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Transport Infrastructure Ireland

## TII Publications



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# Method of Measurement for Road Works Series MM 600 - Earthworks

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## About TII

Transport Infrastructure Ireland (TII) is responsible for managing and improving the country's national road and light rail networks.

## About TII Publications

TII maintains an online suite of technical publications, which is managed through the TII Publications website. The contents of TII Publications is clearly split into 'Standards' and 'Technical' documentation. All documentation for implementation on TII schemes is collectively referred to as TII Publications (Standards), and all other documentation within the system is collectively referred to as TII Publications (Technical). This system replaces the NRA Design Manual for Roads and Bridges (NRA DMRB) and the NRA Manual of Contract Documents for Road Works (NRA MCDRW).

## Document Attributes

Each document within TII Publications has a range of attributes associated with it, which allows for efficient access and retrieval of the document from the website. These attributes are also contained on the inside cover of each current document, for reference. For migration of documents from the NRA and RPA to the new system, each current document was assigned with new outer front and rear covers. Apart from the covers, and inside cover pages, the documents contain the same information as previously within the NRA or RPA systems, including historical references such as those contained within NRA DMRB and NRA MCDRW.

## Document Attributes

<b>TII Publication Title</b>	<i>Method of Measurement for Road Works Series MM 600 - Earthworks</i>
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## NRA DMRB and MCDRW References

For all documents that existed within the NRA DMRB or the NRA MCDRW prior to the launch of TII Publications, the NRA document reference used previously is listed above under 'historical reference'. The TII Publication Number also shown above now supersedes this historical reference. All historical references within this document are deemed to be replaced by the TII Publication Number. For the equivalent TII Publication Number for all other historical references contained within this document, please refer to the TII Publications website.

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## Series 600: Earthworks

### Definitions

- 1 The Earthworks Outline, unless expressly stated otherwise, is defined as the finished earthworks levels and dimensions (prior to topsoiling) required by the Contract for the construction, where specified, of:
  - (a) carriageway, hard shoulder, hard strip, footway, paved area, central reserve, verge, side slope;
  - (b) sub-base, fill on capping, sub-base material and roadbase;
  - (c) contiguous filter material, lightweight aggregate infill;
  - (d) surface water channels;
  - (e) landscape areas, screening mounds, environmental bunds.

In all cases of filter drains the Earthworks Outline shall be the top of the filter material.

- 2 Where capping is required by the Contract in cutting or on embankment, the Earthworks Outline shall be as defined in paragraph 1 of this Series i.e. as the top of capping.
- 3 Where an embankment is required by the Contract to be surcharged, the Earthworks Outline shall be as defined in paragraph 1 of this Series and exclude the surcharge.
- 4 Where permanent storage or stockpiling of topsoil is required by the Contract, the Earthworks Outline shall be as defined in paragraph 1 of this Series and exclude stored topsoil.
- 5 Where the bottom of a structural foundation for an earth retaining structure (other than for reinforced earth and an anchored earth structure) is below Existing Ground Level, the Earthworks Outline shall be the permanently exposed face of the structure below Existing Ground Level.
- 6 Where the bottom of the facing foundation for a reinforced earth structure or an anchored earth structure is below Existing Ground Level, the Earthworks Outline shall be the inside face of the facing above Existing Ground Level to the underside of the capping unit, or where no capping unit is required, to the finished earthworks level prior to topsoiling.
- 7 Where the ground has been subjected to treatment under the Contract in respect of ground improvement, mine workings, swallow holes and the like, for the purpose of this Series Existing Ground Level shall be the level obtained upon completion of any such treatment of the areas affected.
- 8 Sub-soil Level is defined as the level of the ground after the removal of topsoil required by the Contract.
- 9 Surcharge is defined as material placed on embankments for the purpose of loading the embankment for the periods stated in the Contract.

### Measurement General

- 10 For the purposes of this Series it shall be assumed that one cubic metre of material excavated forms one cubic metre of compacted fill. No allowance

shall be made in the measurement for bulking and shrinkage of any material.

- 11** Earthworks within Designated Outlines shall not be measured in this Series.
- 12** For the purpose of this Series no account shall be taken of excavated material arising from the Works measured in accordance with Series 100 to 500 and 700 to 2500 hereof.
- 13** Where deposition and compaction of an embankment has been carried out in accordance with the Contract and settlement occurs:
- (a) subsequent to the Earthworks Outline having being reached, or in the case of a surcharged embankment subsequent to the removal of the surcharge; or
  - (b) from settlement of or penetration into the ground beneath the embankment;

then the additional fill, deposition and compaction required shall be measured immediately prior to the preparation of formation, provided that the first 75 mm of settlement or penetration shall not be measured.

In the case of landscape areas, screening mounds, environmental bunds and other areas of fill where settlement or penetration occurs, the additional fill, deposition and compaction required shall not be measured.

**Excavation**

Units

- 14** The unit of excavation shall be:

- (i) excavation ..... cubic metre.

Measurement

- 15** The measurement of excavation shall be, for:

- (a) Topsoil Class 5A – the volume of the void formed by the excavation of material designated topsoil Class 5A;
- (b) Cutting and other excavation:
  - (i) cutting and bulk excavation – the volume of the void formed by the excavation of material from Existing Ground Level down to the Earthworks Outline, together with the volume of the void formed by the excavation of material below that Outline;
  - or
  - (ii) under embankments and other areas of fill – the volume of the void formed by the excavation of material below Existing Ground Level;

less in each case the volume of topsoil Class 5A in the void included in the measurement under paragraph 15(a). The volume of excavation of soft spots measured under paragraph 62 of this Series shall not be included.

- (c) Removal of surcharge – the volume of material remaining as surcharge to be removed down to the datum stated in the Contract, or if none is stated, to the Earthworks Outline;
- (d) Structural foundations – the volume of the void to accommodate the structural foundation calculated on the basis of the horizontal area of the bottom of the foundation with the depth being measured from the bottom of the foundation (including blinding concrete) to:
  - (i) where the bottom of the foundation is below Existing Ground Level – the Existing Ground Level; provided that where the Earthworks Outline is below Existing Ground Level the depth shall be measured to the Earthworks Outline;
  - (ii) where the bottom of the foundation is at or above Existing Ground Level – the datum stated in the Contract, or where none is stated to the Earthworks Outline;

less in each case the volume of topsoil Class 5A in the void included in the measurement under paragraph 15(a). The volume of excavation of soft spots measured under paragraph 62 of this Series shall not be included.

The classification of stage depths for the excavation of structural foundations shall be the maximum depth of excavation obtained in accordance with this sub-paragraph;

- (e) Foundations for corrugated steel buried structures and the like – the volume of the void to accommodate the structure, bedding and surround down to the outline stated in the Contract from:
  - (i) where the bottom of the bedding is below Existing Ground Level – Existing Ground Level;
  - (ii) where the bottom of the bedding is at or above Existing Ground Level – the datum stated in the Contract or where none is stated – Earthworks Outline;

less in each case the volume of topsoil Class 5A in the void included in the measurement under paragraph 15(a). The volume of excavation of soft spots measured under paragraph 62 of this Series shall not be included.

The classification of stage depths for the excavation of the foundation shall be the maximum depth of excavation obtained in accordance with this sub-paragraph.

- (f) New and enlarged watercourses, intercepting ditches – the volume of the void formed from Existing Ground Level down to the outline stated in the Contract less the volume of topsoil Class 5A in the void included in the measurement under paragraph 15(a) of this Series;
- (g) Clearing abandoned watercourses – the volume of the void formed from Existing Ground Level down to the outline stated in the Contract;

- (h) Gabion walling, mattresses and crib walling – as for structural foundations sub-paragraph (d) of this paragraph;
- (i) Caps to mine working, well, swallow hole and the like – the volume of the voids formed to accommodate the caps;
- (j) Swamps, marshes and bogs – the volume of the void formed from existing Ground Level down to the outline stated in the Contract.

**Itemisation**

- 16** Separate items shall be provided for excavation in accordance with Chapter II paragraphs 3 and 4, and the following:

Group	Feature
I	1 Excavation
II	1 Acceptable material Class 5A
	2 Not used
	3 Acceptable material excluding Class 5A
	4 Unacceptable material Class U1
	5 Unacceptable material Class U2
III	1 Cutting and other excavation
	2 Structural foundations
	3 Foundations for corrugated steel buried structures and the like
	4 New watercourses
	5 Enlarged watercourses
	6 Intercepting ditches
	7 Clearing abandoned watercourses
	8 Removal of surcharge
	9 Gabion walling and mattresses
	10 Crib walling
	11 Caps to mine working, well, swallow hole and the like
	12 Swamps, marshes and bogs
IV	1 0 metres to 3 metres in depth
	2 0 metres to 6 metres in depth and so on in steps of 3 metres

Note 1: Acceptable material Class 5A shall not be separately identified by any Group III or IV feature.

Note 2: Group IV features shall be applied only to Features 2, 3, 9, 10 and 11 of Group III.

**Excavation of  
Acceptable Material  
Class 5A**

Item Coverage

- 17** The items for excavation of acceptable material Class 5A shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) loading into transport;
  - (b) multiple handling of material;
  - (c) selection and separation of materials;
  - (d) keeping earthworks free of water;
  - (e) haulage and deposition in temporary stockpiles including the provision of sites for stockpiles;
  - (f) taking precautions to avoid damage to property, structures, drains, sewers, services, instrumentation and the like;
  - (g) grading beds and trimming side slopes of watercourses and the like;
  - (h) replacing acceptable material rendered unacceptable;
  - (i) facilitating Archaeologist.

**Excavation of  
Acceptable Material  
Excluding Class 5A**

Item Coverage

- 18** The items for excavation of acceptable material excluding Class 5A shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) loosening or breaking up material before or in the process of excavation;
  - (b) upholding the sides;
  - (c) working around and between piles;
  - (d) overbreak and making good;
  - (e) keeping earthworks free of water;
  - (f) selection and separation of materials;
  - (g) forming and trimming side slopes, benchings and berms;
  - (h) trimming the bottom and sides of foundations;
  - (i) grading beds and trimming sides of watercourses and the like, and working in and dealing with the flow of water;
  - (j) protection of subgrade;
  - (k) additional excavation the Contractor may require for working space, timbering, formwork or other temporary works and its subsequent backfilling with approved materials and compaction;

- (l) taking precautions to avoid damage to property, structures, drains, sewers, services, instrumentation and the like;
- (m) treatment of faces of cuttings which are not to receive topsoil;
- (n) loading into transport;
- (o) multiple handling of material;
- (p) disposal of surcharge material (as this Series paragraph 39);
- (q) waiting for frozen material to thaw;
- (r) haulage, deposition and compaction in temporary stockpiles including provision of sites for stockpiles;
- (s) replacing acceptable material rendered unacceptable;
- (t) breaking down and processing material necessary to comply with the requirements of fill;
- (u) complying with special requirements for materials requiring special treatments;
- (v) excavation difficulties due to the presence of traffic on public roads;
- (w) facilitating installation of permanent drainage before excavation reaches 300 mm above formation;
- (x) selection and separation by load of made ground.

**Excavation of Unacceptable Material Classes U1 and U2**

Item Coverage

**19** The items for excavation of unacceptable material Classes U1 and U2 shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) excavation (as this Series paragraph 18);
- (b) special measures for dealing with Class U2 material;
- (c) special measures for dealing with swamps, marshes and bogs.

**Excavation in Hard Material**

Units

**20** The unit of measurement shall be:

- (i) extra over excavation for excavation in Hard Material ..... cubic metre.

Measurement

**21** The measurement of extra over excavation for excavation in Hard Material shall be the volume of Hard Material within the void measured under paragraph 15 of this Series.



Itemisation

- 22** Separate items shall be provided for extra over excavation for excavation in Hard Material in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Extra over excavation for excavation in Hard Material
II	1 Cutting and other excavation
	2 Structural foundations
	3 Foundations for corrugated steel buried structures and the like
	4 New watercourses
	5 Enlarged watercourses
	6 Intercepting ditches
	7 Clearing abandoned watercourses
	8 Gabion walling and mattresses
	9 Crib walling
	10 Caps to mine working, well, swallow hole and the like

**Extra Over Excavation for Excavation in Hard Material**

Item Coverage

- 23** The items for extra over excavation for excavation in Hard Material shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) preliminary site trials of blasting;
  - (b) blasting, splitting, breaking and the like;
  - (c) cutting through reinforcement;
  - (d) saw cutting and trimming;
  - (e) removal of existing paved areas by course or layer, cleaning surfaces, milling or planning, stepping out and treatment to bottoms of foundations;
  - (f) complying with the requirements of blasting in the Contract, including monitoring by vibrograph, and keeping the Employer's Representative informed;
  - (g) make the rock face safe;
  - (h) cleaning down rock face after blasting;
  - (i) forming intermediate rockhead benches and benches at interface of overburden soil and competent rock

**Processing of Unacceptable Material Class U1**

**Definition**

**24** The term ‘processing’ shall refer to treatment whereby material arising from the Site is rendered acceptable for a particular use in the Works by mechanical, chemical, hydraulic or other means.

Units

**25** The unit of measurement shall be:

- (i) processing of unacceptable material Class U1 ..... cubic metre.

Measurement

**26** The processing of unacceptable material Class U1 shall be measured only when the Contract specifically requires particular material to be obtained for use in the Works by processing. Other processing carried out by the Contractor shall not be measured. The measurement of processing of unacceptable material Class U1 shall be the volume of the void required to be filled with the processed material.

Itemisation

**27** Separate items shall be provided for processing of unacceptable material Class U1 in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Processing of unacceptable material Class U1
II	1 Different locations
III	1 Into different classes of acceptable material

**Possessing of Unacceptable Material Class U1**

**28** The items for processing of unacceptable material Class U1 shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) selection and separation of materials;
- (b) taking precautions to avoid damage to property, structures, drains, sewers, services, instrumentation and the like;
- (c) loading into transport;
- (d) multiple handling of material;
- (e) waiting for frozen material to thaw;
- (f) replacing acceptable material rendered unacceptable;
- (g) haulage, deposition and compaction in temporary stockpiles including provision of sites for stockpiles;
- (h) crushing, screening, mixing, grading, drying, wetting and sieving;
- (i) mechanical, chemical, hydraulic and other methods;



**Deposition of Fill**

Item Coverage

- 33** The items for deposition of fill shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) protection of subgrade;
  - (b) multiple handling of material;
  - (c) keeping earthworks free of water;
  - (d) complying with requirements and constraints on the sequence, timing and rate of deposition and filling, and equalisation of earth pressures;
  - (e) complying with the special requirements for materials requiring special treatments;
  - (f) complying with the particular requirements and constraints with regard to soil stabilisation, reinforced earth structures, strengthened embankments, anchored earth structures, corrugated steel buried structures and the like;
  - (g) taking precautions to avoid damage to property, structures, sewers, drains, services, instrumentation and the like;
  - (h) haulage;
  - (i) waiting for frozen material to thaw;
  - (j) replacing acceptable material rendered unacceptable;
  - (k) selection of material of stated Classes and layering or depositing in locations stated in the Contract;
  - (l) depositing fill to slope away from vertical drainage layers and measures to prevent surface water entering such layers;
  - (m) treatment of soil as the Contractor may require to facilitate the use of particular plant;
  - (n) trimming and shaping to levels and contours;
  - (o) deposition of fill resulting from settlement and penetration of landscape areas, screening mounds, environmental bunds and other areas of fill, and from the first 75 mm of settlement and penetration of embankments.

**Disposal of Material**

- Units**                               **34**    The unit of measurement shall be:
- (i)    disposal of material ..... cubic metre.
- Measurement**                       **35**    The measurement of disposal of acceptable material shall be for:
- (a)    acceptable material excluding Class 5A – the volume excavated from within the Site measured in this Series less the volume of compacted fill calculated in accordance with paragraphs 47, 48 and 49 of this Series, after deduction from the latter of the volume of imported fill calculated in accordance with paragraphs 41 and 42 of this Series;
- (b)    acceptable material Class 5A – the volume excavated from within the Site measured in accordance with paragraph 15(a) of this Series less the volume of topsoil to be permanently stored and the volume of topsoil calculated from the areas and thicknesses to be topsoiled in accordance with paragraph 78 of this Series.
- 36**    The measurement of disposal of unacceptable material Class U1 shall be the volume of unacceptable material Class U1 excavated from within the Site and measured under this Series less the volume of processed unacceptable material Class U1 calculated in accordance with paragraph 21 of this Series.
- 37**    The measurement of disposal of unacceptable material Class U2 shall be the volume of unacceptable material Class U2 excavated from within the Site and measured under this Series.
- Itemisation**                               **38**    Separate items shall be provided for disposal of material in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1     Disposal
II	1     Acceptable material excluding Class 5A
	2     Acceptable material Class 5A
	3     Unacceptable material Class U1
	4     Unacceptable material Class U2

- Disposal of Material**                       **39**    The items for disposal of material shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- Item Coverage**
- (a)    haulage and deposition in tips off Site provided by the Contractor;
- (b)    multiple handling of material;
- (c)    special measures for dealing with Class U2 material;
- (d)    allowing for deposition in lieu of disposal of acceptable fill resulting from settlement and penetration of landscape areas, environmental

bunds, screening mounds and other areas of fill, and from the first 75 mm of settlement and penetration of embankments;

- (e) special measures for dealing with materials from swamps, marshes and bogs.

#### **Imported Fill**

Units

**40** The unit of measurement shall be:

- (i) imported fill ..... cubic metre.

Measurement

**41** The measurement of imported acceptable fill shall be the volume of compacted fill, calculated in accordance with paragraphs 47, 48 and 49 of this Series less the volumes of:

- (a) acceptable material (including that measured in accordance with this Series paragraph 26), excluding topsoil Class 5A, excavated from within the Site and measured in this Series;
- (b) other stated classes of imported acceptable fill excluding topsoil Class 5B

**42** The measurement of other stated classes of imported acceptable fill, other than topsoil Class 5B, shall be the volume of the void filled with the stated class of imported acceptable fill to the outline stated in the Contract.

**43** The measurement of imported topsoil Class 5B shall be the volume of topsoil calculated from the areas and thicknesses to be topsoiled less the volume of topsoil Class 5A excavated from within the Site and measured in accordance with paragraph 15(a) of this Series.

Itemisation **44** Separate items shall be provided for imported acceptable fill in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Imported topsoil Class 5B
	2 Imported acceptable material. fill.
	3 Other stated classes of imported acceptable
II	1 Embankments and other areas of fill
	2 Strengthened embankments
	3 Reinforced earth structures
	4 Anchored earth structures
	5 Landscape areas and screening mounds
	6 Environmental bunds
	7 Fill to structures
	8 Fill above structural concrete foundations
	9 Fill on capping, sub-base material and roadbase
	10 Fill on bridges (under footways, verges and central reserves)
	11 Upper bedding to corrugated steel buried structures and the like
	12 Lower bedding to corrugated steel buried structures and the like
	13 Surround to corrugated steel buried structures and the like
	14 Fill above corrugated steel buried structures and the like

Note 1: Group I Feature 3 Imported topsoil Class 5B shall not be separately identified by any Group II feature.

**Imported Fill**

**45** The items for imported fill shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) protection of subgrade;
- (b) multiple handling of material;
- (c) keeping earthworks free of water;
- (d) complying with requirements and constraints on the sequence, timing and rate of deposition and filling, and equalisation of earth pressures;
- (e) complying with the special requirements for Class 3 material and other materials requiring special treatments;
- (f) complying with the particular requirements and constraints with regard to soil stabilisation, reinforced earth structures, strengthened embankments, anchored earth structures, corrugated steel buried structures and the like;

- (g) taking precautions to avoid damage to property, structures, sewers, drains, services, instrumentation and the like;
- (h) fill provided by the Contractor from sources outside the Site;
- (i) replacing acceptable material rendered unacceptable;
- (j) selection of material of stated Classes and layering or depositing in locations stated in the Contract;
- (k) depositing fill to slope away from vertical drainage layers and measures to prevent surface water entering such layers;
- (l) trimming and shaping to levels and contours;
- (m) imported fill resulting from settlement and penetration of landscape areas, screening mounds, environmental bunds and other areas of fill, and from the first 75 mm of settlement and penetration of embankments:
- (n) reports.

#### **Compaction of Fill**

- |             |  |
|-------------|--|
| Units       | <b>46</b> The unit of measurement shall be: <ul style="list-style-type: none"><li>(i) compaction of fill ..... cubic metre.</li></ul>  |
| Measurement | <b>47</b> The measurement of compaction of fill in embankments and other areas of fill, in strengthened embankments, in reinforced earth structures, in anchored earth structures, in landscape areas, in screening mounds and in environmental bunds shall be the volume of the embankment or void filled from Existing Ground Level up to the Earthworks Outline plus, where required by the Contract, the volume of: <ul style="list-style-type: none"><li>(a) the void formed by the removal of topsoil Class 5A beneath the fill in question, and included in the measurement under paragraph 15(a) of this Series;</li><li>(b) the void formed by excavation for the fill in question –<ul style="list-style-type: none"><li>(i) below the Earthworks Outline included in the measurement under paragraph 15(b)(i) of this Series; and</li><li>(ii) below Existing Ground Level included in the measurement under paragraph 15(b) (ii) of this Series;</li></ul></li><li>(c) surcharge, being the void filled from the Earthworks Outline up to the profile stated in the Contract to which the surcharge is required to be constructed;</li></ul> |

less in each case the volume of any compaction of fill to structures, and bedding and surround to corrugated steel buried structures and the like included in the volume so obtained and which is measured separately under paragraph 49 of this Series.

- 48** The measurement of compaction of fill above structural concrete foundations shall be the volume of the void measured in accordance with



paragraph 15(d) of this Series less the volume of the structural foundation and structure within that void.

**49** The measurement of compaction of:

- (a) fill to structures;
- (b) fill on capping, sub-base material and roadbase;
- (c) fill on bridges (under footways, verges and central reserves);
- (d) bedding to corrugated steel buried structures and the like;
- (e) surround to corrugated steel buried structures and the like;

in each case, shall be the volume of the voids filled to the outline stated in the Contract less the volume of corrugated steel buried structures and the like within that void.

**50** Compaction of Class 1C and 6B materials shall be separately measured only where Class 1C or 6B material as such is specifically stated by the Contract to be required to be placed in a particular location.

Itemisation

**51** Separate items shall be provided for compaction of fill in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Compaction
II	1 Acceptable material
	2 Acceptable material Class 1C
	3 Not used
	4 Acceptable material Class 6B
III	1 Embankments and other areas of fill
	2 Strengthened embankments
	3 Reinforced earth structures
	4 Anchored earth structures
	5 Landscape areas and screening mounds
	6 Environmental bunds
	7 Fill to structures
	8 Fill above structural concrete foundations
	9 Fill on capping, sub-base material and roadbase
	10 Fill on bridges (under footways, verges and central reserves)
	11 Upper bedding to corrugated steel buried structures and the like
	12 Lower bedding to corrugated steel buried structures and the like
	13 Surround to corrugated steel buried structures and the like
	14 Fill above corrugated steel buried structures and the like

**Compaction of Fill**

**52** The items for compaction of fill shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) protection of subgrade;
- (b) multiple handling of material;
- (c) keeping earthworks free of water;
- (d) complying with requirements and constraints on the sequence, timing and rate of deposition and filling, and equalisation of earth pressures;
- (e) complying with the requirements for materials requiring special treatment;
- (f) complying with the particular requirements and constraints with regard to soil stabilisation, reinforced earth structures, strengthened embankments, anchored earth structures, corrugated steel buried structures and the like;
- (g) taking precautions to avoid damage to property, structures, sewers, drains, services, instrumentation and the like;
- (h) spreading and levelling;
- (i) trial areas, trials and demonstrations;
- (j) making good after sampling and testing;
- (k) forming and trimming side slopes, benchings and berms;
- (l) treatment of side slopes and berms;
- (m) compaction of fill resulting from settlement and penetration of landscape areas, screening mounds, environmental bunds and other areas of fill, and from the first 75 mm of settlement and penetration of embankments;
- (n) blinding;
- (o) special measures for dealing with processed material.

**Soil Improvement**

Units **53**

The unit of measurement shall be:

- (i) soil improvement ..... cubic metre.

**Measurement**                      **54**      The measurement of soil improvement shall be the volume of material to be improved measured to the outlines stated in the Contract irrespective of the number of layers or thicknesses, methods or sequences of operations involved in improving the material to the depth required.

Note: Soil improvement means the process of improvement whether the material is intact and undisturbed or deposited and compacted prior to improvement.

Excavation, fill, import, disposal and compaction required to expose or produce the layer to be improved, as appropriate, shall be included under the measurement of earthworks elsewhere in this Series.

Excavation, deposition and compaction involved in the process of improvement itself shall not be measured.

**Itemisation**                      **55**      Separate items shall be provided for soil improvement in accordance with Chapter **II** paragraphs 3 and 4 and the following:

Group	Feature
I	1      Soil Improvement
II	1      General Fill
III	1      Cement
	2      Lime

**Soil Improvement**                      **56**      The items for soil Improvement to form general fill shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- Item Coverage**
- (a) excavation of un acceptable material (as this Series paragraph 19);
  - (b) deposition (as this Series paragraph 33);
  - (c) compaction of fill (as this Series paragraph 52);
  - (d) pulverising, measuring, spreading and mixing;
  - (e) laps and joints;
  - (f) lime
  - (g) cement
  - (h) addition of water
  - (i) curing, protection and sealing;
  - (j) shaping to cambers, falls and crowns;
  - (k) edge supports;

- (l) additional fill, deposition, compaction or disposal resulting from the process of stabilisation;
- (j) additional fill and stabilisation resulting from the first 75mm of settlement and penetration of embankments;

**Geotextiles**

- Units **57** The unit of measurement shall be:
- (i) geotextile ..... square metre.
- Measurement **58** The measurement of geotextile shall be the developed area covered by the geotextile measured to the limits stated in the Contract.
- Itemisation **59** Separate items shall be provided for geotextile in accordance with Chapter II paragraphs 3 and 4 and the following:

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Group	Feature
I	1 Geotextile
II	1 Different types
III	1 Different grades

---

- Geotextile** **60** The items for geotextile shall in accordance with Preambles to Bill of Quantities General Directions include for:
- Item Coverage
- (a) cleaning, trimming, regulating and preparing surfaces;
  - (b) laps;
  - (c) measures to protect material;
  - (d) cutting and jointing, sealing and fixing;
  - (e) securing material in place;
  - (f) complying with the requirements of strengthened earthworks;
  - (g) turn ups and overlaps at edges.

**Soft Spots and Other Voids**

- Units **61** The unit of measurement shall be:
- (i) soft spots, other voids ..... cubic metre.
- Measurement **62** The measurement of soft spots and other voids shall be the volume of the voids directed to be excavated or filled. Soft spots and other voids shall be measured separately from the main excavation or filling where the volume:

- (a) below structural foundations, foundations for corrugated steel buried structures or in side slopes of cuttings is less than 1 cubic metre;
- (b) elsewhere is less than 25 cubic metres.

Itemisation

- 63** Separate items shall be provided for soft spots and other voids in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Excavation of soft spots and other voids
	2 Filling of soft spots and other voids
II	1 Below cuttings or under embankments
	2 In side slopes
	3 Below structural foundations and foundations for corrugated steel buried structures
III	1 Different types of fill

**Excavation of Soft Spots and Other Voids**

- 64** The items for excavation of soft spots and other voids shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) excavation of acceptable material (as this Series paragraphs 17 and 18);
- (b) excavation of unacceptable material (as this Series paragraph 19);
- (c) disposal of material (as this Series paragraph 39);
- (d) trimming back cutting faces.

**Filling of Soft Spots and Other Voids**

- 65** The items for filling of soft spots and other voids shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) deposition of fill (as this Series paragraph 33);
- (b) compaction of fill (as this Series paragraph 52);
- (c) formwork (as Series 1700 paragraph 14);
- (d) treatment of cutting faces;
- (e) in situ concrete (as Series 1700 paragraph 4).

**Disused Sewers, Drains, Cables, Ducts, Pipelines and the Like Occurring at Formation or Sub-formation Level; Disused Basements, Cellars and the Like and Gullies**

**Definition**

- 66** The term 'services' in paragraphs 67 to 72 inclusive shall be deemed to include sewers, drains, cables, ducts, pipelines and the like, together with associated chambers, fittings etc.

Units

- 67** The units of measurement shall be:
- (i) removal of disused services ..... linear metre;
  - (ii) removal of disused gullies, manholes and chambers .... number.
  - (ii) backfilling disused services ..... cubic metre;
  - (iii) backfilling disused basement, cellar and the like ..... cubic metre;
  - (iv) backfilling disused gullies ..... number.

Measurement

- 68** The measurement of removal of disused services shall be applied only to those existing services occurring at or below formation or sub-formation level in cutting and, or which are specifically stated in the Contract to be removed. The measurement shall be the distance along the centre line of the route of the services and, unless stated otherwise in the Contract no deduction shall be made for chambers and the like occurring on the pipe run. . Where no piperun is being removed and isolated gullies, manhole and chambers are to be removed item 62 (ii) then applies.

The measurement of backfilling disused services shall be applied only to those existing services occurring at or below formation or sub-formation level in cutting and, or which are specifically stated in the Contract to be backfilled. The measurement shall be the volume of the void directed to be filled, and unless stated otherwise in the Contract shall include chambers and the like.

The removal or backfilling of other disused services occurring elsewhere in the Works shall not qualify for separate measurement under this paragraph.

- 69** The measurement of backfilling disused basements, cellars and the like shall be the volume of the void directed to be filled.

The measurement of backfilling disused gullies shall be the complete operation.

Itemisation

- 70** Separate items shall be provided for removal, backfilling disused services, backfilling disused basements, cellars and the like and gullies in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Removal
	2 Backfilling
II	1 Different types
III	1 Different sizes
IV	1 Disused service with one metre or less of cover to formation level
	2 Disused service exceeding one metre and not exceeding two metres of cover to formation level, and so on in steps of one metre
	3 Disused basement, cellar and the like
	4 Disused gully
V	1 Different materials

Note 1: Group IV Features 3 and 4 shall not be applied to Group I Feature 1.

**Removal of Disused Services**

Item Coverage

- 71** The items for removal of disused services shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) excavation of acceptable material (as this Series paragraphs 17 and 18);
  - (b) excavation of unacceptable material (as this Series paragraph 19);
  - (c) breaking up beds, haunches and surrounds;
  - (d) disposal of material (as this Series paragraph 39);
  - (e) sealing ends of services;
  - (f) credit value of materials.

**Backfilling, Disused Services, Basements, Cellars and the Like and Gullies**

Item Coverage

- 72** The items for backfilling disused services, basements, cellars and the like and gullies shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) compaction (as this Series paragraph 52);
  - (b) perforation of existing slabs and cleaning;
  - (c) in situ concrete (as Series 1700 paragraph 4);
  - (d) reinforcement (as Series 1700 paragraph 25);
  - (e) formwork (as Series 1700 paragraph 14);

- (f) sealing ends of services;
- (g) grouting.

### Supports Left in Excavation

Units **73** The unit of measurement shall be:

- (i) supports left in excavation ..... square metre.

Measurement **74** The measurement of supports left in excavation shall be the area of face directed to be left with supports in position.

Itemisation **75** Separate items shall be provided for supports left in excavation in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature	
I	1	Support
II	2	Timber
	1	Steel
III	2	Different types

### Supports Left in Excavation

**76** The items for supports left in excavation shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) struts, walings and the like and working around them.

### Topsoiling and Storage of Topsoil

Units **77** The units of measurement shall be:

- (i) topsoiling ..... square metre.
- (ii) permanent storage of topsoil ..... cubic metre.

Measurement **78** The measurement of topsoiling shall be the area of the surface to be topsoiled and shall include topsoil class 5A excavated from within the site and imported topsoil Class 5B. The measurement of the permanent storage of topsoil shall be the volume of topsoil Class 5A excavated from within the Site and measured in accordance with paragraph 15(a) of this Series less the volume of topsoil calculated from the areas and thicknesses to be topsoiled.



Itemisation

**79** Separate items shall be provided for topsoiling in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Topsoiling of different thicknesses
	2 Permanent storage of topsoil
II	1 Surfaces sloping at 10° or less to the horizontal
	2 Surfaces sloping at more than 10° to the horizontal

Note 1: Group I Feature 2 shall not be identified by any Group II Feature.

**Topsoiling**

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

Item Coverage

- (a) the removal of stone and other debris;
- (b) taking delivery of imported topsoil;
- (c) excavation from stockpile;
- (d) loading into transport;
- (e) haulage, deposition, spreading, levelling and compaction;
- (f) trimming and shaping to levels and contours;
- (g) harrowing;
- (h) herbicide treatment.

**Permanent Storage of Topsoil**

**81** The items for permanent storage of topsoil shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) excavation from stockpile;
- (b) loading into transport;
- (c) hauling, deposition, spreading, levelling and compaction in permanent storage area;
- (d) trimming and shaping to levels and contours;
- (e) multiple handling of material.

**Grass Seeding and Turfing**

**Units** **82** The unit of measurement shall be:  
(i) grass seeding, turfing ..... square metre.

**Itemisation** **83** Separate items shall be provided for grass seeding and turfing in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Grass seeding
	2 Turfing
	3 Hydraulic mulch grass seeding
II	1 Surfaces sloping at 10° or less to the horizontal
	2 Surfaces sloping at more than 10° to the horizontal
III	1 Turfing in two layers
IV	1 Different mixtures

**Grass Seeding and Turfing**

**Item Coverage** **84** The items for grass seeding and turfing topsoil shall in accordance with the Preambles to Bill of Quantities General Directions include for:  
(a) freeing surfaces of areas to be grassed or turfed from stones and other debris and reducing the soil to a tilth immediately prior to grassing;  
(b) fertilising including additional plant nutrients;  
(c) mowing and clearance of grass cuttings;  
(d) pegging and wiring of turves;  
(e) raking, watering, retaining agent and herbicide treatment;  
(f) additives.

**Completion of Formation and Sub-formation**

**Units** **85** The unit of measurement shall be:  
(i) completion of formation, sub-formation ..... square metre.

**Measurement** **86** The measurement of completion of formation for roads shall be the area of the surface immediately beneath the sub-base except that where capping is required the measurement shall be the area of the surface of the capping excluding sloping sides and edges.  
The measurement of completion of sub-formation for roads shall be the area of the surface immediately beneath capping.

Completion of formation and sub-formation on Classes 1C and 6B materials shall be measured separately only when the Contract states

specifically that those materials are to be provided at formation or sub-formation level.

The measurement of completion of formation beneath structures shall be the area of the surface immediately beneath the blinding.

Itemisation

- 87** Separate items shall be provided for completion of formation and sub-formation in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Completion of sub-formation
	2 Completion of formation
II	1 On acceptable material
	2 On Class 1C material
	3 On Class 6B material
	4 On rock in cuttings

**Completion of Formation and Sub-formation**

- 88** The items for completion of formation and sub-formation shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) removal of protective layer, mud and slurry;
- (b) compaction;
- (c) cleaning, trimming, regulating, making good and rolling;
- (d) cement bound materials;
- (e) excavation, processing, compaction of naturally occurring Hard Material;
- (f) measures to protect formation and sub-formation against deterioration or degradation.

**Lining of Watercourses**

Units

- 89** The unit of measurement shall be:

- (i) lining of watercourses ..... square metre.

Measurement

- 90** Measurement of lining of watercourses shall be the permanently exposed face area of the work.

Measurement of bagwork shall be the flat undeveloped area of the work.

Itemisation

**91** Separate items shall be provided for lining of watercourses in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Lining of new watercourse
	2 Lining of enlarged watercourse
	3 Lining of intercepting ditches
II	1 To inverts
	2 To side slopes
	3 Different types
	4 Different thicknesses

**Lining of Watercourses**

**92** The items for lining of watercourses shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) bedding and compaction;
- (b) laying, setting, bedding, jointing, wedging, cutting and pointing;
- (c) building in pipes;
- (d) concrete (as Series 1700 paragraphs 4 and 9);
- (e) formwork (as Series 1700 paragraph 14);
- (f) reinforcement (as Series 1700 paragraph 25);
- (g) bags, filling, staking and securing;
- (h) blinding concrete (as Series 1700 paragraph 4).

**Clearing of Existing Ditches**

Units

**93** The unit of measurement shall be:

- (i) clearing of existing ditches ..... linear metre.

Measurement

**94** The measurement of clearing of existing ditches shall be the length along the centre line of the ditch.

Itemisation

**95** Separate items shall be provided for clearing of existing ditches in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Clearing of existing ditches
II	2 Different locations

**Clearing of Existing Ditches**

**96** The items for clearing of existing ditches shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) excavation and loading into transport;
- (b) haulage and deposition of excavated materials in tips off Site provided by the Contractor;
- (c) clearing and removing debris and vegetable growth to tips off Site provided by the Contractor;
- (d) trimming side slopes and grading bottoms;
- (e) maintaining existing outfalls.

**Ground Improvement – Establishment of Dynamic Compaction Plant**

Units

**97** The unit of measurement shall be:

- (i) establishment of dynamic compaction plant ..... item.

Measurement

**98** The establishment of dynamic compaction plant shall be measured once only to each separate location of dynamic compaction on the Site. Any additional establishment of dynamic compaction plant to suit the Contractor’s method of working shall not be measured.

Itemisation

**99** Separate items shall be provided for establishment of dynamic compaction plant in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Establishment of dynamic compaction plant
II	2 Different locations

**Establishment of Dynamic Compaction Plant**

**100** The items for establishment of dynamic compaction plant shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) bringing plant and equipment to the location of dynamic compaction;
- (b) erecting and setting up plant and equipment including site preparation, levelling, and access ramps;
- (c) moving and setting up plant and equipment at each position including site preparation, levelling and access ramps;
- (d) dismantling and removing plant and equipment from the Site on completion.

**Ground Improvement – Dynamic Compaction**



- (f) complying with particular requirements and constraints;
- (g) keeping records;
- (h) extracting buried pounder.

**Dynamic Compaction  
Plant Standing Time**

**107** The items for dynamic compaction plant standing time shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) ancillary plant;
- (b) equipment and operatives;
- (c) periods of less than half an hour.

**Granular Blanket**

**108** The items for granular blanket shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) deposition of fill (as this Series paragraph 33);
- (b) compaction of fill (as this Series paragraph 52).

**Gabion Walling and Mattresses**

Units

**109** The unit of measurement shall be:

- (i) gabion walling, mattresses ..... cubic metre.

Measurement

**110** The measurement of gabion walling and mattresses shall be the volume contained within the outline of the gabions or mattresses as stated in the Contract.

Itemisation

**111** Separate items shall be provided for gabion walling and mattresses in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Gabion walling
	2 Mattresses
II	1 Different mesh materials
III	1 Different mesh size
IV	1 Different types of fill
V	1 Mattresses installed at 10° or less to the horizontal
	2 Mattresses installed at more than 10° to the horizontal
VI	1 In environmental bunds

**Gabion Walling and Mattresses**

Item Coverage

- 112** The items for gabion walling and mattresses shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) blinding layer;
  - (b) assembling, tying, fixing, staking and tensioning;
  - (c) fill, compaction and finishes;
  - (d) mesh including cutting and folding to form special units and shapes;
  - (e) bracing and wiring lids.

**Crib Walling**

Units

- 113** The unit of measurement shall be:

- (i) crib walling ..... square metre.

Measurement

- 114** The measurement shall be the flat undeveloped area of crib walling. No deduction shall be made for openings within the wall which are part of the modular system, nor for other openings of one square metre or less.

Itemisation

- 115** Separate items shall be provided for crib walling in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Crib walling
II	1 Different types
III	1 Curved on plan
IV	1 With a battered face
V	1 Different finishes
VI	1 Different infill

**Crib Walling**

Item Coverage

- 116** The items for crib walling shall in accordance with the Preamble to Bill of Quantities General Directions include for:

- (a) blinding layer
- (b) bedding and jointing;
- (c) dowels and pins;
- (d) granular infill and compaction;



- (e) special units and forming ends and corners;
- (f) obtaining manufacturer's certificate and supplying copy to the Employer's Representative;
- (f) building in pipes and forming small openings.

**Filling and Caps to Mine Working, Well, Swallow Hole and the Like**

Units

**117** The units of measurement shall be:

- (i) filling to mine working, well, swallow hole and the like ..... tonne;
- (ii) caps to mine working, well, swallow hole and the like ..... cubic metre.

Measurement

**118** The measurement of filling to mine working, well, swallow hole and the like shall be calculated from the tonnage of material certified by the Employer's Representative, being only that material, included on delivery tickets, which is incorporated in the permanent Works in the locations and to the extent and thickness required by the Contract. Material in excess of the requirements of the Contract and material used for any other purpose shall not be included within the certified tonnage.

**119** The measurement of caps to mine working, well, swallow hole and the like shall be the volume of concrete forming the caps.

Itemisation

**120** Separate items shall be provided for filling and caps to mine working, well, swallow hole and the like in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Filling
	2 Caps
II	1 Mine working
	2 Well
	3 Swallow hole and the like
III	1 Different materials

**Filling and Caps to Mine Working, Well, Swallow Hole and the Like**

Item Coverage

**121** The items for filling and caps to mine working, well, swallow hole and the like shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) excavation of acceptable material (as this Series paragraphs 17 and 18);
- (b) excavation of unacceptable material (as this Series paragraph 19);

- (c) backfilling and compaction;
- (d) concrete (as Series 1700 paragraphs 4 and 9);
- (e) formwork including permanent formwork (as Series 1700 paragraph 14);
- (f) reinforcement (as Series 1700 paragraph 25);
- (g) flushing;
- (h) disposal of material (as this Series paragraph 39);
- (i) investigation and monitoring;
- (j) material not used as filling.

**Ground Anchorages & Soil Nails – Ground Anchorage & Soil Nail Plant**

Units

**122** The unit of measurement shall be:

- (i) establishment of ground anchorage & soil nail plant ..... item.

Measurement

**123** The establishment of ground anchorage & soil nail plant shall be measured once only to each separate location of ground anchorages & soil nail on the Site. Any additional establishment of ground anchorage & soil nail plant to suit the Contractor’s method of working shall not be measured.

Itemisation

**124** Separate items shall be provided for ground anchorage & soil nail plant in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Establishment of ground anchorage & soil nail plant
II	1 Different locations

**Establishment of Ground Anchorage & Soil Nail Plant**

**125** The items for establishment of ground anchorage & soil nail plant shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) bringing plant and equipment to the location of ground anchorages & soil nails;
- (b) erecting and setting up plant and equipment including site preparation, levelling and access ramps;
- (c) moving and setting up plant and equipment at each position including site preparation, levelling and access ramps;
- (d) dismantling and removing plant and equipment from Site on completion.



- (l) grouting ground anchorages including fixed length and free stressing length;
- (m) applying prestress in one or more stages;
- (n) grouting soil nails
- (o) checking the accuracy of load measuring equipment and adjusting;
- (p) taking observations and compiling a record of stressing and grouting operations and supplying one copy to the Employer's Representative;
- (q) measures to prove anchorage or nail suitability;
- (r) proof loading;
- (s) facilities for Employer's Representative's proof loading.

**Ground Anchorages – Waterproofing Anchorage Boreholes**

Units

**130** The unit of measurement shall be:

- (i) waterproofing of boreholes ..... linear metre.

Measurement

**131** The measurement of waterproofing of boreholes shall be the total length of waterproofing operation instructed by the Employer's Representative.

Itemisation

**132** Separate items shall be provided for waterproofing of boreholes in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Waterproofing of boreholes
II	1 Standard grouting
	2 Pressure grouting

**Waterproofing of Boreholes**

**133** The items for waterproofing of boreholes shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) pre-grouting;
- (b) re-drilling and applying water under pressure and proving watertightness of borehole.

**Instrumentation and Monitoring – Boring Plant**

- Units **134** The unit of measurement shall be:
- (i) establishment of boring plant ..... item.
- Measurement **135** The establishment of boring plant shall be measured once only to each separate location of boring on the Site. Any additional establishment of boring plant to suit the Contractor’s method of working shall not be measured.
- Itemisation **136** Separate items shall be provided for boring plant in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Establishment of boring plant
II	1 Different locations

**Establishment of Boring Plant**

- 137** The items for establishment of boring plant shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- Item Coverage
- (a) bringing plant and equipment to the location of boring;
- (b) erecting and setting up plant and equipment including site preparation, levelling and access ramps;
- (c) moving and setting up plant at each position including site preparation, levelling, and access ramps;
- (d) dismantling and removing plant and equipment from Site on completion.

**Instrumentation and Monitoring – Boring Holes**

- Units **138** The unit of measurement shall be:
- (i) boring holes ..... linear metre.
- Measurement **139** The measurement of boring holes shall be the linear distance along the axis of the borehole between the instrument base and the level stated in the Contract.
- Itemisation **140** Separate items shall be provided for boring holes in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Boring holes
II	1 Vertical
	2 Raking
III	1 Depth not exceeding 10 metres
	2 Depth exceeding 10 metres but not exceeding 20 metres and so on in steps of 10 metres

**Boring Holes**

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

Item Coverage

- (a) boring holes in any material, including changing bits and tools;
- (b) disposal of material (as this Series paragraph 39);
- (c) taking measures to deal with the presence of water in the boreholes;
- (d) drilling fluid;
- (e) standing time including ancillary plant, equipment and operatives.

**Instrumentation and Monitoring – Instrumentation**

Units

**142** The units of measurement shall be:

- (i) installation of instruments ..... number;
- (ii) installation of tubing, cabling and the like ..... linear metre;
- (iii) grouting ..... linear metre.

Measurement

**143** The measurement of installation of instruments shall be the complete installation.

The measurement of tubing and the like shall be the length measured from the instrument to the underside of the screw cap, plug or the like, along the centre line of the trench or borehole.

The measurement of cabling and the like shall be the length measured from the instrument to the base of the instrument hut or cabinet along the centre line of the trench or borehole.

The measurement of grouting shall be the distance from the top of the seal to either the bottom of the trench or to the underside of the screw cap plug or the like whichever is the lower.

Itemisation

**144** Separate items shall be provided for instrumentation in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Installation
II	1 Different types of instruments
	2 Different types of tubing or cabling
	3 Different types of grouting
III	1 Length or depth not exceeding 10 metres
	2 Length or depth exceeding 10 metres but not exceeding 50 metres, and so on in steps of 50 metres

**Installation of  
Instruments**

Item Coverage

**145** The items for installation of instruments shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) recording water levels;
- (b) cleaning and keeping hole free of deleterious materials;
- (c) connections and joints;
- (d) keeping items clean during installation;
- (e) sand filters including allowing time for settlement;
- (f) removing contaminated water;
- (g) recording data and supplying one copy to the Employer's Representative;
- (h) proving correct functioning;
- (i) bedding and surround.

**Installation of Tubing  
and Cabling**

Item Coverage

**146** The items for installation of tubing and cabling shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) standpipes;
- (b) cutting and jointing tubing including fittings and screw caps;
- (c) connections and joints;
- (d) excavation in any material (as this Series paragraphs 17, 18, 19 and 23);
- (e) bedding and surround to cable or tube;
- (f) backfilling and compaction;
- (g) marking tape or cable covers;
- (h) extra length of cable for connection to monitoring equipment;
- (i) twisting and snaking;
- (j) incremental installation;
- (k) ducts (as Series 500 paragraph 12).

**Grouting**

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

Item Coverage

- (a) mixing and placing grout;
- (b) in situ concrete (as Series 1700 paragraph 4);
- (c) formwork (as Series 1700 paragraph 14);
- (d) backfilling and compaction;
- (e) disposal of material (as this Series paragraph 39);
- (f) covers, frames, seatings and bedding;
- (g) locks and keys.

**Instrumentation and Monitoring – Instrument Hut or Cabinet**

Units

**148** The unit of measurement shall be:

- (i) erection, servicing, dismantling of instrument hut or cabinet ..... item.

Itemisation

**149** Separate items shall be provided for instrument hut or cabinet in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Erection
	2 Servicing
	3 Dismantling
II	1 Instrument hut for the Employer’s Representative
	2 Instrument cabinet for the Employer’s Representative
III	1 Until completion of the Works
	2 After completion of the Works

**Erection of Instrument Hut**

**150** The items for erection of instrument hut shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) preparation of site;
- (b) foundations, bases and hardstandings;
- (c) heating, power, water and lighting services;
- (d) security fence and lockable gates;
- (e) furnishings and fittings;



- (f) locks and keys.

**Servicing Instrument Hut**

**151** The items for servicing instrument hut shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) depreciation and maintenance of building, services and fences;
- (b) depreciation and maintenance of furnishings, fittings and supplies.

**Dismantling Instrument Hut**

**152** The items for dismantling instrument hut shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) receiving back from the Employer's Representative and removing furnishings and fittings;
- (b) disconnecting, removing and sealing off disused services;
- (c) demolishing and removing off Site instrument hut, hardstandings, fences and gates;
- (d) disposal of material (as this Series paragraph 39);
- (e) reinstatement of the site.

**Erection of Instrument Cabinet**

**153** The items for erection of instrument cabinet shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) preparation of site;
- (b) foundations and bases;
- (c) power and water services;
- (d) locks and keys.

**Servicing of Instrument Cabinet**

**154** The items for servicing of instrument cabinet shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) depreciation and maintenance of cabinet and services;
- (b) depreciation and maintenance of fittings and supplies;
- (c) servicing.

**Dismantling of Instrument Cabinet**

**155** The items for dismantling of instrument cabinet shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) disconnecting, removing, and sealing off disused services;
- (b) removing instrument cabinet off Site;

- (c) breaking up and removal of foundations, and bases, and disposal of surplus material;
- (d) disposal of material (as this Series paragraph 39);
- (e) reinstatement of the site.

**Instrumentation and Monitoring – Monitoring Equipment**

Units **156** The unit of measurement shall be:

- (i) monitoring equipment ..... item.

Itemisation **157** Separate items shall be provided for monitoring equipment in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Monitoring equipment
II	1 Different types

**Monitoring Equipment**

**158** The items for monitoring equipment shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) installing, commissioning, calibrating and maintaining monitoring equipment in instrument hut or cabinet;
- (b) installing, commissioning, calibrating and maintaining monitoring equipment in vehicles for the Employer’s Personnel;
- (c) copies of reports and results and supplying to the Employer’s Representative;
- (d) instructing the Employer’s Personnel in the operation and maintenance of the instrumentation;
- (e) attendance during measurement carried out by the Employer’s Representative;
- (f) removing on completion.

**Ground Water Lowering**

Units **159** The unit of measurement shall be:

- (i) ground water lowering ..... item.

Measurement **160** The measurement of ground water lowering shall be the complete installation. Ground water lowering shall be separately measured only where ground water lowering is specifically required in the Contract.

Itemisation

**161** Separate items shall be provided for ground water lowering in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Ground water lowering
II	1 Different locations

**Ground Water Lowering**

**162** The items for ground water lowering shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) preparing, amending and submitting proposals to the Employer's Representative;
- (b) installation, operation, maintenance and removal of plant;
- (c) making arrangements with owners and occupiers of land temporarily acquired, and cost arising therefrom;
- (d) diversion of rivers and the like;
- (e) soakaways, lagoons and the like;
- (f) measures to safeguard water supplies including liaising with water companies.

**Trial Pits**

Units

**163** The unit of measurement shall be:

- (i) Move equipment to trial pit location ..... number.
- (ii) trial pits ..... cubic metre.

Measurement

**164** The measurement of trial pits shall be the volume of the void, calculated on the basis of the horizontal area of the bottom of the excavation with the depth being measured from the bottom of the excavation to the level at which excavation is directed to be commenced.

Itemisation

**165** Separate items shall be provided for trial pits in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Move equipment to trial pit location
	2 Trial pits
II	1 0 metres to 2 metres in depth
	2 2 metres to 4 metres in depth, and so on in steps of 2 metres

**Trial Pits**

**166** The items for trial pits shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item Coverage

- (a) bringing and setting up plant and equipment at location of trial pit;
- (b) excavation of acceptable material (as this Series paragraphs 17 and 18);
- (c) excavation of unacceptable material (as this Series paragraph 19);
- (d) excavation in Hard Material (as this Series paragraph 23);
- (e) locating, working around and supporting pipes, cables, services, apparatus and the like;
- (f) attendance on the Employer's Representative and others for inspection and investigation purposes;
- (g) disposal of material (as this Series paragraph 39);
- (h) backfilling and compaction;
- (i) reinstatement of surfaces.

**Breaking up and Perforation of Redundant Pavements**

Units

**167** The unit of measurement shall be:

- (i) breaking up of redundant pavements, perforation of redundant pavements ..... square metre.

Measurement

**168** The measurement of breaking up and perforation of redundant pavements shall be the areas stated in the Contract to be broken up or perforated and left in place. The depth of the pavement shall be the depth from the existing surface of the pavement to the underside of bituminous or cementitious material.

Itemisation

**169** Separate items shall be provided for breaking up and perforation of redundant pavements in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature	
I	1	Breaking up of redundant pavements
	2	Perforation of redundant pavements
II	1	Different types of pavement
III	1	Depth not exceeding 100 mm
	2	Depth exceeding 100 mm but not exceeding 200 mm, and so on in steps of 100 mm

**Breaking up and Perforation of Redundant Pavements**

Item Coverage

**170** The items for breaking up and perforation of redundant pavements shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) excavation in Hard Material (as this Series paragraph 23);
- (b) taking precautions to avoid damage to property, structures, drains, sewers, services, instrumentation and the like.

**Perforation of Redundant Slabs, Basements and the Like**

Units

**171** The unit of measurement shall be:

- (i) perforation of redundant slabs, basements and the like ..... square metre.

Measurement

**172** The measurement of perforation of redundant slabs, basements and the like shall be the areas stated in the Contract to be perforated and left in place.

Itemisation

**173** Separate items shall be provided for perforation of redundant slabs, basements and the like in accordance with Chapter II paragraphs 3 and 4 of the following:

Feature		
I	1	Perforation of redundant slabs, basements and the like
II	1	Different types of slabs, basements and the like
III	1	Thickness not exceeding 100 mm
	2	Thickness exceeding 100 mm but not exceeding 200 mm, and so on in steps of 100 mm

**Perforation of Redundant Slabs, Basements and the Like**

**174** The items for perforation of redundant slabs, basements and the like shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) excavation in Hard Material (as this Series paragraph 23);
- (b) taking precautions to avoid damage to property, structures, drains, sewers, services, instrumentation and the like.







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