulk Material > Ready mix concrete > C40/50
		Tresawsen Underbridge	Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: >12m in length	40.32	t	0	HE Carbon Tool: Bulk Material >Reinforcement steel > Steel bar and rod
		Tresawsen Underbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	28.80	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Tresawsen Underbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Horizontal more than 300mm wide	360.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Tresawsen Underbridge	Waterproofing For Concrete Structures - Waterproofing with mastic asphalt or proprietry waterproofing system >300mm wide horizontal or at any inclination <= 30 deg to the horizontal	360.00	m2	1. Assume the thickness of waterproofing layer is 20mm 2. Assume the waterproofing is equivalent to Bitumen in carbon emission	HE Carbon tool: Road Pavement > Bitumen / surface treatment > General bitumen
		Tresawsen Underbridge	Kerbs, Footways And Paved Areas - Combined drainage and kerb blocks	36.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
		Tresawsen Underbridge	Structural Concrete - In situ concrete ST - ST1	18.00	m3	0	HE Carbon Tool: Bulk Material > Ready mix concrete > C6/8 (Gen 0, ST1)
		Tresawsen Underbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Horizontal more than 300mm wide	30.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Tresawsen Underbridge	Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	24.00	m2	1. Assume the formwork is made of plywood 2. Assume the thickness is formwork is 20mm	HE Carbon Tool: Civil Structure > Formwork / Shuttering > Plywood
		Tresawsen Underbridge	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	2.16	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
		Tresawsen Underbridge	Structures - Road Restraint Systems excluding safety fencing - Vehicle parapets	24.00	m	Assume the road restraint system excluding safety fencing is equivalent to Steel RRS barrier double sided in carbon emission	HE Carbon tool: Fencing > Road Restraint System / Safety Barrier > Steel RRS barrier double sided
			Pavement				0
		Tresawsen Underbridge	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	21.60	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
		Tresawsen Underbridge	Pavements - Surface course - Close graded macadam - Thin - In carriageway, hardshoulder and hardstrip 14mm agg, 60PSV	18.00	m3	1. Assume the density of surface course is 2300 kg/m3 2. Assume the close graded macadam as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
		Tresawsen Underbridge	Traffic Signs And Road Markings - Laying - Continuous lines	24.00	m	1. Assume the road marking paint is thermoplastic 2. Assume the width of road continuous marking is 150mm 3. Assume the thickness of thermoplastic marking is 2mm 4. Assume the density thermoplastic road marking is 2150 kg/m3	1. Width of the road marking: Traffic Signs Manual > Chapter 5 Road Marking > Table 4-5 Edge of carriageway markings: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223667/traffic-signs-manual-chapter-05.pdf 2. Density of the paint: http://www.alharamain.com/prod01.htm 3. HE Carbon tool: Road pavement > Road marking > Thermoplastic road marking
		Tresawsen Underbridge	Traffic Signs And Road Markings - Laying - Intermittent lines	24.00	m	1. Assume the road marking paint is thermoplastic 2. Assume the length of road marking lines excludes the blank spaces between lines 3. Assume the width of intermittent marking is 200mm 4. Assume the thickness of thermoplastic marking is 2mm 5. Assume the density thermoplastic road marking is 2150 kg/m3	0
			Sub Total				#N/A
W			ACCOMMODATION WORKS				
			New Field Access				0
	W.1	Accommodation	Fencing - Steel gate - Double	26.00	no.	Assume the mass of one double steel gate is 500kg	1. Reference document: mass of the double steel gate: K-Scroll Steel Gate Specification 2. Bath Inventory of Carbon and Energy (ICE) database: Steel > General Steel
	W.2	Accommodation	Kerbs, Footways And Paved Areas - Kerbs - Precast Concrete - Curved not exceeding 12m radius	104.00	m	Assume the type of kerb is Pre-cast concrete 125*305mm (the most conservative option)	HE Carbon Tool: Road Pavement > Kerb > Pre-cast concrete 125x305mm
	W.3	Accommodation	Pavements - Sub-base Cement Bound granular mixtures: In carriageway, hardshoulder and hardstrip	312.00	m3	1. Assume the sub-base Cement Bound granular mixtures is equivalent to natural aggregate 2. Assume the density of subbase type 1 is 2400 kg/m3	1. HE Carbon Tool: Bulk Material > Fill and aggregate> General fill/aggregate 2. Aggregate density: "Aggregate for Concrete" for concrete
			Access Roads				
	W.4	Accommodation	Pavements - Sub-base type 1 unbound mixture: In carriageway, hardshoulder and hardstrip	11,088.00	m3	1. Assume the subbase type 1 is equivalent to natural aggregate 2. Assume the density of subbase type 1 is 2000 kg/m3	1. HE Carbon Tool: Bulk Material > Fill and aggregate> General fill/aggregate 2. Aggregate density: HE Carbon Tool > Material Density > Quarried/Recycled aggregate
	W.5	Accommodation	Pavements - Base - Dense bitumen macadam (DBM50): In carriageway, hardshoulder and hardstrip	1,280.00	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
	W.6	Accommodation	Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	480.00	m3	1. Assume the density of dense bitumen macadam is 2300 kg/m3 2. Assume the dense bitumen macadam (DBM50) has same carbon factor as Asphalt, 6% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 6% binder content
	W.7	Accommodation	Pavements - Surface course - Close graded macadam - Thin - In carriageway, hardshoulder and hardstrip 10mm agg, 60PSV	320.00	m3	1. Assume the density of close graded macadam is 2300 kg/m3 2. Assume the close graded macadam (DBM50) has same carbon factor as Asphalt, 8% binder content	1. Density of bitumen: http://www.rjcsolutions.com/calculators/grav-den.htm 2. Bath Inventory of Carbon and Energy (ICE) database: Asphalt > Asphalt, 8% binder content
			New Access Bridge				
	NOT WBS	Accommodation	Mainline bridge over road	120.00	m2		1.From the CO2 emissions graph of Lynsay Hughes' PhD, the overbridge carbon emission value is calculated by averaging the over-bridge1&2 data [(1.7+1.35)/2=1.525tonnes/m2 deck] 2.The CO2 emission values only include material and transportation CO2 emissions values (excluded construction factor) 3.The CO2 emission factor includes CO2 produced from transport 4. Reference method: Lynsay Hughes' PhD thesis 5. Reference dimension email: RE: Draft Summary for environmental 5 [17/01/2018 from Lucy Stephenson to Pearson Ltd
			Other Elements				
	0300.10.0 0.35.00.0 00.	Accommodation	Fencing - Timber post and rail fence - 1.2m high, 4 rail	500.00	metre		HE Carbon tool: Fencing > Fence > Timber rail fence [all types, includes posts]
		Accommodation	Private Water supplies	4.00	no	Assume there is no material carbon emssion in private water supplies	
		Accommodation	Cattle Corral	1.00	no.	1. Assume the total fencing length required for Cattle Corral is 20 m 2. Assume Cattle Corral is a type of steel/wire/chain fence [includes posts]	HE Carbon tool: Fencing > Fence > Steel/wire/chain fence [includes posts]

If you need help accessing this or any other Highways England information, please call **0300 123 5000** and we will help you.

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