

# A428 Black Cat to Caxton Gibbet improvements

TR010044

Volume 9

9.52 Construction Phase Greenhouse Gas Emissions

Planning Act 2008

Rule 8(1)(k)

Infrastructure Planning (Examination Procedure) Rules  
2010

January 2022

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning (Examination Procedure)  
Rules 2010**

**A428 Black Cat to Caxton Gibbet  
improvements  
Development Consent Order 202[ ]**

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**9.52 Construction Phase Greenhouse Gas Emissions**

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## Table of contents

<b>Chapter</b>	<b>Pages</b>
<b>1 Introduction</b>	<b>1</b>
<b>2 Methodology</b>	<b>2</b>
<b>3 Data and information sources</b>	<b>3</b>
3.1 Land use change	3
3.2 Construction materials	3
3.3 Construction activity	5
3.4 Summary	6
<b>Appendix A – Construction Material Details</b>	

### Table of Tables

Table 3-1 Summary of construction materials and embodied carbon .....	3
Table 3-2 Summary of the construction phase carbon footprint.....	6

# 1 Introduction

- 1.1.1 This technical note, was initially prepared to support a response made in the Applicant's comments on other parties' responses to the First Round of Written Questions **[REP3-007]** relating to more detail being made available for the carbon construction assessment (response to comments made by Cambridgeshire County Council, Huntingdonshire District Council and South Cambridgeshire District Council **[REP1-051]**, regarding Q1.4.1.1, section e).
- 1.1.2 During the Deadline 3 submission of responses to Relevant Representations, the Applicant committed to "*providing a Technical Note providing a detailed breakdown of construction carbon emissions for Deadline 4*" in regards to Chapter 14, Climate **[APP-083]** of the Environmental Statement.
- 1.1.3 This Technical Note provides information on the methodology and data used to calculate the total carbon emissions associated with the construction phase of the Scheme.
- 1.1.4 This note has been updated at Deadline 9 in response to comments received from the Cambridgeshire Authorities **[REP8-032co]** with regard to differences in habitat areas presented in the Land Use Carbon Calculations **[REP-048]** and in the Biodiversity Net Gain (BNG) calculations **[REP3-013]**.
- 1.1.5 Several small discrepancies arose mainly because the habitat types in the Carbon Land Use Calculator do not always directly align with those in the BNG Calculator. As such, professional judgement was used when transposing habitat areas from the BNG calculator to the most applicable habitat type in the Land Use Carbon Calculator. Following comments received from the Cambridgeshire Authorities an exercise was undertaken to reassign habitat types in the Land Use Carbon Calculator so that the two data sets align. Additionally, there was a calculation error found when converting kilometres of tree line from the BNG Calculator into hectares of a similar tree type in the Land Use Carbon Calculator.
- 1.1.6 This has now been corrected.
- 1.1.7 As a result of these changes to the Land Use Carbon Calculations, carbon sequestration capacity of the project has reduced from 13,061tCO<sub>2</sub> to 13,036 tCO<sub>2</sub>e, a reduction of 0.2%.
- This change in the Land Use Carbon Calculation does not impact the BNG Calculation.

## 2 Methodology

The approach for calculating the carbon emissions were informed by the Design Manual for Roads and Bridges LA 114 Climate<sup>1</sup>, which is produced by National Highways.

2.1.1 The scope, boundary and data quality principles of the assessment was influenced by The World Business Council for Sustainable Development and World Resources Institutes' Greenhouse Gas (GHG) Protocol<sup>2</sup> and the British Standards Institutions' PAS 2080:2016 Carbon Management in Infrastructure<sup>3</sup>.

2.1.2 GHG emissions from construction were calculated using National Highways Carbon Reporting Tool<sup>4</sup>. The tool sources emission factors for fuel use and transportation from those published by the Department for Business, Energy and Industrial Strategy<sup>5</sup>. The tool uses emissions factors for embodied carbon in materials from the Inventory of Carbon and Energy (ICE) v.3 published by Circular Ecology<sup>6</sup>.

2.1.4 Carbon stock values were calculated using guidance from the European Commission<sup>7</sup>. This method assumes post-work habitats that are created through landscaping or remediation will have carbon values that represent their final intended habitat state. In reality, these carbon values will not be fully attained during the construction phase but will continue to gain carbon as plants and trees mature throughout the operational period.

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<sup>1</sup> Design Manual for Roads and Bridges (2019). LA 114 Climate [has since been revised in June 2021]

<sup>2</sup> Greenhouse Gas Protocol Corporate Accounting and Reporting Standard. World Resources Institute and World Business Council for Sustainable Development (2015).

<sup>3</sup> Design Manual for Roads and Bridges. Highways England (2019 – 2020).

<sup>4</sup> Carbon Reporting Tool, v2.2. Highways England (2019).

<sup>5</sup> Conversion factors for company reporting of greenhouse gas emissions

<sup>7</sup> Official Journal of the European Union (2010). Commission Decision of 10 June 2010 on guidelines for the calculation of land carbon stocks for the purpose of Annex V to Directive 2009/28/EC. Available: [redacted]

### 3 Data and information sources

#### 3.1 Land use change

3.1.1 Data and information on baseline and post-works habitat types and areas were taken from Deadline 3 Submission – 9.25 Biodiversity Net Gain: Metric 2 [REP3-012]. Habitat areas were multiplied by the ‘above and below-ground’ carbon stock values (termed “C Veg”) to calculate the total tonnes of carbon. C Veg was converted to carbon dioxide by multiplying the ratio of the molecular weight of carbon dioxide to that of carbon (44/12).

The changes in carbon values through land use change do not include that associated with soil carbon due to uncertainties in the current and future management and input of these habitats.

3.1.2

#### 3.2 Construction materials

3.2.1 Emissions associated with materials and their transport were calculated within the National Highways Carbon Reporting Tool with the following material types, weight and emission factors. A summary of the materials types, their weight and the emission factor used to calculate the embodied carbon of the materials are summarised in **Table 3-1**, with the full material data appended to this Technical Note.

**Table 3-1 Summary of construction materials and embodied carbon**

Material Type	Weight (tonnes)	Emission Factor (tCO <sub>2</sub> e per tonnes of material)	Total Embodied Carbon per Material Type (tCO <sub>2</sub> e)
Aggregate and sand	1,388,839	0.007	9,722
Asphalt	570,964	0.055	31,403
Soil	9,917	0.058	575
Concrete- for bridges	778	0.065	51
Concrete- ready mix, and pre-cast general concrete	15,371	0.103	1,583
Concrete- precast structural concrete, for beams, drainage and box culverts	129,754	0.122	15,830
Concrete- precast for kerbs	10,599	0.132	1,399

A428 Black Cat to Caxton Gibbet improvements  
Construction Phase Greenhouse Gas Emissions

Material Type	Weight (tonnes)	Emission Factor (tCO <sub>2</sub> e per tonnes of material)	Total Embodied Carbon per Material Type (tCO <sub>2</sub> e)
Concrete- precast for pipe culverts	3,027	0.18	545
Concrete- precast for piles	48,922	0.249	12,182
Concrete- structural concrete for formwork	736	0.54	397
Manholes	3	0.205	1
Bitumen and surfacing—pavement tack coat	1,074	0.222	238
Bitumen and surfacing—high friction surfacing	>1	5.7	0.51
Timber	921	0.263	242
Steel- structural steelwork	13,568	1.55	21,030
Steel- steel bars and rods	9,578	1.99	19,060
Steel-for gantries, fencing, handrails, and road restraints	1,822	2.76	5,029
Steel-drainage pipework	10	3.02	30
Cables	580	1.86	1,079
Plastic- HDPE for drainage pipework	990	2.52	2,495
Plastic- Polypropylene for band drains	6,441	3.37	21,706
Geotextile	24	2.54	61
Copper	<1	2.71	0.87
Aluminium	90	6.67	600
	17	3.2	54

Material Type	Weight (tonnes)	Emission Factor (tCO <sub>2</sub> e per tonnes of material)	Total Embodied Carbon per Material Type (tCO <sub>2</sub> e)
Miscellaneous (e.g. signs, camera's, oily water separator, posts, road studs etc.)	3	3.31	10
	5	4.323	22
	13	8.1	105
Paint	16	3.76	60
<b>TOTAL</b>	<b>2,214,062</b>		<b>145,511</b>

3.2.2 Transportation distances of materials were determined by material type and provided by the Applicant's delivery partner. A round trip distance of between 11 and 214km was used, with a National Highways Carbon Reporting Tool of 0.0001128 tCO<sub>2</sub>e per tonne per km.

3.2.3 The emissions factors used were sourced from the Department of Business, Energy and Industrial Strategy's Government conversion factors for company reporting of greenhouse gas emissions<sup>8</sup> and the Inventory for Carbon and Energy Database<sup>9</sup>.

### 3.3 Construction activity

3.3.1 Data on plant to be used during construction was based on information contained within Chapter 11, Noise and Vibration [APP-080] of the Environmental Statement. Firstly, kWh for each plant type was calculated by multiplying together the plant's likely power rating (e.g. 250kw), with the number of plant and the total hours the plant will be run for. The total kWh was then multiplied by an emission factor to ascertain the carbon emissions, in this case, an emission factor for 100% mineral diesel (GCV) including well-to-tank.

3.3.2 Construction worker commuting was also included in the total calculation for this phase and was based upon information from the Principal Contractor . In total, throughout the duration of construction 500,000 commutes were estimated to be undertaken by vehicle, assuming a round trip distance of 50km. Emissions are then calculated by multiplying the total distance covered by an emission factor, in this case, an emission factor for average business travel.

3.3.3 Transportation of waste material from site to a waste treatment facility was included in the total calculation for this phase, which included waste volumes from any initial demolition and then wastes generated throughout subsequent construction that could not be used on site. It was determined that 71,051 tonnes from demolition and 395 tonnes from construction would be taken off-site. Volumes of wastes for off-site treatment or disposal were provided by the

<sup>8</sup> Government conversion factors for company reporting of greenhouse gas emissions. Department for Environment, Food and Rural Affairs and the Department of Business, Energy and Industrial Strategy (2020).

<sup>9</sup> Inventory of Carbon and Energy Database (Version 3). Sustainable Energy Research Team, Department of Mechanical Engineering, University of Bath, UK (2019).



Applicant’s delivery partner. To calculate the emissions, the total tonnage of waste was multiplied by a transportation emission factor, in this case, an emission factor from the National Highways Carbon Reporting Tool for a round trip travel distance of 50km.

3.3.4 Treatment and disposal of waste materials was included in the total calculation for this phase using recycling and landfill targets proposed by the Applicant’s delivery partner. To calculate the emissions, the total waste type for each disposal method was multiplied by a corresponding waste disposal emission factor, in this case, an emission factor from the National Highways Carbon Reporting Tool.

### 3.4 Summary

3.4.1 **Table 3-2** provides a summary of GHG emissions from the construction of the Scheme. Biodiversity Net Gain calculations have been revised since the publication of Appendix 8.19 – Biodiversity Net Gain **[APP-206]** of the Environmental Statement, the subsequent carbon stocks have been amended.

3.4.2 Due to discrepancies identified by the Cambridgeshire Authorities with regard to the area of habitat types presented in the revised Land Use Carbon Tool and in the BGN Calculator **[REP8-032co]** the data presented in the Carbon Land Use Calculator has been reviewed and updated.

3.4.3 The habitat areas in the carbon tool now align with the BNG Calculator. As a result of these changes to the Land Use Carbon Calculations, carbon sequestration capacity of the project has reduced from 13,061tCO<sub>2</sub> to 13,036 tCO<sub>2</sub>e, a reduction of 0.2%. This change in the Land Use Carbon Calculation  
3.4.4 does not impact the BNG Calculation.

3.4.5 The original post-development value of the carbon stocks was estimated as a net sequestration of 5,850 tCO<sub>2</sub>e over the appraisal period of the Scheme (60 years from opening). The emission totals and percentage contributions have been updated accordingly.

Embodied carbon in construction materials accounts for the greatest proportion of construction emissions.

**Table 3-2 Summary of the construction phase carbon footprint**

Reporting Category	Emissions (tCO <sub>2</sub> e)	% Contribution
Land clearance (net balance)	-13,037	-6.5%
Embodied carbon in materials	145,511	72.3%
Transportation of materials	17,720	8.8%
Fuel use (plant/equipment)	45,210	22.5%
Worker travel	4,430	2.2%

A428 Black Cat to Caxton Gibbet improvements  
Construction Phase Greenhouse Gas Emissions

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<b>Reporting Category</b>	<b>Emissions (tCO<sub>2</sub>e)</b>	<b>% Contribution</b>
Transport of construction waste	1,180	0.6%
Disposal of construction waste	180	Less than 1%
<b>Total</b>	<b>201,194</b>	<b>100%</b>

## Appendix A – Construction Material Details

Description	Activity data	Conversion Factor (Density)		Mass (t)	Carbon Factor	
		Units	CF (t/unit)		EF (tCO2e/t)	Emissions (tCO2e)
150mm Perforated pipe in back of Wall drainage	8,286.80	m	0.0024	19.89	2.52	50.12
150mm unreinforced Concrete	3,026.00	m3	2.4	7,262.40	0.103	748.03
20mm dense binder course asphalt concrete	2,464.00	m3	2.322	5,721.41	0.055	314.68
6mm dense asphalt concrete surface course	998.00	m3	2.322	2,317.36	0.055	127.45
Band Drains	292,765.00	m	0.022	6,440.83	3.37	21,705.60
Bespoke Chamber below Bridge Deck	8.00	No.	0.3257	2.61	0.205	0.53
Box Culvert - Single Cell, 1200 span x 1200 high	1,011.08	tonnes	1	1,011.08	0.122	123.35
Box Culvert - Single Cell, 1500 span x 1500 high	736.44	tonnes	1	736.44	0.122	89.85
Box Culvert - Single Cell, 1800 span x 1200 high	75.98	tonnes	1	75.98	0.122	9.27
Box Culvert - Single Cell, 1800 span x 1800 high	13.10	tonnes	1	13.10	0.122	1.60
Box Culvert - Single Cell, 2000 span x 2000 high	251.79	tonnes	1	251.79	0.122	30.72
Box Culvert - Single Cell, 2400 span x 1200 high	72.38	tonnes	1	72.38	0.122	8.83
Box Culvert - Single Cell, 2400 span x 1800 high	189.66	tonnes	1	189.66	0.122	23.14
Box Culvert - Single Cell, 2700 span x 1200 high	64.53	tonnes	1	64.53	0.122	7.87
Box Culvert - Single Cell, 3000 span x 3000 high	790.53	tonnes	1	790.53	0.122	96.45
Box Culvert - Single Cell, 3500 span x 1500 high	231.73	tonnes	1	231.73	0.122	28.27
Box culvert headwall - Single Cell, 1200 span x 1200 high	42.00	tonnes	1	42.00	0.122	5.12
Box culvert headwall - Single Cell, 1500 span x 1500 high	17.08	tonnes	1	17.08	0.122	2.08
Box culvert headwall - Single Cell, 1800 span x 1800 high	11.40	tonnes	1	11.40	0.122	1.39
Box culvert headwall - Single Cell, 2400 span x 1200 high	7.90	tonnes	1	7.90	0.122	0.96
Box culvert headwall - Single Cell, 2400 span x 1800 high	11.20	tonnes	1	11.20	0.122	1.37
Box culvert headwall - Single Cell, 3000 span x 3000 high	50.10	tonnes	1	50.10	0.122	6.11
Box culvert headwall - Single Cell, 3500 span x 1500 high	12.00	tonnes	1	12.00	0.122	1.46
Bridge Deck unit	10.36	tonnes	1	10.36	3.02	31.27
Cantilever Gantry	7.00	No.	11.5	80.50	2.76	222.18
Downstream Defender	224.20	tonnes	1	224.20	0.18	40.36
Drainage - Chambers & Gullies - Precast Concrete Chambers - <=1050mm dia - Depth to uppermost surface of base slab >1.5 but <=2.5m (1050mm dia)	349.53	tonnes	1	349.53	0.122	42.64
Drainage - Chambers & Gullies - Precast Concrete Chambers - <=1050mm dia - Depth to uppermost surface of base slab >1.5 but <=2.5m (600mm dia)	173.24	tonnes	1	173.24	0.122	21.14
Drainage - Chambers & Gullies - Precast Concrete Chambers - <=1050mm dia - Depth to uppermost surface of base slab >2.5 but <=4.0m (600mm dia)	13.66	tonnes	1	13.66	0.122	1.67
Drainage - Chambers & Gullies - Precast Concrete Chambers - <=1050mm dia - Depth to uppermost surface of base slab not exceeding 1.5 (1050mm dia)	37.82	tonnes	1	37.82	0.122	4.61
Drainage - Chambers & Gullies - Precast Concrete Chambers - <=1050mm dia - Depth to uppermost surface of base slab not exceeding 1.5 (600mm dia)	70.27	tonnes	1	70.27	0.122	8.57
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1050mm dia but <=1200mm dia - Depth to uppermost surface of base slab >1.5m but <=2.5m (1200mm dia)	1,228.50	tonnes	1	1,228.50	0.122	149.88
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1050mm dia but <=1200mm dia - Depth to uppermost surface of base slab >1.5m but <=2.5m (1200mm dia) + V Grating	129.87	tonnes	1	129.87	0.122	15.84
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1050mm dia but <=1200mm dia - Depth to uppermost surface of base slab >2.5m but <=4.0m (1200mm dia)	129.17	tonnes	1	129.17	0.122	15.76
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1050mm dia but <=1200mm dia - Depth to uppermost surface of base slab not exceeding 1.5m (1200mm dia)	269.57	tonnes	1	269.57	0.122	32.89
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1200mm dia but <=1500mm dia - Depth to uppermost surface of base slab >1.5m but <=2.5m (1350mm dia)	376.00	tonnes	1	376.00	0.122	45.87
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1200mm dia but <=1500mm dia - Depth to uppermost surface of base slab >1.5m but <=2.5m (1350mm dia) + V Grating	24.00	tonnes	1	24.00	0.122	2.93
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1200mm dia but <=1500mm dia - Depth to uppermost surface of base slab >1.5m but <=2.5m (1500mm dia)	1,005.76	tonnes	1	1,005.76	0.122	122.70
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1200mm dia but <=1500mm dia - Depth to uppermost surface of base slab >2.5m but <=4.0m (1350mm dia)	12.80	tonnes	1	12.80	0.122	1.56
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1200mm dia but <=1500mm dia - Depth to uppermost surface of base slab >2.5m but <=4.0m (1500mm dia)	308.91	tonnes	1	308.91	0.122	37.69
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1200mm dia but <=1500mm dia - Depth to uppermost surface of base slab not exceeding 1.5m (1350mm dia)	7.20	tonnes	1	7.20	0.122	0.88
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1200mm dia but <=1500mm dia - Depth to uppermost surface of base slab not exceeding 1.5m (1500mm dia)	37.72	tonnes	1	37.72	0.122	4.60
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1500mm dia but <=1800mm dia - Depth to uppermost surface of base slab <=2.5m (1800mm dia)	443.30	tonnes	1	443.30	0.122	54.08
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1500mm dia but <=1800mm dia - Depth to uppermost surface of base slab >2.5m but <=4.0m (1800mm dia)	250.25	tonnes	1	250.25	0.122	30.53
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1800mm dia but <=2100mm dia - Depth to uppermost surface of base slab >2.5m but <=4.0m (2100mm dia)	344.80	tonnes	1	344.80	0.122	42.07
Drainage - Chambers & Gullies - Precast Concrete Chambers - >1800mm dia but <=2100mm dia - Depth to uppermost surface of base slab <=2.5m (2100mm dia)	137.92	tonnes	1	137.92	0.122	16.83
Drainage - Chambers & Gullies - Precast Concrete Chambers - >2100mm dia but <=2400mm dia - Depth to uppermost surface of base slab <=4.0m (3000mm dia)	226.77	tonnes	1	226.77	0.122	27.67
Drainage - Chambers & Gullies - Precast Concrete Chambers - >2100mm dia but <=2400mm dia - Depth to uppermost surface of base slab >4.0m (3000mm dia)	17.44	tonnes	1	17.44	0.122	2.13
Drainage - Drains - Diameter <300mm - In trench: Depth to invert <=1.5m (150mm dia)	390.00	m	0.0024	0.94	2.52	2.36
Drainage - Drains - Diameter <300mm - In trench: Depth to invert <=1.5m (225mm dia)	3,237.70	m	0.0042	13.60	2.52	34.27
Drainage - Drains - Diameter <300mm - In trench: Depth to invert >1.5m but <=2.5m (150mm dia)	225.00	m	0.0024	0.54	2.52	1.36
Drainage - Drains - Diameter <300mm - In trench: Depth to invert >1.5m but <=2.5m (225mm dia)	7,078.00	m	0.0042	29.73	2.52	74.91
Drainage - Drains - Diameter <300mm - In trench: Depth to invert >2.5m but <=4m (225mm dia)	456.00	m	0.0042	1.92	2.52	4.83
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert <=1.5m (300mm dia)	1,178.00	m	0.0075	8.84	2.52	22.26
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert <=1.5m (375mm dia)	31.00	m	0.0093	0.29	2.52	0.73
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert <=1.5m (450mm dia)	156.00	m	0.0112	1.75	2.52	4.40
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert <=1.5m (525mm dia)	240.00	m	0.0158	3.79	2.52	9.56
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >1.5m but <=2.5m (300mm dia)	8,401.00	m	0.0075	63.01	2.52	158.78
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >1.5m but <=2.5m (375mm dia)	5,095.00	m	0.0093	47.38	2.52	119.41
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >1.5m but <=2.5m (450mm dia)	7,243.00	m	0.0112	81.12	2.52	204.43
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >1.5m but <=2.5m (525mm dia)	5,017.00	m	0.0158	79.27	2.52	199.76
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >2.5m but <=4m (300mm dia)	310.00	m	0.0075	2.33	2.52	5.86
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >2.5m but <=4m (375mm dia)	318.00	m	0.0093	2.96	2.52	7.45
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >2.5m but <=4m (450mm dia)	541.00	m	0.0112	6.06	2.52	15.27
Drainage - Drains - Diameter >=300mm but <600mm - In trench: Depth to invert >2.5m but <=4m (525mm dia)	190.00	m	0.0158	3.00	2.52	7.57
Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert <=1.5m (600mm dia)	310.00	m	0.0205	6.36	2.52	16.01
Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert <=1.5m (750mm dia)	89.00	m	0.0326	2.90	2.52	7.31
Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert <=1.5m (825mm dia)	26.00	m	0.0247	0.64	2.52	1.62
Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert >1.5m but <=2.5m (600mm dia)	2,125.00	m	0.0205	43.56	2.52	109.78
Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert >1.5m but <=2.5m (675mm dia)	1,023.00	m	0.0217	22.20	2.52	55.94

Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert >1.5m but <=2.5m (750mm dia)	851.00	m	0.0326	27.74	2.52	69.91
Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert >1.5m but <=2.5m (825mm dia)	289.00	m	0.0247	7.14	2.52	17.99
Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert >2.5m but <=4m (600mm dia)	390.00	m	0.0205	8.00	2.52	20.15
Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert >2.5m but <=4m (675mm dia)	1,066.00	m	0.0217	23.13	2.52	58.29
Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert >2.5m but <=4m (750mm dia)	614.00	m	0.0326	20.02	2.52	50.44
Drainage - Drains - Diameter >=600mm but <900mm - In trench: Depth to invert >2.5m but <=4m (825mm dia)	316.00	m	0.0247	7.81	2.52	19.67
Drainage - Drains - Diameter >=900mm but <1200mm - In trench: Depth to invert <=1.5m - (900mm dia)	446.00	m	0.0447	19.94	2.52	50.24
Drainage - Drains - Diameter >=900mm but <1200mm - In trench: Depth to invert >1.5m but <=2.5m - (1050mm dia)	81.00	m	0.0595	4.82	2.52	12.15
Drainage - Drains - Diameter >=900mm but <1200mm - In trench: Depth to invert >1.5m but <=2.5m - (900mm dia)	580.00	m	0.0447	25.93	2.52	65.33
Drainage - Drains - Diameter >=900mm but <1200mm - In trench: Depth to invert >2.5m but <=4m - (1050mm dia)	12.00	m	0.0595	0.71	2.52	1.80
Drainage - Drains - Diameter >=900mm but <1200mm - In trench: Depth to invert >2.5m but <=4m - (900mm dia)	1,053.00	m	0.0447	47.07	2.52	118.61
Drainage - Drains - Filter Drains - Filter material contiguous with filter drain - Type A	7,096.80	tonnes	1	7,096.80	0.007	49.68
Drainage - Drains - Filter Drains - Filter material contiguous with filter drain - Type B	13,509.60	tonnes	1	13,509.60	0.007	94.57
Drainage - Drains - Filter Drains - Sub-base material	1,584.00	tonnes	1	1,584.00	0.007	11.09
Drainage - Drains - Narrow Filter Drains	86,547.00	m	0.0024	207.71	2.52	523.44
Drainage - Filter Drains - Diameter <300mm - In trench: Depth to invert <=1.5m - (225mm dia)	451.00	m	0.0042	1.89	2.52	4.77
Drainage - Filter Drains - Diameter <300mm - In trench: Depth to invert >1.5m but <=2.5m - (225mm dia)	2,179.00	m	0.0042	9.15	2.52	23.06
Drainage - Filter Drains - Diameter <300mm - In trench: Depth to invert >2.5m but <=4m - (225mm dia)	51.00	m	0.0042	0.21	2.52	0.54
Drainage - Filter Drains - Diameter >=300 but <600mm - In trench: Depth to invert <=1.5m - (300mm dia)	133.00	m	0.0075	1.00	2.52	2.51
Drainage - Filter Drains - Diameter >=300 but <600mm - In trench: Depth to invert <=1.5m - (450mm dia)	47.00	m	0.0112	0.53	2.52	1.33
Drainage - Filter Drains - Diameter >=300 but <600mm - In trench: Depth to invert >1.5m but <=2.5m - (300mm dia)	996.00	m	0.0075	7.47	2.52	18.82
Drainage - Filter Drains - Diameter >=300 but <600mm - In trench: Depth to invert >1.5m but <=2.5m - (375mm dia)	898.00	m	0.0093	8.35	2.52	21.05
Drainage - Filter Drains - Diameter >=300 but <600mm - In trench: Depth to invert >1.5m but <=2.5m - (450mm dia)	762.00	m	0.0112	8.53	2.52	21.51
Drainage - Filter Drains - Diameter >=300 but <600mm - In trench: Depth to invert >2.5m but <=4m - (375mm dia)	184.00	m	0.0093	1.71	2.52	4.31
Drainage - Filter Drains - Diameter >=300 but <600mm - In trench: Depth to invert >2.5m but <=4m - (450mm dia)	342.00	m	0.0112	3.83	2.52	9.65
Drainage - Filter Drains - Diameter >Drainage - Filter Drains - Diameter >=600 but <900mm - In trench: Depth to invert <=1.5m - (600mm dia)	35.00	m	0.0205	0.72	2.52	1.81
Drainage - Filter Drains - Diameter >Drainage - Filter Drains - Diameter >=600 but <900mm - In trench: Depth to invert >1.5m but <=2.5m - (600mm dia)	152.00	m	0.0205	3.12	2.52	7.85
Drainage - Filter Drains - Diameter >Drainage - Filter Drains - Diameter >=600 but <900mm - In trench: Depth to invert >1.5m but <=2.5m - (675mm dia)	107.00	m	0.0217	2.32	2.52	5.85
Drainage - Filter Drains - Diameter >Drainage - Filter Drains - Diameter >=600 but <900mm - In trench: Depth to invert >2.5m but <=4m - (675mm dia)	71.00	m	0.0217	1.54	2.52	3.88
Drainage - Headwalls - In reinforced concrete	564.00	m3	2.4	1,353.60	0.103	139.42
Earthworks - Imported acceptable material class 6F - Embankments & other areas of fill (Classes 6F1, 6F2, 6F3, 6F4 AND 6F5)	432,667.20	tonnes	1	432,667.20	0.007	3,028.67
Earthworks - Imported acceptable material other than class 6F - Embankments & other areas of fill (Classes 1,2,3,6,7 and 9)	102,739.66	tonnes	1	102,739.66	0.007	719.18
Earthworks - Imported acceptable material other than class 6F - Free Draining Fill to Structures	4,481.47	tonnes	1	4,481.47	0.007	31.37
Earthworks - Imported acceptable material other than class 6F - Reinforced earth structures (Classes 6 and 7)	38,523.41	tonnes	1	38,523.41	0.007	269.66
Electrical Work For Road Lighting And Traffic Signs - Cable & Duct	27,810.00	m	0.0024	66.74	1.86	124.14
Electrical Work For Road Lighting And Traffic Signs - Chambers	95.00	No.	4.23	401.85	2.76	1,109.11
Electrical Work For Road Lighting And Traffic Signs - Earth electrodes	0.32	tonnes	1	0.32	2.71	0.87
Electrical Work For Road Lighting And Traffic Signs - Feeder pillars	0.20	tonnes	1	0.20	2.76	0.55
Fencing - Steel gate - Double	0.81	tonnes	1	0.81	2.76	2.24
Fencing - Steel gate - Single	0.69	tonnes	1	0.69	2.76	1.90
Fencing - Timber post and rail fence	64,502.00	m	0.0142839	921.34	0.263	242.31
Geocellular tank with volume 300m3	24.00	tonnes	1	24.00	2.54	60.96
Geotextile membrane medium density Terram or similar wrapped around ends of scour protection	74.18	m2	0.000946	0.07	2.54	0.18
Grasscrete	543.50	m3	2.4	1,304.40	0.122	159.14
Half Battered Kerb	7,604.00	m	0.0431	327.73	0.132	43.26
High Friction Surfacing	74.88	litres	0.0012	0.09	5.7	0.51
Hydrobrake	8.25	tonnes	1	8.25	2.76	22.77
Imported acceptable material Class 6G in scour protection	0.30	tonnes	1	0.30	0.007	0.00
Jointed Reinforced Concrete Slabs (JRC)	5,539.20	tonnes	1	5,539.20	0.132	731.17
Kerbs, Footways And Paved Areas - Channels - In situ reinforced concrete	29,614.00	m	0.0877	2,597.15	0.132	342.82
Kerbs, Footways And Paved Areas - Combined drainage and kerb blocks	13,222.00	m	0.0877	1,159.57	0.132	153.06
Kerbs, Footways And Paved Areas - Edgings	10,566.00	m	0.0431	455.39	0.132	60.11
Kerbs, Footways And Paved Areas - Linear drainage channel systems	907.00	m	0.0877	79.54	2.52	200.45
Mainline bridge (minor)	345.60	tonnes	1	345.60	0.065	22.46
Mainline bridge over road	432.00	tonnes	1	432.00	0.065	28.08
Masonry Facing to Walls 200mm thick	962.32	m3	2.4	2,309.57	0.103	237.89
Motorways Communications and Technology - Cable and Duct	106,922.00	m	0.0024	256.61	1.86	477.30
Motorways Communications and Technology - Cable and Duct - 10mm2 non armoured	10,692.00	m	0.0024	25.66	1.86	47.73
Motorways Communications and Technology - Cable and Duct - 70mm2 non armoured	96,229.00	m	0.0024	230.95	1.86	429.57
Motorways Communications and Technology - Cable and Duct - Ducts - Non standard or specials	7,612.16	m	0.0024	18.27	2.52	46.04
Motorways Communications and Technology - Chambers	159.00	No.	0.364	57.88	0.103	5.96
Motorways Communications and Technology - Technology Equipment - Cabinet type 600 or similar - including plinths, supports and cabling / connections to and in the cabinet	11.00	No.	0.2	2.20	2.76	6.07
Motorways Communications and Technology - Technology Equipment - Cabinet type 609 or similar - including plinths, supports and cabling / connections to and in the cabinet	21.00	No.	0.2	4.20	2.76	11.59
Motorways Communications and Technology - Technology Equipment - Emergency Roadside Telephone	8.00	No.	0.2	1.60	2.76	4.42
Motorways Communications and Technology - Technology Equipment - Message Signs type MS4 - Gantry Mounted	7.00	No.	0.725	5.08	4.323	21.94
Motorways Communications and Technology - Technology Equipment - Pan, Tilt, Zoom (PTZ) camera - Junction Viewing (pole mounted)	6.00	No.	2.76	16.56	3.2	52.99
Pavements - Base - Dense bitumen macadam (DBM50): In carriageway, hardshoulder and hardstrip	168,419.00	m3	2.4	404,205.60	0.055	22,231.31
Pavements - Base course - Rolled Asphalt in carriageway, hardshoulder and hardstrip	765.00	m3	2.4	1,836.00	0.055	100.98
Pavements - Binder course - Dense bitumen macadam (DBM50) in carriageway, hardshoulder and hardstrip	31,754.00	m3	2.4	76,209.60	0.055	4,191.53
Pavements - Binder course - Dense bitumen macadam (DBM50) in central reserve	4,145.00	m3	2.4	9,948.00	0.055	547.14
Pavements - Binder course - Rolled Asphalt in carriageway, hardshoulder and hardstrip	765.00	m3	2.4	1,836.00	0.055	100.98
Pavements - Regulating course - Dense bitumen macadam (DBM50) with 20mm aggregate	445.00	m3	2.4	1,068.00	0.055	58.74
Pavements - Sub-base Cement Bound granular mixtures: In carriageway, hardshoulder and hardstrip	68,950.00	m3	2.4	165,480.00	0.007	1,158.36
Pavements - Sub-base type 1 unbound mixture	19,041.00	m3	2.4	45,698.40	0.007	319.89

Pavements - Sub-base type 1 unbound mixture: In carriageway, hardshoulder and hardstrip	224,878.00	m3	2.4	539,707.20	0.007	3,777.95
Pavements - Sub-base type 1 unbound mixture: In carriageway, hardshoulder and hardstrip (central reservation)	15,563.00	m3	2.4	37,351.20	0.007	261.46
Pavements - Surface course - Close graded macadam - Thin - In carriageway, hardshoulder and hardstrip 10mm agg, 65PSV	25,831.00	m3	2.4	61,994.40	0.055	3,409.69
Pavements - Surface course - Close graded macadam in carriageway, hardshoulder and hardstrip (central reservation)	1,638.00	m3	2.4	3,931.20	0.055	216.22
Pavements - Surface course - Rolled Asphalt in carriageway, hardshoulder and hardstrip	765.00	m3	2.4	1,836.00	0.055	100.98
Pavements - Tack Coat	1,073.93	tonnes	1	1,073.93	0.222	238.41
Penstock	3.15	tonnes	1	3.15	2.76	8.69
Permanent ground anchor with corrosion protection	17.23	tonnes	1	17.23	2.76	47.55
Piling And Embedded Retaining Walls - Cast in Place Piles - Vertical - >600mm dia but <=900 mm dia	961.89	tonnes	1	961.89	0.249	239.51
Piling And Embedded Retaining Walls - Cast in Place Piles - Vertical - >900 mm dia (1050mm diameter)	17,830.64	tonnes	1	17,830.64	0.249	4,439.83
Piling And Embedded Retaining Walls - Contiguous Bored Pile Walls - >900 mm dia; exceeding 20 metres in depth (1200mm diameter)	30,129.13	tonnes	1	30,129.13	0.249	7,502.15
Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel bar reinforcement nominal size - 12mm<dia.<=25mm, >12m in length	1,702.40	tonnes	1	1,702.40	1.99	3,387.78
Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel helical reinforcement nominal size: 12mm and under	503.94	tonnes	1	503.94	1.99	1,002.84
Piling And Embedded Retaining Walls - Reinforcement for Cast-in-Place Piles - Steel helical reinforcement nominal size: 12mm< dia <=25mm	370.10	tonnes	1	370.10	1.99	736.50
Pipe Culvert - Single cell, 1200 dia	924.00	m	1.404	1,297.30	0.18	233.51
Pipe Culvert - Single cell, 1500 dia	479.00	m	1.796	860.28	0.18	154.85
Pipe Culvert - Single cell, 1800 dia	144.00	m	2.86	411.84	0.18	74.13
Pipe culvert headwall - Single cell, 1200 dia	216.24	tonnes	1	216.24	0.18	38.92
Pipe culvert headwall - Single cell, 1500 dia	16.96	tonnes	1	16.96	0.18	3.05
Pre-stressed Precast Concrete Beam (Edge Beam) - YE8	120.79	m3	2.4	289.88	0.122	35.37
Pre-stressed Precast Concrete Beam (Main Member) - U10	179.95	m3	2.4	431.87	0.122	52.69
Pre-stressed Precast Concrete Beam (Main Member) - U12	714.03	m3	2.4	1,713.68	0.122	209.07
Pre-stressed Precast Concrete Beam (Main Member) - W12	506.13	m3	2.4	1,214.72	0.122	148.20
Pre-stressed Precast Concrete Beam (Main Member) - W5	316.01	m3	2.4	758.43	0.122	92.53
Pre-stressed Precast Concrete Beam (Main Member) - Y8	1,039.61	m3	2.4	2,495.07	0.122	304.40
Reinforced Soil Wall	9,917.21	tonnes	1	9,917.21	0.058	575.20
Road Lighting Columns and Brackets, Wall Mountings, CCTV Masts and Cantilever Masts - Road lighting column of nominal height <=8m - With flange plate base & single bracket arm, 1.5m projection, IP66 aluminium high pressure die cast lantern incorporating a 100W SON-T lamp	38.00	No.	0.132	5.02	2.76	13.84
Road Lighting Columns and Brackets, Wall Mountings, CCTV Masts and Cantilever Masts - Road lighting column of nominal height >8m but <=12m - With flange plate base & single bracket arm, 2.0m projection, IP66 aluminium high pressure die cast lantern incorporating a 250W SON-T lamp	223.00	No.	0.189	42.15	2.76	116.33
Road Restraint Systems - H1 Safety Barriers - Safety barrier containment performance class H1 working width class W4 designed to be impacted on both sides straight or curved exceeding 120m radius (OBB)	1,303.00	m	0.02229	29.04	2.76	80.16
Road Restraint Systems - H2 Safety Barrier - Safety barrier containment performance class H2 working width class W2 designed to be impacted on both sides straight or curved exceeding 120m (VCB)	18,940.00	m	0.02229	422.17	2.76	1,165.20
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)	205.84	m	0.02229	4.59	2.76	12.66
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)	22,753.00	m	0.02229	507.16	2.76	1,399.77
Road Restraint Systems - Pedestrian Guardrails - P3-Pedestrian	2,459.65	m	0.02229	54.83	2.76	151.32
Road Restraint Systems - Terminals - Designed to be impacted on one side only - P1 and lateral displacement zone class x1,y2 - (on driven posts)	1,356.00	m	0.02229	30.23	2.76	83.42
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)	612.00	m	0.02229	13.64	2.76	37.65
Spillage Tank	12.75	tonnes	1	12.75	8.1	103.28
Splayed Kerb	12,071.00	m3	0.0431	520.26	0.132	68.67
Structural Concrete - In situ concrete - of nominal strength <=25N/mm2: In blinding 75mm or less in thickness	788.15	m3	2.4	1,891.56	0.122	230.77
Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2	2,103.09	m3	2.4	5,047.42	0.122	615.78
Structural Concrete - In situ concrete - of nominal strength >30N/mm2 but <= 40N/mm2 sulphate resisting	7,805.49	m3	2.4	18,733.18	0.122	2,285.45
Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2	7,411.56	m3	2.4	17,787.74	0.122	2,170.10
Structural Concrete - In situ concrete - of nominal strength >40N/mm2 but <= 50N/mm2 sulphate resisting	28,313.63	m3	2.4	67,952.71	0.122	8,290.23
Structural Concrete - In situ concrete ST - ST1	395.88	m3	2.4	950.11	0.122	115.91
Structural Concrete - Precast concrete - Facing units	1,828.05	m3	2.4	4,387.32	0.103	451.89
Structural Concrete - Reinforcement for Structures - Dowel - 20mm diameter	0.34	tonnes	1	0.34	1.99	0.67
Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm & under: <=12m in length	150.52	tonnes	1	150.52	1.99	299.53
Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: <=12m in length	2,227.50	tonnes	1	2,227.50	1.99	4,432.73
Structural Concrete - Reinforcement for Structures - Steel Bar reinforcement - 12mm <dia.<=25mm: >12m in length	4,620.09	tonnes	1	4,620.09	1.99	9,193.98
Structural Concrete - Surface Finish of Concrete - Formwork - Permanent formwork >300 - Class F3 - Horizontal more than 300mm wide	378.91	m3	0.681	258.04	0.54	139.34
Structural Concrete - Surface Finish of Concrete-Formwork - Class F1 - Vertical more than 300mm wide	158.29	m3	0.681	107.79	0.54	58.21
Structural Concrete - Surface Finish of Concrete-Formwork - Class F3 - Vertical more than 300mm wide	68.65	m3	0.681	46.75	0.54	25.25
Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Horizontal more than 300mm wide	92.48	m3	0.681	62.98	0.54	34.01
Structural Concrete - Surface Finish of Concrete-Formwork - Class F4 - Vertical more than 300mm wide	382.34	m3	0.681	260.37	0.54	140.60
Structural Steelwork - Erection of Steelwork - Permanent erection: Substructure	6,588.76	tonnes	1	6,588.76	1.55	10,212.58
Structural Steelwork - Fabrication of Steelwork - Fabrication of main members - Plated girders	6,254.82	tonnes	1	6,254.82	1.55	9,694.97
Structural Steelwork - Fabrication of Steelwork - Fabrication of main members - Plated rolled sections	28.00	tonnes	1	28.00	1.55	43.40
Structural Steelwork - Fabrication of Steelwork - Fabrication of main members - Rolled sections	567.10	tonnes	1	567.10	1.55	879.01
Structural Steelwork - Shear Studs	3.60	tonnes	1	3.60	1.99	7.17
Structures - Bearings, joints and sealing of gaps - Bearing - Bearing	129.00	tonnes	1	129.00	1.55	199.95
Structures - Bearings, joints and sealing of gaps - Bridge deck expansion joints - Expansion joint	14.35	tonnes	1	14.35	2.76	39.61
Structures - Bearings, Joints and Sealing of Gaps - Sealing of Gaps - Joint sealant	60.31	tonnes	1	60.31	0.055	3.32
Structures - Protection of Steelwork Against Corrosion - Organic Protective System	5,651.38	litres	0.0012	6.78	3.76	25.50
Structures - Road Restraint Systems excluding safety fencing - Pedestrian parapets	4.23	tonnes	1	4.23	2.76	11.67
Structures - Road Restraint Systems excluding safety fencing - Vehicle parapets	173.71	tonnes	1	173.71	2.76	479.43
Traffic Signs And Road Markings - Laying - Ancillary lines	36.00	litres	0.0012	0.04	3.76	0.16
Traffic Signs And Road Markings - Laying - Arrow	17.40	litres	0.0012	0.02	3.76	0.08
Traffic Signs And Road Markings - Laying - Continuous lines	3,427.86	litres	0.0012	4.11	3.76	15.47
Traffic Signs And Road Markings - Laying - Intermittent lines	1,608.69	litres	0.0012	1.93	3.76	7.26
Traffic Signs And Road Markings - Laying - Letters	49.46	litres	0.0012	0.06	3.76	0.22
Traffic Signs And Road Markings - Laying - Numerals	34.41	litres	0.0012	0.04	3.76	0.16
Traffic Signs And Road Markings - Laying - Raised rib lines	2,498.76	litres	0.0012	3.00	3.76	11.27
Traffic Signs And Road Markings - Laying - Solid areas	288.00	litres	0.0012	0.35	3.76	1.30

Traffic Signs And Road Markings - Laying - Symbols	5.38	litres	0.0012	0.01	3.76	0.02
Traffic Signs And Road Markings - Marker posts	2.24	tonnes	1	2.24	3.31	7.42
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - <0.5m2 in area	156.50	m2	0.05	7.83	6.67	52.19
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >0.5m2 but <=1m2 in area	313.00	m2	0.05	15.65	6.67	104.39
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >1.0m2 but <=2m2 in area	312.00	m2	0.05	15.60	6.67	104.05
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >10m2 but <15m2 in area	105.00	m2	0.05	5.25	6.67	35.02
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >15m2 but <20m2 in area	120.00	m2	0.05	6.00	6.67	40.02
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >2.0m2 but <=3m2 in area	237.00	m2	0.05	11.85	6.67	79.04
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >20m2 but <25m2 in area	150.00	m2	0.05	7.50	6.67	50.03
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >25m2 in area	75.00	m2	0.05	3.75	6.67	25.01
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >3.0m2 but <=4m2 in area	120.00	m2	0.05	6.00	6.67	40.02
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >4.0m2 but <=5m2 in area	105.00	m2	0.05	5.25	6.67	35.02
Traffic Signs And Road Markings - Permanent traffic signs - Unlit Signs - >5m2 but <10m2 in area	110.00	m2	0.05	5.50	6.67	36.69
Traffic Signs And Road Markings - Road Studs	9,832.00	No.	0.00005	0.49	3.31	1.63