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**VOLUME 5    CONTRACT DOCUMENTS  
FOR SPECIALIST  
ACTIVITIES**

**SECTION 3    GROUND INVESTIGATION**

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**PART 6**

**METHOD OF MEASUREMENT**

**SUMMARY**

This Method of Measurement is to be used in conjunction with the Specification for Ground Investigation for Highway Works.

**INSTRUCTIONS FOR USE**

This is a new document to be inserted into the manual.

1.    Insert Method of Measurement into Volume 5, Section 3.
2.    Archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from the Stationery Office Ltd.

**MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS**



**THE HIGHWAYS AGENCY**



**THE SCOTTISH OFFICE DEVELOPMENT DEPARTMENT**



**THE WELSH OFFICE  
Y SWYDDFA GYMREIG**



**THE DEPARTMENT OF THE ENVIRONMENT FOR  
NORTHERN IRELAND**

# **Ground Investigation: Part 6: Method of Measurement**

Summary:	This Method of Measurement is to be used in conjunction with the Specification for Ground Investigation for Highway Works.
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**REGISTRATION OF AMENDMENTS**

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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**PART 6**

**METHOD OF MEASUREMENT**

**Contents**

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1.    Definitions
2.    General Principles
3.    Preparation of Bill of Quantities
4.    Units and Methods of Measurement
5.    Enquiries

# 1. DEFINITIONS

1.1 In this document, entitled Method of Measurement for Ground Investigation (hereinafter referred to as 'the Method of Measurement') unless the context otherwise requires, the following words and expressions shall have the meanings hereby respectively assigned to them, that is to say:

- (a) 'Conditions of Contract' means the Conditions of Contract referred to in the Tender;
- (b) Words and expressions to which meanings are assigned in the Conditions of Contract have the same meanings in the Method of Measurement;
- (c) Words and expressions to which meanings are assigned in the Specification and Drawings referred to in the Conditions of Contract have the same meanings in the Method of Measurement;
- (d) 'Bill of Quantities' means a list of items giving brief identifying descriptions and estimated quantities of work comprised in the execution of the Investigation to be performed;
- (e) 'Daywork' means the method of valuing work on the basis of the time spent by the workmen, the materials used and the equipment employed;
- (f) Items designated as 'Provisional' are items for which the quantities of work to be executed cannot be determined with the same degree of accuracy as other items but for which it is deemed necessary to make provision;
- (g) 'Preliminary Item' means an item in respect of works and or general obligations and risks antecedent to or involved in the execution of the Contract and which is set out in the 'Preliminaries' section of the Bill of Quantities;
- (h) 'Existing Ground Level' means the level of the ground before any work under the Contract has been carried out.

## 2. GENERAL PRINCIPLES

### Method of Measurement

- 2.1(a) This Method of Measurement is intended for use for Ground Investigation Contracts based on the ICE Conditions of Contract for Ground Investigation. The use of this Method of Measurement requires the appropriate amendment to Clause 57 of the Conditions and to the Appendix to the Form of Tender. If it is intended to use this Method of Measurement with other Conditions of Contract, amendments will be required to this Method of Measurement.
- (b) This Method of Measurement is based on the Specification for Ground Investigation and on the principle that full details of investigation requirements are provided in the Contract. Additions or amendments to the Specification for Ground Investigation which are not adequately covered by this Method of Measurement will necessitate appropriate amendments to suit. Provision is made in Chapter 3, - Preambles to Bill of Quantities, "Amendments to Method of Measurement" to accommodate such amendments.

### Bill of Quantities

- 2.2(a) In the Bill of Quantities the sub headings and item descriptions identify the work covered by the respective items, read in conjunction with the matters listed against the relevant marginal headings "Item Coverage" in Chapter 4, of the Method of Measurement, Chapter 3, Preambles to Bill of quantities and amendments. The nature and extent of the work to be performed is to be ascertained by reference to the Drawings, Specification, Schedules and Conditions of Contract.
- (b) Items included in the Bill of Quantities for work to be executed or goods, materials or services to be supplied by a Nominated Sub Contractor shall be followed by separate items for:
- (i) Labours in connection therewith in the form of a lump sum.
  - (ii) All other charges and profit in connection therewith in the form of a percentage.

- (c) The Bill of Quantities shall identify work in the Contract to be executed within and below:-
- (i) non tidal open water (such as water-courses, streams, rivers, ponds, lakes, canals and the like) at the "open water level" stated in the Contract; or
  - (ii) tidal water at the "tide level" stated in the Contract.

The work shall be measured separately, for each chapter, of the Method of Measurement, and shall be included within the Bill of Quantities under sub headings or in the item description as falling within (i) or (ii) above.

- (d) The Bill of Quantities shall identify work in the Contract to be executed on:
- (i) potentially contaminated land (in Site Operations); or
  - (ii) samples taken from potentially contaminated land (in Laboratory Testing).

The work shall be measured separately, for Site Operations and Laboratory Testing only, and shall be included within the Bill of Quantities under sub headings or in the item description as falling within (i) or (ii) above.

### Itemisation - Groups and Features

2.3 Each item description is to be consistent with, and be compounded from, one or more of the Groups listed under the marginal headings "Itemisation" within the Sections of Chapter 4 of the Method of Measurement, incorporating amendments introduced in the Preambles to the Bill of Quantities. An item description may contain Features from as many Groups as necessary to identify the work required, but may include only one Feature from any one Group.

### Items in the Bills of Quantities

2.4 The Bill of Quantities, unless expressly stated otherwise in the Contract is to contain all those items compounded in accordance with the foregoing paragraph 2.3 required to comprise the Investigation (apart from Provisional Sums and Prime Cost Items which may be required).

## 3. PREPARATION OF BILLS OF QUANTITIES

### Subdivision of Bills of Quantities

3.1 The Bill of Quantities is to be divided into separate sections as appropriate in the following sequence:

Preliminaries  
Site Operations  
Laboratory Testing and Reports  
Schedule of Rates for Professional and Technical Staff  
Dayworks

### Quantities

3.2 Quantities shall be expressed in whole numbers except for units of measurement of tonnes and hectares, in which case the quantities shall be to three decimal places.

### Units of Measurement

3.3 The following abbreviations shall be used for the units of measurement:

Unit	Abbreviation
millimetres	mm
metre	m
kilometre	km
square millimetre	mm <sup>2</sup>
square metre	m <sup>2</sup>
cubic metre	m <sup>3</sup>
square metre per day	m <sup>2</sup> /day
kilogramme	kg
tonne	t
sum	sum
number	No
hour	h
week	wk
vehicle week	v/wk
item	item
man hour	m/hr
day	day

### Preambles to the Bill of Quantities

3.4 The matters set out under the heading "Preambles to Bill of Quantities" (paragraphs 3.4 - 3.15) hereafter are always to be included as a preamble to the Bill of Quantities. Additional numbered preambles

may be included as necessary. Amendments to this Method of Measurement are to be incorporated in the Preambles to Bill of Quantities. (See paragraph 3.15 and the footnote.)

### General Directions

3.5 In this Bill of Quantities the sub-headings and item descriptions identify the work covered by the respective items read in conjunction with the matters listed against the relevant marginal headings 'Item coverage' in Chapter 4 of the Method of Measurement for Ground Investigation. The nature and extent of the work is to be ascertained by reference to the Drawings, Specification, Schedules and Conditions of Contract.

The rates and prices entered in the Bill of Quantities shall be deemed to be the full inclusive value of the work covered by the several items including the following, unless expressly stated otherwise:

- (i) Labour and costs in connection therewith.
- (ii) The supply of materials, goods, storage and costs in connection therewith and delivery to Site. Taking delivery of materials and goods supplied by others, unloading, storage and costs in connection therewith.
- (iii) Fixing, erecting and installing or placing of materials and goods in position, including Ancillary Works.
- (iv) Equipment and costs in connection therewith.
- (v) General obligations, liabilities and risks involved in the execution of the Works set forth or reasonably implied in the documents on which the tender is based.
- (vi) Consultation with relevant local authorities and police in connection with traffic management matters.
- (vii) Establishment charges, overheads and profit.
- (viii) Waste.



### **Measurement**

3.6 The measurement of work shall be computed net from the agreed records unless stated otherwise in the Method of Measurement.

### **Pricing of Items**

3.7 Each individual item shall have a rate or price entered against it. Rates and prices shall be expressed to two decimal places.

### **Privately and Publicly Owned Services or Supplies**

3.8 The Contractor shall include in his rates and prices for taking measures for the support and full protection of pipes, cables and other apparatus during the progress of the Site Operations and for keeping the Engineer informed of all arrangements he makes with the owners of privately owned services, Statutory Undertakers and Public Authorities as appropriate.

### **Labours**

3.9 Labours in connection with nominated Sub-Contractors shall include:

- (a) in the case of work or services executed, for affording the use of existing working space, access, temporary roads, erected scaffolding, working shelters, staging, ladders, hoists, storage, latrines, messing, welfare and other facilities existing on Site and the provision of protection, water, electricity for lighting and clearing away rubbish and debris arising from the work;
- (b) in the case of goods, materials or services supplied, for taking delivery, unloading, storing, protecting and returning crates, cartons and packing materials.

### **Work Within and Below Non-Tidal Open Water or Tidal Water**

3.10 The Contractor shall allow in his rates and prices for taking measures required to execute the work separately measured as being within and below non-tidal open water or tidal water. For the measurement of work affected by non-tidal open water or tidal water the datum stated in the Contract shall be used irrespective of the actual level encountered in the Site Operations.

### **Dealing with Flows**

3.11 The Contractor shall allow in his rates and prices for taking measures to deal with the existing flow of water, sewage and the like.

### **Schedule of Rates for Professional and Technical Staff**

3.12 The Schedule of Rates for Professional and Technical Staff shall be priced at the rates for the various grades of staff who will be employed in the preparation of the interpretative and advisory section of the report, or employed for advisory work for the Engineer on site on the conduct of the Investigation, as required by the Engineer. This excludes the superintendence and technical direction and output required under Clause 15 of the Conditions of Contract which must be included in the rates and prices entered in the main Bill of Quantities.

### **Reimbursement by the Employer of Fees, Rates, Taxes and Engineer's Telephone Calls**

3.13 The Employer will reimburse the Contractor the actual price paid by the Contractor in respect of:

- (i) fees, rates and taxes - the sums certified by the Engineer as properly payable and repayable to the Contractor in accordance with Clause 26 of the Conditions of Contract.
- (ii) Engineer's telephone calls and facsimile - the telephone calls charged to the number or numbers allocated to the Engineer.

Any other cost, charge or expense in respect of these items shall be allowed for in the rates and prices for temporary accommodation.

### **Work on Potentially Contaminated Land or on Samples taken from Potentially Contaminated Land**

3.14 The Contractor shall allow in his rates and prices for taking measures required to execute the work separately measured as being on potentially contaminated land or on samples taken from potentially contaminated land. The Contractor shall include in his rates and prices for such work for submitting and resubmitting statements of working arrangements, liaison with authorities and the Engineer, complying with hygiene and safety requirements, taking measures

necessary to control activities and complying with particular requirements, taking measures in handling and storage of material, complying with particular testing requirements, replacement of solid arisings in pits and trenches and disposing of surplus material to a suitably licensed site.

#### **Amendments to the Method of Measurement<sup>1</sup>**

3.15 For the purpose of this Contract, the Method of Measurement referred to in Preamble 1 General Directions is amended as follows:

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<sup>1</sup> Where amendments to Chapter 4 of the Method of Measurement are required in accordance with paragraph 1(b) of General Principles, this preamble should be the last numbered preamble and inserted immediately prior to the amendments.

## 4. UNITS AND METHODS OF MEASUREMENT

### Preliminaries

#### Temporary accommodation

##### 4.1 Units

The units of measurement shall be:

- (i) erection servicing dismantling of temporary accommodation ..... item.

##### 4.2 Itemisation

Separate items shall be provided for temporary accommodation in accordance with Chapter 2, paragraphs 2.3 and 2.4 and the following:

Group	Feature
I	1 Erection servicing and dismantling
II	1 Offices for the Engineer 2 Offices and Stores for the Contractor

##### 4.3 Erection, servicing and dismantling of temporary accommodation

The items for erection, servicing and dismantling of temporary accommodation shall in accordance with the Preambles to Bill of Quantities General Directions include for:

##### Item coverage

- (i) in the case of accommodation for the Contractor,
  - (a) everything required by the Contractor including depreciation, maintenance, demolition and removal off site including reinstatement of site occupied by temporary accommodation;
  - (b) hygiene facilities;
  - (c) disposal of all contaminated materials including clothing, wash water, and any other materials to a suitably licensed site;

- (ii) in the case of accommodation for the Engineer,
  - (a) provision and preparation of a site for and occupied by temporary accommodation;
  - (b) foundations, bases and hardstandings;
  - (c) water, sanitation, heating, power and lighting services including charges, rental charges, water rates and sewage disposal, depreciation, maintenance, disconnecting and removing services and sealing off disused services;
  - (d) fences, notice and direction boards, vehicle access, hardstandings, parking areas and footpaths including depreciation, maintenance, demolishing and removing from Site;
  - (e) office and survey equipment, furnishings, fittings supplies and consumable stores including depreciation, maintenance, replenishment of consumable stores, credit value of surplus equipment or material which becomes the property of the Contractor and transport and delivery to the Employer of equipment or material which becomes the property of the Employer;
  - (f) cleaning accommodation;
  - (g) disposal of surplus material;
  - (h) telephones, extensions, facsimile and switchboard separately connected to the Post Office telephone system including rental charge;
  - (i) hygiene facilities;
  - (j) disposal of all contaminated materials including clothing, wash water, and any other materials to a suitably licensed site.

**Vehicles for the Engineer**

4.4 Units

The units of measurements shall be:

- (i) vehicles for the Engineer ..... vehicle week.

4.5 Measurement

The measurement of vehicles for the Engineer shall be each week or part thereof during which a vehicle is provided.

4.6 Itemisation

Separate items shall be provided for vehicles for the Engineer in accordance with Chapter 2, paragraphs 3 and 4 and the following:

Group	Feature
I	1 Each type of vehicle for the Engineer

4.7 Vehicles for the Engineer

The items for vehicles for the Engineer shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) additional apparatus and fittings as described in the Contract;
- (b) taxing for use on the public highways and for the carriage of goods and samples;
- (c) comprehensive insurance covering the Engineer and any driver authorised by him and the carriage of goods and samples;
- (d) provision of a suitable replacement including apparatus and fittings as fitted to the regular vehicle;
- (e) depreciation;
- (f) maintenance in a roadworthy condition and in conformity with the vehicle manufacturer's recommendations;

- (g) fuel and oil;

- (h) keeping clean inside and out;

- (i) collection when the vehicle is returned.

**Equipment**

4.8 Units

The units of measurement shall be:

- (i) establishment on Site of all Equipment.

4.9 Itemisation

Separate items shall be provided for establishment on Site of all Equipment in accordance with Chapter 2, paragraphs 3 and 4 and the following:

Group	Feature
I	1 Establishment on Site of all Equipment

4.10 Establishment on site of all Equipment

The items for establishment on Site of all Equipment shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) bringing all Equipment to the Site;
- (b) giving notices to the Engineer, Statutory Undertakers, owners or occupiers affected by the Investigation or on the access routes;
- (c) dismantling and removing Equipment from Site on completion of the Site Operations, including any reinstatement of the Site, and returning all Equipment to the Contractor's Depot.

**Photographs**

4.11 Units

The units of measurement shall be:

- (i) photographs ..... number.
- (ii) bound photograph volumes ..... number.

4.12 Measurement

A photograph shall comprise such numbers of negatives and prints as described in the Contract and as approved by the Engineer. Photographs not approved by the Engineer shall not be measured.

4.13 A bound photograph volume shall contain a complete set of prints properly mounted and labelled.

4.14 Itemisation

Separate items shall be provided for photographs in accordance with Chapter 2, paragraphs 3 and 4 and the following:

<b>Group</b>	<b>Feature</b>
I	1 Photographs 2 Bound Photograph volumes

4.15 Photographs and bound photograph volumes

The items for photographs and bound photograph volumes shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) delivery of sample print from each photograph to the Engineer for approval;
- (b) delivery of negatives of all approved photographs to the Engineer;
- (c) mounting, identification and titling of all prints in bound photograph volumes;
- (d) delivery of bound photograph volumes to the Engineer;
- (e) colour chart, monochrome step wedge and graduated scale where required;
- (f) all development and printing costs;
- (g) delay in excavating, boring or drilling due to photographing.

**Traffic safety and management**

4.16 Units

The units of measurement shall be:

- (i) Traffic Safety and Management ..... item.

4.17 Measurement

Traffic Safety and Management shall be measured once only.

4.18 Itemisation

Separate items shall be provided for traffic safety and management in accordance with Chapter 2, paragraphs 3 and 4 and the following:

<b>Group</b>	<b>Feature</b>
I	1 Traffic Safety and Management

4.19 Item coverage

The items for traffic safety and management shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

- (a) complying with the recommendations contained in Chapter 8 of the "Traffic Signs Manual" published by Her Majesty's Stationery Office and any amendment thereto or where the circumstances of any particular case are not covered submitting proposals for dealing with such situations to the Engineer for his consent;
- (b) complying with particular requirements of the Contract;
- (c) initiating or continuing consultation with statutory, police or other authorities concerned, proposing or developing and submitting to the Engineer for his consent, proposals based on such consultation showing a scheme of traffic safety and management measures including details of safety zones and emergency routes and furnishing such details as necessitated by the Site Operations or as the Engineer may require;

- (d) design of traffic safety and management measures specified by the Engineer;
- (e) awaiting Engineer's consent to proposals;
- (f) modification and re-submission of proposals and designs;
- (g) traffic signs, traffic signs provided by the Employer, road markings, lamps, barriers and traffic control signals including maintaining, cleaning, repositioning, covering, uncovering and removing;
- (h) complying with the requirements for labour and plant working on or adjacent to a highway and at entry and exit points to the Site including signing;
- (i) road lighting, modification and removal;
- (j) giving of notice to the Engineer;
- (k) collecting and returning traffic signs provided by the Employer;
- (l) surveillance and maintaining stocks;
- (m) immediate reinstatement and replacement of defective or damaged items.

**Site Operations**

**Moving of Equipment**

4.20 Units

The units of measurement shall be:

- (i) Moving of Equipment to the site of each exploratory hole ..... number.

4.21 Measurement

The measurement of moving of Equipment to the site of each exploratory hole shall correspond to the number of exploratory holes bored, drilled, grouted, probed or excavated, plus any additional moves instructed by the Engineer. Any additional moves to suit the Contractor's method of working shall not be measured.

4.22 Moving of Equipment shall not be measured for hand augering equipment, hand dynamic probing equipment, probing equipment for soil gas surveys, percussive boring with tube window sampler, hand dug pitting and hand dug trenching equipment or inspection pitting equipment. Moving of drilling equipment shall only be measured where such plant does not consist as an attachment to the boring equipment.

4.23 Itemisation

Separate items shall be provided for moving of Equipment to the site of each exploratory hole in accordance with Chapter 2, paragraphs 3 and 4 and the following:

Group	Feature
I	1 Moving of Equipment to the Site of each exploratory hole.
II	1 Boring Equipment 2 Drilling Equipment 3 Grouting Equipment 4 Probing Equipment 5 Pitting and trenching Equipment 6 Power augering Equipment 7 Pumping Equipment
III	1 Over water 2 Over mineshafts 3 On a slope of gradient greater than 20%

4.24 Moving of Equipment to the site of each exploratory hole

The items for moving of Equipment to the site of each exploratory hole shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) giving notices to the Engineer, statutory undertakers, owners or occupiers affected by the Investigation or on the access routes;
- (b) moving and setting up Equipment at each exploratory hole including site preparation, levelling and access ramps and roads and any lifting or staging required;

(c) making good to walls, fences and hedges breached or otherwise disturbed with stock proof barriers;

**Boring**

4.25 Units

The units of measurement shall be:

(i) Boring, backfilling exploratory holes ..... linear metres;

4.26 Measurement

The measurement of boring and backfilling shall be the length of the exploratory hole measured along the axis between existing ground level and the bottom of the hole in accordance with the Contract. Where a particular level is specified from which boring shall commence, then the measurement of length shall be from that specified level. Where a boring commences from the base of a pit or trench, then the measurement of length shall be from the base of that pit or trench. The lengths shall be measured within depth bands taken at ten metre increments from existing ground level.

4.27 The diameter stated shall be the minimum diameter stated in the Contract or ordered by the Engineer.

4.28 The length classifications for those items listed in paragraph 4.25 above shall be based on the appropriate lengths determined in accordance with paragraph 4.26 above.

4.29 The backfilling of exploratory holes in which standpipes or piezometers have been installed shall be measured as described in paragraphs 4.81 to 4.107 inclusive.

4.30 Itemisation

Separate items shall be provided for boring in accordance with Chapter 2, paragraphs 3 and 4 and the following:

<b>Group</b>	<b>Feature</b>
I	1 Cable Percussion Boring 2 Hand Auger Boring 3 Power Auger Boring 4 Percussive Boring with Tube Window Sampler 5 Backfilling

II	1 Vertical 2 Raking
III	1 Various diameters
IV	1 Over water 2 Over mineshafts 3 On a slope of gradient greater than 20%
V	1 Between existing ground level to not exceeding 10 metres depth 2 Between 10 metres to not exceeding 20 metres depth and so on in steps of 10 metres
VI	1 Soil 2 Concrete 3 Cement/Bentonite grout 4 Sand

4.31 Cable percussion boring, hand auger boring, power auger boring and percussive boring with tube window sampler

The items for cable percussion boring, hand augering, power augering and percussive boring with tube window sampler shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) stripping turf and topsoil and reserving for re-use;
- (b) casing, lining;
- (c) allowing for oversize exploratory hole and casings;
- (d) changing tools;
- (e) taking information and preparing the journal and preliminary records and submitting in triplicate to the Engineer;
- (f) removing temporary casing or lining;

- (g) in the case of hand or power auger boring and percussive boring with tube window sampler; moving and setting up equipment at each exploratory hole, including site preparation or levelling;
- (h) taking precautions to avoid damage to property, structures, sewers, drains and services;
- (i) dealing with artesian water;
- (j) any additional depth for sampling or in situ tests;
- (k) in the case of percussive boring with tube window sampler, logging of soil in the sampler;
- (l) full-time supervision of non-accredited drillers.

**4.32 Backfilling**

The items for backfilling shall in accordance with the Preambles to Bill of Quantities General Directions include for:

**Item Coverage**

- (a) compaction;
- (b) mixing, placing and compaction of concrete or grout against any surface including soil faces;
- (c) dealing with artesian water;
- (d) multiple handling of excavated material;
- (e) taking precautions to avoid damage to property, structures, sewers, drains and services;
- (f) reinstatement of surfaces including deposition, spreading and levelling of topsoil and laying of turf;
- (g) freeing surfaces of areas to be turfed or seeded from stones and other debris and reducing the soil to a tilth immediately prior to turfing or seeding;
- (h) excavation, haulage and deposition in tips off site provided by the Contractor of turf, top soil and excavated material not required for re-use;

- (i) precast concrete cover slabs if required in the Contract;
- (j) importing any additional soil required for backfilling.

**Hard strata and obstructions**

**4.33 Units**

The units of measurement shall be:

- (i) Breaking out hard strata or obstructions ..... hours.

**4.34 Measurement**

The measurement of breaking out hard strata or obstructions shall be the duration of time which the boring equipment is engaged in breaking out the hard strata or obstructions as agreed by the Engineer. This measurement shall be in addition to the measurement of boring in paragraph 4.7.

4.35 The use of drilling equipment to break out hard strata or obstructions shall not be measured in addition to the measurement of rotary drilling in paragraph 4.39 below.

**4.36 Itemisation**

Separate items shall be provided for breaking out hard strata or obstructions in accordance with Chapter 2, paragraphs 3 and 4 and the following:

<b>Group</b>	<b>Feature</b>
I	1 Breaking out hard strata and obstructions
II	1 Different types of Equipment

**4.37 Breaking out hard strata or obstructions**

The items for breaking out hard strata or obstructions shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) boring, hand augering and power augering as paragraph 4.31 above;
- (b) changing drills, bits or tools;
- (c) delay in breaking out hard strata or obstructions;



- (d) consequential costs;
- (e) changes in the programme of working.

**Rotary drilling**

4.38 Units

The units of measurement shall be:

- (i) Rotary drilling and backfilling exploratory holes ..... linear metres.

4.39 Measurement

The measurement of rotary drilling and backfilling shall be the length of the exploratory hole measured along the axis between existing ground level and the bottom of the hole in accordance with the Contract. Where a particular level is specified from which rotary drilling shall commence, then the measurement shall be from that specified level. Where rotary drilling commences from the base of a pit or trench, then the measurement of length shall be from the base of that pit or trench. The lengths shall be measured within depth bands taken at ten metre increments from existing ground level.

4.40 The diameter stated for rotary drilling to produce continuous cores shall be the minimum diameter of the cores required in the Contract or ordered by the Engineer. The diameter stated for open hole rotary drilling shall be the minimum nominal diameter of the hole stated in the Contract or ordered by the Engineer. The diameter stated for backfilling shall be the minimum nominal hole diameter of the exploratory hole required in the Contract.

4.41 The use of rotary drilling equipment to break out hard strata or obstructions shall not be measured in addition to the measurement of rotary drilling in paragraph 4.39 above.

4.42 The backfilling of exploratory holes in which standpipes or piezometers have been installed shall be measured as described in paragraphs 4.81 to 4.107 inclusive.

4.43 Itemisation

Separate items shall be provided for rotary drilling in accordance with Chapter 2, paragraphs 3 and 4 and the following:

Group	Feature
I	1 Open hole rotary drilling 2 Rotary drilling to produce continuous cores 3 Backfilling
II	1 Various diameters
III	1 Vertical 2 Raking
IV	1 Over water 2 Over mineshafts 3 On a slope of gradient greater than 20%
V	1 Between existing ground level to not exceeding 10 metres depth 2 Between 10 metres to not exceeding 20 metres depth and so on in steps of 10 metres
VI	1 Soil 2 Concrete 3 Cement/bentonite grout 4 Sand

4.44 Rotary drilling

The items for rotary drilling shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) stripping turf and topsoil and reserving for re-use;
- (b) casing, lining or split inner tubing;
- (c) allowing for oversize exploratory hole and casing;
- (d) drilling fluids;
- (e) changing drills, bits or tools;
- (f) taking information and preparing the journal and preliminary records and submitting in triplicate to the Engineer;

- (g) removing temporary casing or lining;
- (h) providing core boxes;
- (i) taking, extruding, examining, logging, marking, and placing of cores in core boxes;
- (j) transporting of core boxes to laboratory including storage and subsequent disposal;
- (k) dealing with artesian water;
- (l) any additional depth for sampling or in situ tests;
- (m) full-time supervision of non-accredited drillers.

**4.45 Backfilling**

The items for backfilling shall in accordance with the Preambles to Bill of Quantities General Directions include for:

**Item coverage**

- (a) compaction;
- (b) mixing, placing and compaction of concrete or grout against any surface including soil faces;
- (c) dealing with artesian water;
- (d) multiple handling of excavated material;
- (e) taking precautions to avoid damage to property, structures, sewers, drains and services;
- (f) freeing surfaces of areas to be turfed or seeded from stones and other debris and reducing the soil to a tilth immediately prior to turfing or seeding;
- (g) reinstatement of surfaces including deposition, spreading and levelling of topsoil and laying of turf;
- (h) excavation, haulage and deposition in tips off site provided by the Contractor of turf, top soil and excavated material not required for re-use;
- (i) precast concrete cover slabs if required in the Contract;
- (j) importing any additional soil required for backfilling.

**Pits and trenches**

**4.46 Units**

The units of measurement shall be:

- (i) excavation, backfilling ..... cubic metre
- (ii) leaving open ..... square metre per day
- (iii) pumping groundwater ..... hours.

**4.47 Measurement**

The measurement of excavation and backfilling shall be calculated separately for each inspection pit, trial pit, trial trench, observation pit and observation trench.

**4.48** The measurement of excavation of pits and trenches shall be the volume of the void calculated on the basis of the minimum base plan area of the excavation together with the vertical depth excavated in each material. The base plan area and the vertical depth shall be as required by the Contract or instructed by the Engineer.

**4.49** The measurement of backfilling pits and trenches shall be the volume of the void filled calculated on the basis of the minimum base plan area of the excavation together with the vertical depth filled with each material. The base plan area and the vertical depth shall be as required by the Contract or instructed by the Engineer.

**4.50** The depth category for excavation and backfilling shall be the maximum depth of excavation from existing ground level as required by the Contract or instructed by the Engineer.

**4.51** The measurement of leaving open of exploratory holes shall only be made when the exploratory hole is left open on the instructions of the Engineer. Leaving open of the exploratory holes to suit the Contractor's working arrangement shall not be measured. The measurement shall be calculated from the minimum base plan area of the excavation together with the length of time elapsed between the completion of the excavation and commencement of backfilling of that excavation, except that the first 12 hours of that time shall not be paid for being deemed to be included in the Contractor's other rates.

**4.52** The measurement of pumping groundwater shall be the duration of the time of pumping out groundwater.

4.53 Itemisation

Separate items shall be provided for pits and trenches in accordance with Chapter 2, paragraphs 3 and 4 and the following:

<b>Group</b>	<b>Feature</b>
I	1 Excavation of soil 2 Excavation of hard material 3 Backfilling 4 Leaving open of exploratory holes 5 Pumping groundwater
II	1 Inspection pit 2 Trial pit 3 Trial trench 4 Observation pit 5 Observation trench
III	1 Machine dug 2 Hand dug
IV	1 Between existing ground level to not exceeding 1.2 metres depth 2 Between existing ground level to not exceeding 3 metres depth 3 Between existing ground level to not exceeding 4.5 metres depth, and so on in steps of 1.5 metres.
V	1 Soil 2 Concrete 3 Sand

4.54 Excavation of soil

The items for excavation of soil shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) stripping turf and topsoil and reserving for re-use;
- (b) loading into transport;
- (c) loosening or breaking up material before or in the process of excavation;
- (d) multiple handling of excavated material;

- (e) keeping the excavation free of surface water;
- (f) upholding the sides and taking all safety measures and precautions;
- (g) separation of materials;
- (h) taking precautions to avoid damage to property, structures, sewers, drains and services;
- (i) additional excavation the Contractor may require for working space, timbering or other temporary works and its subsequent backfilling with approved material and compaction;
- (j) deposition in temporary stockpiles;
- (k) taking information and preparing the journal and preliminary records, and submitting in triplicate to the Engineer;
- (l) in the case of hand dug trial pitting and hand dug trenching, moving and setting up equipment at each exploratory hole including site preparation or levelling.

4.55 Excavation of hard material

The items for excavation of hard material shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) loading into transport;
- (b) loosening, or breaking up by other means, of material before or in the process of excavation;
- (c) multiple handling of excavated material;
- (d) keeping the excavation free of surface water;
- (e) upholding the sides, and taking all safety measures and precautions;
- (f) overbreak and making good;
- (g) taking precautions to avoid damage to property, structures, sewers, drains and services;

- (h) additional excavation the Contractor may require for working space, timbering or other temporary works and its subsequent backfilling with approved material and compaction;
- (i) deposition in temporary stockpiles;
- (j) taking in information and preparing the journal and preliminary records, and submitting in triplicate to the Engineer;
- (k) in the case of hand dug trial pitting and hand dug trenching, moving and setting up equipment at each exploratory hole including site preparation or levelling.

**4.56 Backfilling**

The items for backfilling shall in accordance with the Preambles to Bill of Quantities General Directions include for:

**Item coverage**

- (a) deposition, spreading and levelling;
- (b) multiple handling of excavated material;
- (c) keeping exploratory holes free of surface water;
- (d) taking precautions to avoid damage to property, structures, sewers, drains and services;
- (e) compaction;
- (f) free surfaces of areas to be turfed or seeded from stones and other debris and reducing the soil to a tilth immediately prior to turfing or seeding;
- (g) reinstatement of surfaces including deposition, spreading and levelling of topsoil and laying of turf;
- (h) excavation, haulage and deposition in tips off site provided by the Contractor of turf, top soil and excavated material not required for re-use;
- (i) importing any additional soil required for backfilling;
- (j) provision, laying and compaction of all material required for footpath and road pavement reinstatement;

- (k) sealing of joints in bituminous material with bituminous sealer.

**4.57 Leaving open of exploratory holes**

The items for leaving open of exploratory holes shall in accordance with the Preambles to Bill of Quantities General Directions include for:

**Item coverage**

- (a) leaving in of all supports and props;
- (b) providing, erecting and maintaining all fencing lighting and signing as required in the Contract;
- (c) dismantling and removing all fencing lighting and signing when no longer required;
- (d) protecting the exploratory hole from the adverse effects of weather and surface water;
- (e) changes in the programme of working;
- (f) delays and consequential costs.

**4.58 Pumping groundwater**

The items for pumping groundwater shall in accordance with the Preambles to Bill of Quantities General Directions include for:

**Item coverage**

- (a) operation and maintenance of pumping equipment;
- (b) controlling groundwater;
- (c) sump.

**Probing**

**4.59 Units**

The units of measurement shall be:

- (i) probing ..... linear metre.
- (ii) gas valves and tubes ..... number.

**4.60 Measurement**

The measurement of probing shall be the length of the exploratory hole measured along the axis to the level at which probing ceased in accordance with the Contract from the existing ground level. Provided that where a particular level is specified from which probing shall commence, then the measurement shall be from that specified level. The lengths shall be measured within depth bands taken at ten metre increments from existing ground level.

**4.61 Itemisation**

Separate items shall be provided for probing in accordance with Chapter 2, paragraphs 3 and 4 and the following:

<b>Group</b>	<b>Feature</b>
I	1 Dynamic Probing 2 Static Probing
II	1 By Hand 2 Electrical Recording 3 Probing for Soil Gas Surveys 4 Gas Valves and Tubes
III	1 Vertical 2 Raking
IV	1 Over water 2 Over mineshafts 3 On a slope of gradient greater than 20%
V	1 Between existing ground level to not exceeding 10 metres depth 2 Between 10 metres to not exceeding 20 metres depth and so on in steps of 10 metres

**4.62 Probing**

The items for probing shall in accordance with the Preambles to Bill of Quantities General Directions include for:

**Item coverage**

- (a) taking information and preparing the journal and preliminary records, and submitting in duplicate to the Engineer;

- (b) calibration of instruments and supplying evidence of the calibration to the Engineer;
- (c) reinstatement of surfaces including deposition, spreading and levelling of topsoil;
- (d) taking precautions to avoid damage to property structures, sewers, drains and services;
- (e) in the case of hand dynamic probing and probing for soil gas surveys, moving and setting up equipment at each exploratory hole, including site preparation or levelling;
- (f) in the case of probing for soil gas surveys, forming pilot hole, providing equipment for analysing gas and sealing hole.
- (g) all in-situ tests required during probing operations and recording the required data.

**4.63 Gas Valves and Tubes**

The items for gas valves and tubes shall in accordance with the Preambles to Bill of Quantities General Directions include for:

**Item Coverage**

- (a) tube and isolating valve;
- (b) sealing tube in the ground.

**Standing time of Equipment**

**4.64 Units**

The units of measurement shall be:

Standing time of equipment ..... hours.

**4.65 Measurement**

The measurement of standing time shall be the duration of time which the Equipment is standing on the instructions of the Engineer, or in accordance with the Contract.

**4.66 Itemisation**

Separate items shall be provided for standing time of Equipment in accordance with Chapter 2, paragraphs 3 and 4 and the following:

<b>Group</b>	<b>Feature</b>
I	1 Standing Time
II	1 Different types of Equipment

**4.67 Standing time of Equipment**

The items for standing time of equipment shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) consequential costs;
- (b) changes in the programme of working;
- (c) taking information and preparing the journal and preliminary records and submitting in triplicate to the Engineer;
- (d) equipment and operatives.

**Sampling**

**4.68 Units**

The units of measurement shall be:

- (i) Samples ..... number.

**4.69 Measurement**

The measurement shall be the number of samples required by the Contract or ordered by the Engineer. Field tests carried out in lieu of sampling shall be measured as in situ testing.

4.70 Unsuccessful attempts to obtain samples shall be measured as successfully obtained samples only if the sampling procedures were carried out correctly in the opinion of the Engineer. Otherwise unsuccessful sampling shall not be measured.

**4.71 Itemisation**

Separate items shall be provided for site samples in accordance with Chapter 2, paragraphs 3 and 4 and the following:

<b>Group</b>	<b>Feature</b>
I	1 Small disturbed samples 2 Bulk disturbed samples 3 Open tube samples 4 Piston samples 5 Thin-walled tube samples 6 Undisturbed block samples 7 Groundwater samples taken directly from exploratory holes 8 Water samples from groundwater sampling standpipes and combined gas monitoring/groundwater sampling standpipe 9 Surface water samples 10 Gas samples
II	1 Samples of different diameters and sizes
III	1 Samples of different weights 2 Samples of different volumes 3 Samples of different lengths
IV	1 Different methods of sampling

**4.72 Small disturbed samples**

The items for small disturbed samples shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) delay in excavating, boring, drilling or probing due to sampling;
- (b) complying with the requirements of BS 5930;
- (c) providing containers, packaging, transportation to Contractor's laboratory or to a laboratory described in the Contract, including loading and unloading;
- (d) taking representative samples and transporting to Engineer's office;
- (e) taking and providing of records;
- (f) taking precautions against weather exposure and temperature;
- (g) storage and subsequent disposal;

(h) recording position of samples.

**4.73 Bulk disturbed samples**

The items for bulk disturbed samples shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) mixing and quartering;
- (b) small disturbed samples (as this chapter, paragraph 4.72).

**4.74 Open tube samples, piston samples and thin-walled tube samples**

The items for open tube samples, piston samples and thin-walled tube samples shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) preparation of bottoms of exploratory holes;
- (b) unsuccessful sampling due to contractor's method of working;
- (c) sealing;
- (d) recording percussion boring information;
- (e) small disturbed samples (as this chapter, paragraph 4.72).

**4.75 Undisturbed block samples**

The items for undisturbed block samples shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) preparation of bottom of exploratory holes, including working around the undisturbed block sample;
- (b) trimming of sample;
- (c) sealing;

(d) keeping the exploratory hole free of water;

(e) labelling and marking with orientation;

(f) small disturbed sample (as this chapter, paragraph 4.72).

**4.76 Groundwater samples**

The items for groundwater samples shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) baling out exploratory hole;
- (b) small disturbed sample (as this chapter, paragraph 4.72).

**4.77 Water samples from groundwater sampling standpipes and combined gas monitoring/groundwater sampling standpipes**

The items for water samples from groundwater sampling standpipes and combined gas monitoring/groundwater sampling standpipes shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) delay due to gas sampling;
- (b) purging;
- (c) field tests and measurements;
- (d) dividing into sub-samples;
- (e) fixing agents and filtering;
- (f) small disturbed sample (as this chapter, paragraph 4.72).

**4.78 Surface water samples**

The items for surface water samples shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) water samples from groundwater sampling standpipes and combined gas monitoring/ groundwater sampling standpipes (as this chapter, paragraph 4.77(b), (c), (d) and (e)).

4.79 Gas samples

The items for gas samples shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) providing containers, packaging, transportation to Contractor's laboratory or to a laboratory described in the Contract, including loading and unloading;
- (b) taking and providing of records;
- (c) taking precautions against weather exposure and temperature;
- (d) recording position of sample and time o'clock of sampling.

**Standpipes, standpipe piezometers, pneumatic piezometers, vibrating wire piezometers, gas monitoring standpipes, groundwater sampling standpipes and combined gas monitoring/ groundwater sampling standpipes**

4.80 Units

The units of measurements shall be:

- (a) standpipes, standpipe piezometers, pneumatic piezometers, vibrating wire piezometers, gas monitoring standpipes, groundwater sampling standpipes and combined gas monitoring/ groundwater sampling standpipes, filling holes, removal ..... linear metre
- (b) piezometer porous elements, protective covers, groundwater readings, gas pressure and emission rate measurements ..... number.

4.81 Measurement

The exploratory holes for standpipes, standpipe piezometers, pneumatic piezometers, vibrating wire piezometers, gas monitoring standpipes, groundwater sampling standpipes, combined gas monitoring/

groundwater sampling standpipes and removal shall be measured as boring or drilling.

4.82 The diameter stated shall be as for backfilling boring or drilling (paragraphs 4.27 and 4.40) as appropriate.

4.83 The measurement of standpipes, gas monitoring standpipes, groundwater sampling standpipes and combined gas monitoring/groundwater sampling standpipes shall be the length of tubing from the base to the cap.

4.84 The measurement of filling for standpipes shall be the length from the bottom of the hole to the underside of the concrete.

Provided that where more than one type of filling is used in any one hole then the measurement of each type of filling shall be from the interface of the two types of filling to either the bottom of the hole or to the underside of the concrete.

4.85 The measurement of filling for gas monitoring standpipes and groundwater sampling standpipes shall be the length from the bottom of the hole to the underside of the bentonite seal.

Provided that where more than one type of filling is used in any one hole then the measurement of each type of filling shall be from the interface of the two types of filling to either the bottom of the hole or to the underside of the bentonite seal.

4.86 The measurement of filling for combined gas monitoring/groundwater sampling standpipes shall be:

- (a) below standpipe - the length from the bottom of the hole to the base of the groundwater sampling standpipe;
- (b) around groundwater sampling standpipe - the length from the base of the groundwater sampling standpipe to the underside of the gas monitoring standpipe;
- (c) around gas monitoring standpipe - the length from the base of the gas monitoring standpipe to the underside of the bentonite seal.

4.87 The measurement of standpipe piezometers shall be the length of standpipe from the top of the porous element to the cap.



4.88 The measurement of filling holes for standpipe piezometers shall be:

- (a) below piezometer - the length from the base of the hole to the underside of the sand filter;
- (b) above piezometer - the length from the top surface of the sand filter to the underside of the concrete;
- (c) around piezometer - the length between the interfaces of the sand filter and any other filling.

4.89 The measurement of pneumatic piezometers and vibrating wire piezometer shall be the length of the nylon tubing, or conductor cable as applicable, from the top of the porous element to the underside of the coverplate.

4.90 The measurement of pneumatic piezometers and vibrating wire piezometer shall be:

- (a) below piezometer - the length from the base of the hole to the underside of the sand filter;
- (b) above piezometer - the length from the top surface of the sand filter to the underside of the concrete;
- (c) around piezometer - the length between the interfaces of the sand filter and any other filling.

4.91 Where more than one piezometer is installed in any one hole then the filling between:

- (a) the upper surface of the sand filter, of the deepest piezometer; and
- (b) the lower surface of the sand filter, to the next deepest piezometer;

shall be measured as below piezometer.

4.92 The measurement of groundwater level readings and groundwater pressure readings shall be for each reading taken at each standpipe or standpipe piezometer or pneumatic or vibrating wire piezometer but excluding those readings required to be taken before and immediately after installation.

4.93 The measurement of gas pressure and emission rate measurements shall be for each measurement taken at each gas monitoring standpipe but excluding that reading to be taken immediately after installation.

4.94 Itemisation

Separate items shall be provided for standpipes, standpipe piezometers, pneumatic piezometers, gas monitoring standpipes, groundwater sampling standpipes and combined gas monitoring/groundwater sampling standpipes in accordance with Chapter 2, paragraphs 3 and 4 and the following:

Group	Feature
I	1 Standpipe 2 Standpipe piezometer 3 Pneumatic piezometer 4 Vibrating wire piezometer 5 Gas monitoring standpipe 6 Groundwater sampling standpipe 7 Combined gas monitoring/groundwater sampling standpipe 8 Filling holes 9 Piezometer porous elements 10 Protective covers 11 Groundwater level readings 12 Groundwater pressure readings 13 Gas pressure and emission rate measurement 14 Removal
II	1 Different diameter holes
III	1 Different types of filling
IV	1 Different types of cover
V	1 Below piezometer 2 Above piezometer 3 Around piezometer 4 Below standpipe 5 Around standpipe 6 Around groundwater sampling standpipe 7 Around gas monitoring standpipe

4.95 Standpipes

The items for standpipes shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

Item coverage

- (a) recording water level before and immediately after installation;

- (b) clearing and keeping hole free of unwanted materials;
- (c) bringing Equipment to the site of each exploratory hole;
- (d) installation;
- (e) proving correct functioning;
- (f) protective fencing;
- (g) delays due to installation;
- (h) marker posts.

**4.96 Standpipe piezometers**

The items for standpipe piezometers shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

**Item coverage**

- (a) cutting, jointing tubing including fittings;
- (b) removing water contaminated by grout and replacing with clean water before standpipe piezometer installation;
- (c) standpipes (as paragraph 4.95).

**4.97 Pneumatic piezometers**

The items for pneumatic piezometers shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

**Item coverage**

- (a) cutting, jointing tubing including fittings;
- (b) removing water contaminated by grout and replacing with clean water before piezometer installation;
- (c) recording water level immediately before installation and water pressure immediately after installation
- (d) standpipes (as paragraph 4.95 (b) to (h)).

**4.98 Vibrating wire piezometers**

The items for vibrating wire piezometers shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

- (a) cable;
- (b) removing water contaminated by grout and replacing with clean water before piezometer installation;
- (c) recording water level immediately before installation and water pressure immediately after installation;
- (d) recording atmosphere pressure at the time of initial water pressure reading;
- (e) standpipes (as paragraph 4.95(b) to (h)).

**4.99 Gas monitoring standpipes**

The items for gas monitoring standpipes shall in accordance with the Preambles to Bill of Quantities General Directions include for:

**Item coverage**

- (a) taking gas flow and pressure measurements immediately after installation;
- (b) gas tight cap with valves and gas sampling tubes;
- (c) standpipes (as paragraph 4.95 (b) to (h)).

**4.100 Groundwater sampling standpipes**

The items for groundwater sampling standpipes shall in accordance with the Preambles to Bill of Quantities General Directions include for:

**Item coverage**

- (a) standpipes (as paragraph 4.95);
- (b) filter sleeve.

**4.101 Combined gas monitoring/groundwater sampling standpipes**

The items for combined gas monitoring/groundwater sampling standpipes shall in accordance with the

Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) gas monitoring standpipes (as paragraph 4.99);
- (b) groundwater sampling standpipes (as paragraph 4.100).

#### 4.102 Filling holes

The items for filling holes shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

Item coverage

- (a) backfilling and compaction;
- (b) mixing and placing grout;
- (c) allowing time for grout to harden;
- (d) sand filter including allowing time for settlement;
- (e) recording required data;
- (f) disposal of surplus material.

#### 4.103 Piezometer porous elements

The items for piezometer porous elements shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

Item coverage

- (a) connection to tubing or cable;
- (b) keeping clean during installation;
- (c) proving correct functioning.

#### 4.104 Protective covers

The items for protective covers shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

Item coverage

- (a) in situ concrete, including drainhole;
- (b) formwork;

- (c) pipework including lockable cap;
- (d) lockable cover and frame including painting bedding and seating;
- (e) bentonite seal in gas monitoring standpipes;
- (f) terminal plate with fittings for pneumatic or vibrating wire piezometer;
- (g) excavation, haulage and deposition in tips off site provided by the Contractor of turf, topsoil and excavated material not required for re-use.

#### 4.105 Groundwater level and pressure readings

The items for groundwater level and pressure readings shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

Item coverage

- (a) transport;
- (b) recording groundwater level or groundwater pressure;
- (c) approved sounding instrument or readout unit.

#### 4.106 Gas pressure and emission rate measurements

The items for gas pressure and emission rate measurements shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) transport;
- (b) recording gas pressure and emission rate;
- (c) approved measuring equipment and read-out unit;
- (d) calibration of measuring equipment and supplying evidence of calibration to the Engineer;
- (e) gas concentration measurements carried out in association with gas pressure and emission rate measurements.

4.107 Removal

The items for removal of standpipes and piezometers shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

Item coverage

- (a) removal and disposal off-site of all standpipes and piezometer equipment including tubing, standpipes, protective covers, valves, frames, fencing, marker posts and concrete, and pipework;
- (b) giving notices of re-entry to the Engineer, statutory undertakers, owners or occupiers affected by the Investigation or on the access routes;
- (c) access ramps and roads;
- (d) making good to walls, fences and hedges breached or otherwise disturbed with stockproof fencing.

**In situ testing**

4.108 Units

The units of measurement shall be:

- (i) in situ testing ..... number.

4.109 Measurement

Gas concentration measurements carried out in association with gas pressure and emission rate measurements shall not be measured under this item.

4.110 Itemisation

Separate items shall be provided for in situ testing in accordance with Chapter 2, paragraphs 3 and 4 and the following:

Group	Feature
I	1 Different types of in situ tests
II	1 Test duration up to 3 hours 2 Test duration 3 hours to 6 hours 3 Test duration 6 hours to 9 hours 4 Test duration 9 hours to 12 hours 5 Test duration 12 hours to 24 hours

4.111 In situ testing

The items for in situ testing shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) calibration of instruments and supplying evidence of the calibration to the Engineer;
- (b) delays in excavating, boring or drilling due to in situ testing;
- (c) recording required data;
- (d) supplying all required data to the Engineer;
- (e) split-barrel samples from standard penetration test;
- (f) bulk disturbed samples from standard penetration test;
- (g) bringing Equipment to the site of each in situ test;
- (h) demonstrating reproducibility of constant and variable head permeability tests.

**Self-boring pressuremeter**

4.112 Units

The units of measurement shall be:

- (i) moving of pressuremeter test Equipment to the site of each exploratory hole ..... number.
- (ii) advancing the hole to a test location, backfilling ..... linear metre.

(iii) self-boring to form a test pocket ..... number.

(iv) pressuremeter test ..... number.

**4.113 Measurement**

The measurement of moving of pressuremeter test Equipment to the site of each exploratory hole shall correspond to the number of exploratory holes in which the self-boring pressuremeter is used. Any additional moves to suit the Contractor's method of working shall not be measured.

4.114 The measurement of advancing the hole to a test location and backfilling shall be the length of the exploratory hole measured along the axis between existing ground level and the bottom of the hole in accordance with the Contract. Where a particular level is specified from which advancing the hole and backfilling shall commence, then the measurement of length shall be from that specified level. The lengths shall be measured within depth bands taken at 10 metre intervals from existing ground level. The diameter stated shall be the minimum diameter stated in the Contract or ordered by the Engineer.

Breaking out of hard strata or obstructions shall not be measured in addition to the measurement of advancing the hole to a test location.

The measurement of self-boring to form a test pocket shall be the number of test pockets required by the Contract or instructed by the Engineer.

Unsuccessful attempts to form a test pocket shall be measured as successfully formed test pockets only if the self-boring procedures were carried out correctly in the opinion of the Engineer. Otherwise unsuccessful self-boring to form a test pocket shall not be measured.

4.115 The measurement of pressuremeter tests shall be the number of tests required by the Contract or ordered by the Engineer.

4.116 The measurement of pressuremeter test Equipment means all Equipment necessary to carry out pressuremeter testing, to advance the hole to the next test location and attend during pressuremeter testing.

4.117 The measurement for standing time of pressuremeter test Equipment shall be in accordance with paragraphs 4.64 to 4.67 inclusive.

**4.118 Itemisation**

Separate items shall be provided for self-boring pressuremeter in accordance with Chapter 2, paragraphs 3 and 4 and the following:

<b>Group</b>	<b>Feature</b>
I	1 Moving of pressuremeter test Equipment to the site of each exploratory hole 2 Advancing the hole to a test location 3 Self-boring to form a test pocket 4 Pressuremeter test 5 Backfilling
II	1 Test duration up to 1.5 hours 2 Test duration 1.5 hours to 3 hours
III	1 Over water 2 On a slope of gradient greater than 20%
IV	1 Between existing ground level to not exceeding 10 metres depth 2 Between 10 metres to not exceeding 20 metres depth and so on in steps of 10 metres
V	1 Soil 2 Concrete 3 Cement/bentonite grout 4 Sand

**4.119 Moving of pressuremeter test Equipment to the site of each exploratory hole**

The items for moving of pressuremeter test Equipment to the site of each exploratory hole shall in accordance with the Preambles to Bill of Quantities General Directions include for:

**Item coverage**

- (a) giving notices to the Engineer, statutory undertakers, owners or occupiers affected by the Investigation or on the access routes;
- (b) moving and setting up the pressuremeter test Equipment at each exploratory hole including site preparation, levelling and access ramps and roads;

- (c) making good to walls, fences and hedges breached or otherwise disturbed with stockproof barriers.

#### 4.120 Advancing the hole to a test location

The items for advancing the hole to a test location shall, in accordance with the Preambles to Bill of Quantities General Directions include for:

##### Item coverage

- (a) stripping turf and topsoil and reserving for re-use;
- (b) casing, lining or split inner tubing;
- (c) allowing for oversize exploratory hole and casing;
- (d) changing drill bits or tools;
- (e) drilling fluids;
- (f) taking information and preparing the preliminary test results and submitting to the Engineer;
- (g) removing temporary casing or lining;
- (h) taking precautions to avoid damage to property, structures, sewers, drains and services;
- (i) dealing with artesian water;
- (j) delay to Pressuremeter Test Equipment during advancing the hole to a test location.

#### 4.121 Self-boring to form a test pocket

The items for self-boring to form a test pocket shall in accordance with the Preambles to Bill of Quantities General Directions include for:

##### Item coverage

- (a) taking information and preparing the journal and preliminary records and submitting in duplicate to the Engineer;
- (b) all flushing fluids and materials;
- (c) disposal of all excavated material not required for backfilling and all flushing fluids and materials;
- (d) providing and maintaining all necessary means of reaction;

- (e) delay to Pressuremeter Test Equipment during formation of test pocket.

#### 4.122 Pressuremeter test

The items for pressuremeter test shall in accordance with the Preambles to Bill of Quantities General Directions include for:

##### Item coverage

- (a) all calibrations of pressuremeter test Equipment as required in the Contract, supplying evidence of calibrations and supplying copies of instrument calibration register to the Engineer;
- (b) providing manufacturer's statement for straightness and sensitivity;
- (c) taking, and recording information, preparing preliminary site records and submitting all data to the Engineer;
- (d) all time spent by the pressuremeter test Equipment from completion of self-boring to form a test pocket to commencement of either advancing the hole to a further test location or self-boring to form a test pocket;
- (e) delay to pressuremeter test equipment during pressuremeter test and calibrations.

#### 4.123 Backfilling

The items for backfilling shall in accordance with the Preambles to Bill of Quantities General Directions include for:

##### Item coverage

- (a) compaction;
- (b) moving, placing and compaction of grout against any surface including soil faces;
- (c) dealing with artesian water;
- (d) freeing surfaces of areas to be turfed or seeded from stones and other debris and reducing the soil to a tilth immediately prior to turfing or seeding;
- (e) precast concrete cover slabs if required in the Contract;

- (f) reinstatement of surfaces including depositing, spreading and levelling of topsoil and laying of turf.
- (g) multiple handling of excavated material;
- (h) taking precautions to avoid damage to property, structures, sewers, drains and services;
- (i) excavation, haulage and deposition in tips off site provided by the Contractor of turf, top soil and excavated material not for re-use;
- (j) importing any additional soil required for backfilling.

**Closed circuit television surveys**

4.124 Units

The units of measurement shall be:

- (i) moving of closed circuit television survey equipment to the site of each exploratory hole ..... number.
- (ii) carry out closed circuit television surveys in exploratory holes ..... linear metre.

4.125 Measurement

The measurement of moving of closed circuit television survey equipment to the site of each exploratory hole shall correspond to the number of exploratory holes in which a closed circuit television survey is required by the Contract or instructed by the Engineer. Any additional moves to suit the Contractor's method of working shall not be measured.

4.126 The measurement of carrying out closed circuit television surveys in exploratory holes shall be that length of the exploratory hole measured along the axis of the hole surveyed by the camera and recorded on the video tape. Lengths of exploratory hole not recorded on video tape shall not be measured.

4.127 Itemisation

Separate items shall be provided for closed circuit television surveys in accordance with Chapter 2, paragraphs 3 and 4 and the following:

Group	Feature
I	1 Moving of closed circuit television survey equipment to the site of each exploratory hole 2 Carry out closed circuit television survey in exploratory hole

4.128 Moving of closed circuit television survey equipment

The items for moving of closed circuit television survey equipment to the site of each exploratory hole shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) provision of all necessary equipment including adequate power supply and experienced operator;
- (b) moving and setting up equipment at each exploratory hole and dismantling after completion;
- (c) reinstatement around each exploratory hole.

4.129 Carrying out closed circuit television surveys

The items for carrying out closed circuit television surveys in exploratory holes shall in accordance with the Preambles to Bill of Quantities General Directions include:

Item coverage

- (a) all standing time incurred by boring, drilling, grouting or probing equipment as a result of these surveys;
- (b) leaving in of any temporary casing as necessary in the exploratory hole;
- (c) removal of any temporary casing on completion of survey including all additional moves by boring or drilling equipment;
- (d) delays and consequential costs;
- (e) supplying video tape recording and reports to the Engineer.

**Laboratory Testing and Reports**

**Laboratory tests**

4.130 Units

The units of measurement shall be:

(i) Laboratory tests ..... number.

4.131 Measurement

The measurement of laboratory tests shall be the number of tests ordered by the Engineer. The expected maximum duration of tests which are likely to be of variable duration shall be stated in the item description.

4.132 The measurement of a day shall be a continuous period of 24 hours

4.133 Itemisation

Separate items shall be provided for laboratory tests in accordance with Chapter 2, paragraphs 3 and 4 and the following:

Group	Feature
I	1 Soil tests 2 Rock tests 3 Solids tests 4 Water tests 5 Gas tests
II	1 Each type of laboratory test
III	1 Different maximum duration of test
IV	1 Specimen size

Note: For each item which includes a Feature from Group III an associated item shall be provided for adjustment of the rate for each test day in excess of the maximum where the actual duration of the test carried out in accordance with the Contract varies from that stated in the Bill of Quantities.

4.134 Laboratory tests

The items for laboratory tests shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) preparation and description of specimens;
- (b) storage of samples;
- (c) materials and chemicals required for testing;
- (d) monitoring and recording results and supplying two copies of the preliminary laboratory test results to the Engineer;
- (e) disposal of surplus material;
- (f) a copy of each of the actual laboratory test result sheets and summary supplied to the Engineer each week;
- (g) an example of the calculation of each type of test result supplied to the Engineer.

**Additional laboratory test procedures**

4.135 Units

(i) The units of measurement shall be:

Extra over laboratory tests for amended drying procedure, procedure to correct moisture content determination .....number.

4.136 Measurement

The measurement of additional laboratory test procedures shall be the number of additional test procedures required for determination of moisture content.

4.137 Itemisation

Separate items shall be provided for additional laboratory test procedures in accordance with Chapter 2, paragraphs 3 and 4 and the following:



Group	Feature
I	1 Extra over laboratory tests
II	1 For amended moisture content drying procedure 2 For correction to moisture content for material retained on a 425 micron sieve 3 For correction to moisture content for water absorption 4 For correction to moisture content for dissolved salts

4.138 Additional laboratory test procedures

The items for additional laboratory test procedures shall in accordance with the Preambles to the Bill of Quantities General Directions include for:

Laboratory tests (as this chapter, paragraph 4.134).

**Sample examination**

4.139 Units

The units of measurement shall be:

- (i) examination and description of small disturbed, bulk disturbed, open tube, piston, thin-walled tube, undisturbed block soil samples in the laboratory ..... number.
- (ii) examination and description of rock cores in the laboratory ..... metre.

4.140 Measurement

The measurement of examination and description of soil samples in the laboratory shall be the number of samples instructed by the Engineer. Examination and description of soil samples which are tested in the laboratory shall not be measured under this item.

4.141 Measurement of examination and description of rock cores in the laboratory shall be of those lengths only as instructed by the Engineer. Examination and description of rock cores on site shall not be measured under this item.

Itemisation

4.142 Separate items shall be provided for the examination and description of soil samples, and rock cores in the laboratory in accordance with Chapter 2, paragraphs 3 and 4 and the following:

Group	Feature
I	1 Examination and description of soil samples in the laboratory 2 Examination and description of rock cores in the laboratory
II	1 Small disturbed soil samples 2 Bulk disturbed soil samples 3 Open tube samples 4 Piston samples 5 Thin walled tube samples 6 Undisturbed block soil samples

4.143 Examination and description of soil samples in the laboratory

The items for examination and description of soil samples in the laboratory shall in accordance with the Preambles to Bill of Quantities General Directions include:

Item coverage

- (a) complying with the requirements of BS 5930;
- (b) preparation of samples including extrusion of undisturbed samples;
- (c) recording of data.

4.144 Examination and description of rock cores in the laboratory

The items for examination and description of rock cores in the laboratory shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) complying with the requirements of BS 5930;
- (b) recording of data.

**Reports**

4.145 Units

The units of measurement shall be:

Copies of factual report, copies of interpretative report, copies of digital data report .... item.

4.146 Measurement

The number of copies of the factual, digital data and interpretative report required by the Engineer shall be stated in the item description.

4.147 Itemisation

Separate items shall be provided for reports in accordance with Chapter 2, paragraphs 3 and 4 and the following:

<b>Group</b>	<b>Feature</b>
I	1 Copies of Report
II	1 Factual Report 2 Interpretative Report 3 Digital Data Report

Item coverage

- (a) preparation and submission of draft report to Engineer;
- (b) amending draft report;
- (c) awaiting Engineer’s approval to draft report;
- (d) printing, copying and binding;
- (e) delivery of copies to the Engineer.
- (f) providing formatted virus free data disks;
- (g) complying with the required data format;
- (h) use of appropriate system of hardware and software;
- (i) preparation and submission of dummy set of data;
- (j) labelling and indexing digital data disks and keeping index until completion of the Period of Maintenance;
- (k) preparation and submission of all digital data disks and indexes and keeping copies until the expiry of the Period of Maintenance.

4.148 Copies of Factual and Interpretative Report

The items for copies of factual and interpretative report shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) preparation and submission of draft report to Engineer;
- (b) amending draft report;
- (c) awaiting Engineer’s approval to draft report;
- (d) printing, copying and binding;
- (e) delivery of copies to the Engineer.

4.149 Copies of Digital Data Report

The items for copies of the digital data report shall in accordance with the Preambles to Bill of Quantities General Directions include for:

## 5. ENQUIRIES

Approval of this document for publication is given by the undersigned.

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