



Bonneagar Iompair Éireann
Transport Infrastructure Ireland

TII Publications



Method of Measurement for Road Works Series MM 1600 - Piling and Embedded Retaining Walls

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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.

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Document Attributes

TII Publication Title	<i>Method of Measurement for Road Works Series MM 1600 - Piling and Embedded Retaining Walls</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NRA MCDRW prior to the launch of TII Publications, the NRA document reference used previously is listed above under 'historical reference'. The TII Publication Number also shown above now supersedes this historical reference. All historical references within this document are deemed to be replaced by the TII Publication Number. For the equivalent TII Publication Number for all other historical references contained within this document, please refer to the TII Publications website.

Series 1600: Piling and Embedded Retaining Walls

Piling Plant

Units	1	The units of measurement shall be: <ul style="list-style-type: none"> (i) establishment of piling plant item. (ii) moving piling plant number. 																				
Measurement	2	The establishment of piling plant shall be measured once only to each structure. Any additional establishment of piling plant to suit the Contractor's method of working shall not be measured. The measurement of moving piling plant shall be measured once only to each pile.																				
	3	Moving of piling plant shall not be measured for steel sheet piling.																				
Itemisation	4	Separate items shall be provided for piling plant in accordance with Chapter II paragraphs 3 and 4 and the following:																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Group</th> <th style="text-align: left;">Feature</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="vertical-align: top;">I</td> <td>1 Establishment of piling plant</td> </tr> <tr> <td>2 Moving piling plant</td> </tr> <tr> <td rowspan="5" style="vertical-align: top;">II</td> <td>1 Precast concrete piles</td> </tr> <tr> <td>2 Bored cast-in-place piles</td> </tr> <tr> <td>3 Driven cast-in-place piles</td> </tr> <tr> <td>4 Steel bearing piles</td> </tr> <tr> <td>5 Steel sheet piles</td> </tr> <tr> <td>III</td> <td>1 Different types</td> </tr> <tr> <td>IV</td> <td>1 Different cross-sections</td> </tr> <tr> <td rowspan="2" style="vertical-align: top;">V</td> <td>1 Preliminary piling as a separate operation in advance of the main piling</td> </tr> <tr> <td>2 Main piling</td> </tr> <tr> <td>VI</td> <td>1 Different locations</td> </tr> </tbody> </table>			Group	Feature	I	1 Establishment of piling plant	2 Moving piling plant	II	1 Precast concrete piles	2 Bored cast-in-place piles	3 Driven cast-in-place piles	4 Steel bearing piles	5 Steel sheet piles	III	1 Different types	IV	1 Different cross-sections	V	1 Preliminary piling as a separate operation in advance of the main piling	2 Main piling	VI	1 Different locations
Group	Feature																					
I	1 Establishment of piling plant																					
	2 Moving piling plant																					
II	1 Precast concrete piles																					
	2 Bored cast-in-place piles																					
	3 Driven cast-in-place piles																					
	4 Steel bearing piles																					
	5 Steel sheet piles																					
III	1 Different types																					
IV	1 Different cross-sections																					
V	1 Preliminary piling as a separate operation in advance of the main piling																					
	2 Main piling																					
VI	1 Different locations																					
Establishment of Piling Plant	5	The items for the establishment of piling plant shall in accordance with the Preambles to Bill of Quantities General Directions include for:																				
Item coverage		<ul style="list-style-type: none"> (a) bringing plant and equipment to the site of the structure; (b) erecting and setting up plant and equipment including site preparation, levelling and access ramps; (c) dismantling and removing plant and equipment from Site on completion. 																				

- Moving Piling Plant**
- Item coverage 6 The items for moving piling plant shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) moving and setting up plant and equipment at each pile position including site preparation, levelling and access ramps.

Precast Concrete Piles

- Units 7 The units of measurement shall be:
- (i) precast concrete piles, driving, lengthening, driving lengthened piles linear metre.
- (ii) stripping precast concrete pile heads number.
- Measurement 8 The measurement of precast concrete piles shall be the lengths required by the Contract. The jointing of segmental piles shall not be measured.
- 9 The measurement of driving precast concrete piles shall be the length of each pile measured along the axis from the toe to:
- (a) the Existing Ground Level or the level of the underside of the pile cap or ground beam (ignoring any blinding layer) whichever is the lower, provided that where a particular level is specified from which driving shall commence then the measurement shall be to that specified level; or
- (b) the site joint of piles to be lengthened, provided that the site joint after completion of the driving is below the level determined in accordance with the preceding sub-paragraph.

- 10 The measurement of lengthening precast concrete piles shall be the lengths of the added concrete ordered by the Employer.

The measurement of lengthening precast segmental piles shall be the length of the added segment ordered by the Employer.

- 11 The measurement of driving lengthened precast concrete piles shall be the length from the site joint to the level determined in accordance with subparagraph 9(a) above.

- 12 The length classification for those items listed in sub-paragraph 7(i) above shall be based on the appropriate measured lengths determined in accordance with paragraphs 8 to 11 above inclusive.

- Itemisation 13 Separate items shall be provided for precast concrete piles in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Precast concrete piles
II	1 Driving precast concrete piles
	2 Lengthening precast concrete piles
	3 Driving lengthened precast concrete piles

	4	Stripping pile heads
III	1	Vertical
	2	Raking
IV	1	Different types
V	1	Different materials
VI	1	Different cross-sections
VII	1	Piles not exceeding 5 metres in length
	2	Piles exceeding 5 metres in length but not exceeding 10 metres and so on in steps of 5 metres
VIII	1	Preliminary piling as a separate operation in advance of the main piling
	2	Main piling

Precast Concrete Piles	14	The items for precast concrete piles shall in accordance with the Preambles to Bill of Quantities General Directions include for:
Item coverage		<ul style="list-style-type: none"> (a) design; (b) certificates; (c) provision of data and drawings; (d) resubmissions and modifications; (e) amendments to the Works; (f) precast members, and the like (as Series 1700 paragraph 9); (g) pile shoes, tapered points, prefabricated joints and joint fitments; (h) measures for reduction of friction.

Driving Precast Concrete Piles	15	The items for driving precast concrete piles shall in accordance with the Preambles to Bill of Quantities General Directions include for
Item coverage		<ul style="list-style-type: none"> (a) pre-boring or jetting; (b) handling, pitching and driving to a set or level; (c) taking observations and compiling the record of each pile and supplying one copy to the Employer; (d) moving plant and equipment back and re-driving risen piles.

Lengthening Precast Concrete Piles	16	The items for lengthening precast concrete piles shall in accordance with the Preambles to Bill of Quantities General Directions include for:
Item coverage		<ul style="list-style-type: none"> (a) design; (b) certificates; (c) provision of data and drawings;

- (d) resubmissions and modifications;
- (e) amendments to the Works;
- (f) stripping concrete;
- (g) forming connection with the old work including splicing, tying, connecting or welding reinforcement;
- (h) in situ concrete (as Series 1700 paragraph 4);
- (i) formwork (as Series 1700 paragraph 14);
- (j) reinforcement (as Series 1700 paragraph 25);
- (k) precast members and the like (as Series 1700 paragraph 9), joints and fitments;
- (l) lost time, moving plant and equipment, standing time and disruption caused by the process of lengthening including waiting for concrete to achieve a specified strength.

**Driving Lengthened
 Precast Concrete Piles**

17 The items for driving lengthened precast concrete piles shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) driving to a set or level;
- (b) taking observations and compiling the record of each pile and supplying one copy to the Employer;
- (c) moving plant and equipment back and driving lengthened piles;
- (d) moving plant and equipment back and redriving risen piles.

**Stripping Precast Concrete
 Pile Heads**

18 The items for stripping precast concrete pile heads shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) cutting off, removing and disposing of surplus;
- (b) exposing reinforcement;
- (c) bending projecting reinforcement.

Cast-in-place Piles

Units

19 The units of measurement shall be:

- (i) pile shafts, empty bores linear metre.
- (ii) enlarged bases number.

Measurement

20 The measurement of pile shafts shall be the length of the pile measured along the axis from the toe of the shoe or the bottom of the excavation, including any enlarged base, whichever is appropriate to the specified finished level of the concrete pile head.

Where an empty bore is specified above a pile shaft, the length classification of the pile shaft shall be based on the overall bored or

driven depth including the empty bore.

- 21 Empty bores shall only be measured where a particular level is specified from which boring or driving shall commence and shall be the length of empty bore or drive measured from the specified finished level of the concrete pile head, to that particular commencing level.
- Itemisation 22 Separate items shall be provided for cast-in-place piles in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Pile shafts
	2 Empty bores
	3 Enlarged bases
II	1 Vertical
	2 Raking
III	1 Different types
IV	1 Different materials
V	1 Different cross-sections
VI	1 Pile shafts not exceeding 5 metres in length
	2 Pile shafts exceeding 5 metres in length but not exceeding 10 metres and so on in steps of 5 metres
VIII	1 Preliminary piling as a separate operation in advance of the main piling
	2 Main piling

Pile Shafts and Empty Bores

Item coverage

- 23 The items for pile shafts and empty bores shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) pre-boring or jetting;
 - (b) casing or lining;
 - (c) boring or augering to a given level and removing and disposing of surplus material;
 - (d) driving to a given set or level with or without pile shoe;
 - (e) excavation, removal, and disposal of material (as Series 600 paragraphs 17, 18, 19, 23 and 39);
 - (f) support fluid and disposal;
 - (g) protection for personnel, and apparatus for entering the empty bore for the inspection of pile excavation or inside of pile casing;
 - (h) taking observations and maintaining the boring or driving record and concreting or grouting record of each pile and supplying one copy to the Employer;
 - (i) precautions to prevent ingress of surface water and foreign matter;

- (j) in situ concrete and precast members, and the like (as Series 1700 paragraphs 4 and 9) and stripping concrete to required level and exposing reinforcement;
- (k) taking undisturbed soil samples from the bore at any level;
- (l) filling of empty bore and around the top of piles and subsequent removal and disposal;
- (m) systems for monitoring construction of the piles;
- (n) measures for reduction of friction.

Enlarged Bases

24 The item for enlarged bases shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) excavation, including under-reaming, removal and disposal of material (as Series 600 paragraphs 17, 18, 19, 23 and 39);
- (b) in situ concrete (as Series 1700 paragraph 4);
- (c) taking measures required because of the presence of water.

Reinforcement for Cast-in-place Piles

Units

25 The unit of measurement shall be:

- (i) bar and helical reinforcement tonne.

Measurement

26 The mass of plain bar reinforcement to cast-in-place piles shall be calculated on the basis that the nominal density of steel is 0.00785 kilogrammes per square millimetre of cross-sectional area per linear metre; the mass of deformed bar reinforcement shall be calculated on the basis of the nominal rolling mass of the reinforcement.

Itemisation

27 Separate items shall be provided for reinforcement for cast-in-place piles in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Bar reinforcement
	2 Helical reinforcement
II	1 Nominal size 16 millimetres and under
	2 Nominal size 20 millimetres and over
III	1 Different types and grades of steel
IV	1 Bars not exceeding 12 metres in length
	2 Bars exceeding 12 metres in length but not exceeding 13.5 metres and so on in steps of 1.5 metres

Reinforcement for Cast-in-Place Piles

28 The items for reinforcement for cast-in-place piles shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- Item coverage (a) reinforcement (as Series 1700 paragraph 25);
 (b) bending projecting reinforcement.

Steel Bearing Piles

- Units **29** The units of measurement shall be:
- (i) steel bearing piles, driving, lengthening pieces, driving lengthened steel bearing piles linear metre.
 - (ii) welding on lengthening pieces number.
 - (iii) cutting or burning off surplus number.
- Measurement **30** The measurement of steel bearing piles shall be the length required by the Contract.
- 31** The measurement of driving steel bearing piles shall be the length of the pile measured along the axis from the toe to:
- (a) the Existing Ground Level or the level of the underside of the pile cap or ground beam (ignoring any blinding layer) whichever is the lower, provided that where a particular level is specified from which driving shall commence then the measurement shall be to that specified level; or
 - (b) the site joint of piles to be lengthened, provided that the site joint after completion of the driving is below the level determined in accordance with the preceding sub-paragraph.
- 32** The measurement of lengthening pieces for steel bearing piles shall be the additional length ordered by the Employer.
- 33** The measurement of driving lengthened steel bearing piles shall be the length from the site joint to the level determined in accordance with subparagraph 31(a) above.
- 34** The length classification for those items listed in sub-paragraph 29(i) above shall be based on the appropriate measured lengths determined in accordance with paragraphs 30 to 33 above inclusive.
- Itemisation **35** Separate items shall be provided for steel bearing piles in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Steel bearing piles
	2 Lengthening pieces for steel bearing piles
II	1 Driving steel bearing piles
	2 Driving lengthened steel bearing piles
	3 Welding on lengthening pieces
	4 Cutting or burning off surplus
III	1 Vertical

	2	Raking
IV	1	Different types
V	1	Piles not exceeding 5 metres in length
	2	Piles exceeding 5 metres in length but not exceeding 10 metres and so on in steps of 5 metres
VI	1	Preliminary piling as a separate operation in advance of the main piling
	2	Main piling

Steel Bearing Piles and Lengthening Pieces for Steel Bearing Piles

36 The items for steel bearing piles and lengthening pieces for steel bearing piles shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) fabrication (as Series 1800 paragraph 6) and slinging holes;
- (b) protective system (as Series 1900 paragraph 4);
- (c) measures for reduction of friction.

Driving Steel Bearing Piles and Driving Lengthened Steel Bearing Piles

37 The items for driving steel bearing piles and driving lengthened steel bearing piles shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) pre-boring or jetting;
- (b) handling, pitching and driving to a set, level or penetration;
- (c) taking observations and compiling the record of each pile and supplying one copy to the Employer;
- (d) moving plant and equipment back and re-driving risen piles.

Welding on Lengthening Pieces

38 The items for welding on lengthening pieces shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) stripping protective system and preparing the head of the driven pile to receive additional length;
- (b) cleaning the affected area and applying protective system;
- (c) lost time, moving plant and equipment, standing time and disruption caused by the process of lengthening;
- (d) inspection of welds.

Cutting or Burning off Surplus

39 The items for cutting or burning off surplus shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage

- (a) achieving profile;
- (b) cleaning the affected area and applying protective system;
- (c) disposal of material (as Series 600 paragraph 39).

Proof Loading of Piles

- | Units | 40 | <p>The units of measurement shall be:</p> <ul style="list-style-type: none"> (i) establishment of proof loading equipment item. (ii) proof loading of piles number. | | | | | | | | | | | | | | | | | |
|---|--|---|-------|---------|---|--|--------------------------|----|----------------------------|-----|---------------------|--------------|----|-------------------|----------------------|----------------|---|------------|----------|
| Measurement | 41 | <p>The establishment of proof loading equipment shall be measured once only to each structure. Any additional establishment of proof loading equipment to suit the Contractor's method of working shall not be measured.</p> <p>Measurement of proof loading of piles shall be the number required by the Contract.</p> | | | | | | | | | | | | | | | | | |
| Itemisation | 42 | <p>Separate items shall be provided for proof loading of piles in accordance with Chapter II paragraphs 3 and 4 and the following:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Group</th> <th style="text-align: left;">Feature</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="vertical-align: top;">I</td> <td>1 Establishment of proof loading equipment</td> </tr> <tr> <td>2 Proof loading of piles</td> </tr> <tr> <td style="vertical-align: top;">II</td> <td>1 Piles of different types</td> </tr> <tr> <td rowspan="2" style="vertical-align: top;">III</td> <td>1 Preliminary piles</td> </tr> <tr> <td>2 Main piles</td> </tr> <tr> <td rowspan="3" style="vertical-align: top;">IV</td> <td>1 Maintained load</td> </tr> <tr> <td>2 Constant rate load</td> </tr> <tr> <td>3 Dynamic load</td> </tr> <tr> <td rowspan="2" style="vertical-align: top;">V</td> <td>1 Vertical</td> </tr> <tr> <td>1 Raking</td> </tr> </tbody> </table> | Group | Feature | I | 1 Establishment of proof loading equipment | 2 Proof loading of piles | II | 1 Piles of different types | III | 1 Preliminary piles | 2 Main piles | IV | 1 Maintained load | 2 Constant rate load | 3 Dynamic load | V | 1 Vertical | 1 Raking |
| Group | Feature | | | | | | | | | | | | | | | | | | |
| I | 1 Establishment of proof loading equipment | | | | | | | | | | | | | | | | | | |
| | 2 Proof loading of piles | | | | | | | | | | | | | | | | | | |
| II | 1 Piles of different types | | | | | | | | | | | | | | | | | | |
| III | 1 Preliminary piles | | | | | | | | | | | | | | | | | | |
| | 2 Main piles | | | | | | | | | | | | | | | | | | |
| IV | 1 Maintained load | | | | | | | | | | | | | | | | | | |
| | 2 Constant rate load | | | | | | | | | | | | | | | | | | |
| | 3 Dynamic load | | | | | | | | | | | | | | | | | | |
| V | 1 Vertical | | | | | | | | | | | | | | | | | | |
| | 1 Raking | | | | | | | | | | | | | | | | | | |
| Establishment of Proof Loading Equipment | 43 | <p>The items for establishment of proof loading equipment shall in accordance with the Preambles to Bill of Quantities General Directions include for:</p> | | | | | | | | | | | | | | | | | |
| Item coverage | | <ul style="list-style-type: none"> (a) bringing plant and equipment to the site of each structure; (b) erecting and setting up plant and equipment including site preparation, levelling and access ramps; (c) dismantling and removing plant and equipment from the Site on completion. | | | | | | | | | | | | | | | | | |
| Proof Loading of Piles | 44 | <p>The items for proof loading of piles shall in accordance with the Preambles to Bill of Quantities General Directions include for:</p> | | | | | | | | | | | | | | | | | |
| Item coverage | | <ul style="list-style-type: none"> (a) setting up rigs, kentledge, cable anchorages, anchor piles, reference bench marks and the like; (b) moving and setting up plant and equipment at each position including site preparation, levelling and access ramps; | | | | | | | | | | | | | | | | | |

- (c) setting up, operating and maintaining instruments and apparatus;
- (d) constructing temporary pile caps and subsequent removal;
- (e) applying and re-applying the proof load and releasing;
- (f) taking readings, measurements and observations;
- (g) preparation and supply of record sheets

Steel Sheet Piles

- | | |
|-------------|---|
| Units | <p>45 The units of measurement shall be:</p> <ul style="list-style-type: none">(i) steel sheet piling, driving, lengthening pieces, driving lengthened steel sheet piling square metre.(ii) corner, junction, special steel sheet piles linear metre.
Measured extra over steel sheet piling(iii) lengthening pieces to corner, junction, special steel sheet piles linear metre.
Measured extra over lengthening pieces to steel sheet piling.(iv) driving corner, junction, special steel sheet piles linear metre.
Measured extra over driving steel sheet piling.(v) driving lengthened corner, junction, special steel sheet piles linear metre.
Measured extra over driving lengthened steel sheet piling.(vi) welding on lengthening pieces linear metre.(vii) cutting or burning off surplus linear metre.(viii) walings, ties tonne. |
| Measurement | <p>46 The measurement of steel sheet piling shall be the plane (undeveloped) horizontal length along the centre line of the piling multiplied by the pile length as required by the Contract.</p> <p>47 The measurement for driving steel sheet piling shall be the plane (undeveloped) horizontal length along the centre line of the piling multiplied by the depth from the toe to:</p> <ul style="list-style-type: none">(a) the Existing Ground Level, provided that where a particular level is specified from which driving shall commence then the measurement shall be to that specified level; or(b) the site joint of piles to be lengthened provided that the site joint after completion of the driving is below the level determined in accordance with the preceding sub-paragraph. |

- 48 The measurement of lengthening pieces to steel sheet piling shall be the plane (undeveloped) horizontal length along the centre line of the piling multiplied by the additional length ordered by the Employer.
- 49 The measurement for driving lengthened steel sheet piling shall be the plane (undeveloped) horizontal length along the centre line of the piling multiplied by the depth from the site joint to the level determined in accordance with sub-paragraph 47(a) above.
- 50 The length classification for those items listed in sub-paragraphs 45(i) to (v) above shall be based on the appropriate measured lengths determined in accordance with paragraphs 46 to 49 above inclusive.
- 51 The measurement of welding on lengthening pieces and cutting or burning off surplus shall be the plane (undeveloped) horizontal length along the centre line of the piling.
- 52 The measurement of those items listed in paragraph 45(viii) shall be the computed mass of the finished member comprising plates, rolled sections, shear connectors, stiffeners, ties, cleats, packs, splice plates and all fittings, without allowance for tolerances for rolling margin and other permissible deviations from standard masses or nominal dimensions and excluding the masses of welds, couplings, turnbuckles, bolts, nuts, washers, rivets and protective coatings. No deductions shall be made for notches, cope holes, bolt and rivet holes, and the like, which are less than 0.03 square metres.

The computed mass of rolled and cast steel and cast iron shall be determined from the dimensions shown on the drawings on the following basis:

- (a) rolled or cast steel, 7850 kilogrammes per cubic metre;
- (b) cast iron, 7210 kilogrammes per cubic metre.

Itemisation

- 53 Separate items shall be provided for steel sheet piles in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Steel sheet piles
	2 Corner, junction, special steel sheet piles
	3 Lengthening pieces to steel sheet piles
	4 Lengthening pieces to corner, junction, special steel sheet piles
II	1 Driving
	2 Welding on lengthening pieces
	3 Cutting or burning off surplus
III	1 Walings
	2 Ties
IV	1 Different types
V	1 Piles not exceeding 5 metres in length

		2	Piles exceeding 5 metres in length but not exceeding 10 metres and so on in steps of 5 metres
	VI	1	In main construction
		2	In anchorages
Steel Sheet Piling, Corner, Junction, Special Steel Sheet Piles and Lengthening Pieces to Steel Sheet Piling, Corner Junctions, Special Steel Sheet Piles	54		The items for steel sheet piling, corner, junction, special steel sheet piles and lengthening pieces to steel sheet piling, corner, junctions, special steel sheet piles shall in accordance with the Preambles to Bill of Quantities General, Directions include for:
Item coverage		(a)	fabrication (as Series 1800 paragraph 6), slinging holes and tapered points;
		(b)	protective system (as Series 1900 paragraph 4);
		(c)	drainage holes and the like up to 200 mm in diameter and making good to protective system;
		(d)	measures for reduction of friction.
Driving Steel Sheet Piling, Corner, Junction, Special Steel Sheet Piles and Driving Lengthened Steel Sheet Piling, Corner, Junction Special Steel Sheet Piles	55		The items for driving steel sheet piling, corner, junction, special steel sheet piles and driving lengthened steel sheet piling, corner, junctions, special steel sheet piles shall in accordance with the Preambles to Bill of Quantities General Directions include for:
Item coverage		(a)	handling, pitching and driving to a set, level or penetration;
		(b)	moving and setting up plant and equipment at each pile position including site preparation or levelling;
		(c)	taking observations and compiling the record of the piling and supplying one copy to the Employer;
		(d)	moving plant and equipment back and redriving risen piles.
Welding on Lengthening Pieces	56		The items for welding on lengthening pieces shall in accordance with the Preambles to Bill of Quantities General Directions include for:
Item coverage		(a)	welding on lengthening pieces (as this Series paragraph 38).
Cutting or Burning Off Surplus	57		The item for cutting or burning off surplus shall in accordance with the Preambles to Bill of Quantities General Directions include for:
Item coverage		(a)	cutting or burning off surplus (as this Series paragraph 39).
Walings and Ties	58		The items for walings and ties shall in accordance with the Preambles to Bill of Quantities General Directions include for:
Item coverage		(a)	fabrication (as Series 1800 paragraph 6);

- (b) excavation of acceptable material (as Series 600 paragraphs 17 and 18);
- (c) excavation of unacceptable material (as Series 600 paragraph 19);
- (d) excavation in Hard Material (as Series 600 paragraph 23);
- (e) backfilling and compaction;
- (f) disposal of material (as Series 600 paragraph 39);
- (g) threading, couplings, turnbuckles and the like;
- (h) protective system (as Series 1900 paragraph 4);
- (i) marking and drilling piles and making good to protective system.

Embedded Retaining Wall Plant

- | | | |
|-------------|-----------|--|
| Units | 59 | The unit of measurement shall be:
(i) establishment of embedded retaining wall plant item. |
| Measurement | 60 | The establishment of embedded retaining wall plant shall be measured once only for each embedded retaining wall. |
| Itemisation | 61 | Separate items shall be provided for embedded retaining wall plant in accordance with Chapter II paragraphs 3 and 4 and the following: |

Group	Feature
I	1 Establishment of embedded retaining wall plant
II	1 Diaphragm walls
	2 Hard/hard secant pile walls
	3 Hard/soft secant pile walls
	4 Contiguous bored pile walls
III	1 Different locations

Establishment of Embedded Retaining Wall Plant

- | | |
|---------------|--|
| 62 | The items for the establishment of embedded retaining wall plant shall in accordance with the Preambles to Bill of Quantities General Directions include for: |
| Item coverage | <ul style="list-style-type: none"> (a) bringing plant and equipment to the site of the embedded retaining wall; (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; (e) guide walls. |

Diaphragm Walls

Units	63	The unit of measurement shall be:												
		(i) diaphragm walls, empty excavation square metre.												
Measurement	64	The measurement of the diaphragm walls shall be the area of the vertical section through the centre line of the wall as required by the Contract. All lengths of walls comprising T-shaped, L-shaped or other shaped panels in plan, shall be measured and included in the calculated area. Empty excavation shall only be measured where a particular level is specified from which excavation shall commence and shall be the area of the vertical section through the centre line of the empty excavation between the specified commencing level and the specified finished level of the top of the wall.												
Itemisation	65	Separate items shall be provided for diaphragm walls in accordance with Chapter II paragraphs 3 and 4 and the following:												
		<table border="0" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Group</th> <th style="text-align: left; border-bottom: 1px solid black;">Feature</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;">I</td> <td style="vertical-align: top;">1 Diaphragm walls</td> </tr> <tr> <td></td> <td style="vertical-align: top;">2 Empty excavation</td> </tr> <tr> <td style="vertical-align: top;">II</td> <td style="vertical-align: top;">1 Different thicknesses of walls</td> </tr> <tr> <td style="vertical-align: top;">III</td> <td style="vertical-align: top;">1 Diaphragm walls 0 metres to 5 metres in depth</td> </tr> <tr> <td></td> <td style="vertical-align: top;">2 Diaphragm walls 0 metres to 10 metres in depth and so on in steps of 5 metres</td> </tr> </tbody> </table>	Group	Feature	I	1 Diaphragm walls		2 Empty excavation	II	1 Different thicknesses of walls	III	1 Diaphragm walls 0 metres to 5 metres in depth		2 Diaphragm walls 0 metres to 10 metres in depth and so on in steps of 5 metres
Group	Feature													
I	1 Diaphragm walls													
	2 Empty excavation													
II	1 Different thicknesses of walls													
III	1 Diaphragm walls 0 metres to 5 metres in depth													
	2 Diaphragm walls 0 metres to 10 metres in depth and so on in steps of 5 metres													
Diaphragm Walls and Empty Excavation	66	The items for diaphragm walls and empty excavation shall in accordance with the Preambles to Bill of Quantities General Directions include for:												
Item coverage		<ul style="list-style-type: none"> (a) excavation of acceptable material (as Series 600 paragraphs 17 and 18); (b) excavation of unacceptable material (as Series 600 paragraph 19); (c) excavation in Hard Material (as Series 600 paragraph 23); (d) backfilling and compaction; (e) support fluid and disposal; (f) in situ concrete (as Series 1700 paragraph 4); (g) trimming concrete at top of wall; (h) records and supplying one copy to the Employer; (i) sealing; (j) cutting chases, recesses, holes, mortices and the like; (k) disposal of material (as Series 600 paragraph 39); (l) filling of empty excavation and its subsequent removal and disposal; (m) cleaning and treatment of faces. 												

Secant Pile Walls

Units	67	The unit of measurement shall be:																
	(i)	secant pile walls, empty bores square metre.																
Measurement	68	The measurement of the secant pile walls shall be the area of the vertical section through the centre line of the wall as required by the Contract. Empty bores shall only be measured where a particular level is specified from which boring shall commence and shall be the area of the vertical section through the centre line of the empty boring between the specified commencing level and specified finished level of the top of the wall.																
Itemisation	69	Separate items shall be provided for secant pile walls in accordance with Chapter II paragraphs 3 and 4 and the following:																
		<table border="0" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-right: 1px solid black; border-bottom: 1px solid black;">Group</th> <th style="text-align: left; border-bottom: 1px solid black;">Feature</th> </tr> </thead> <tbody> <tr> <td style="border-right: 1px solid black; vertical-align: top;">I</td> <td>1 Hard/hard secant pile walls</td> </tr> <tr> <td style="border-right: 1px solid black; vertical-align: top;"></td> <td>2 Hard/soft secant pile walls</td> </tr> <tr> <td style="border-right: 1px solid black; vertical-align: top;"></td> <td>3 Empty bores</td> </tr> <tr> <td style="border-right: 1px solid black; vertical-align: top;">II</td> <td>1 Different diameters of piles</td> </tr> <tr> <td style="border-right: 1px solid black; vertical-align: top;"></td> <td>2 Different spacings and overlap of piles at commencing level</td> </tr> <tr> <td style="border-right: 1px solid black; vertical-align: top;">III</td> <td>1 Secant pile walls 0 metres to 5 metres in depth</td> </tr> <tr> <td style="border-right: 1px solid black; vertical-align: top;"></td> <td>2 Secant pile walls 0 metres to 10 metres in depth and so on in steps of 5 metres</td> </tr> </tbody> </table>	Group	Feature	I	1 Hard/hard secant pile walls		2 Hard/soft secant pile walls		3 Empty bores	II	1 Different diameters of piles		2 Different spacings and overlap of piles at commencing level	III	1 Secant pile walls 0 metres to 5 metres in depth		2 Secant pile walls 0 metres to 10 metres in depth and so on in steps of 5 metres
Group	Feature																	
I	1 Hard/hard secant pile walls																	
	2 Hard/soft secant pile walls																	
	3 Empty bores																	
II	1 Different diameters of piles																	
	2 Different spacings and overlap of piles at commencing level																	
III	1 Secant pile walls 0 metres to 5 metres in depth																	
	2 Secant pile walls 0 metres to 10 metres in depth and so on in steps of 5 metres																	
Hard/Hard and Hard/Soft Secant Pile Walls and Empty Bores	70	The items for hard/hard and hard/soft secant pile walls and empty bores shall in accordance with the Preambles to Bill of Quantities General Directions include for:																
Item Coverage	(a)	pre-boring or jetting;																
	(b)	casing or lining;																
	(c)	boring or augering to a given level and removing and disposing of surplus material;																
	(d)	excavation, removal, and disposal of material (as Series 600 paragraphs 17, 18, 19, 23 and 39);																
	(e)	support fluid and disposal;																
	(f)	taking observations and maintaining the boring record and concreting or grouting record of each pile and supplying one copy to the Employer;																
	(g)	precautions to prevent ingress of surface water and foreign matter;																
	(h)	in situ concrete and precast members and the like (as Series 1700 paragraphs 4 and 9) and stripping concrete to required level and exposing reinforcement;																
	(i)	trimming concrete at top of wall;																

- (j) formwork (as Series 1700 paragraph 14);
- (k) taking undisturbed soil samples from the bore at any level;
- (l) filling of empty bore and around the top of piles and subsequent removal and disposal;
- (m) systems for monitoring construction of the piles;
- (n) measures for reduction of friction;
- (o) cleaning and treatment of faces.

Contiguous Bored Pile Walls

Units	71	The unit of measurement shall be: <ul style="list-style-type: none"> (i) contiguous bored pile walls, empty bores square metre.
Measurement	72	The measurement of the contiguous bored pile walls shall be the area of the vertical section through the centre line of the wall as required by the Contract. Empty bores shall only be measured where a particular level is specified from which boring shall commence and shall be the area of the vertical section through the centre line of the empty boring between the specified commencing level and the specified finished level of the top of the wall.
Itemisation	73	Separate items shall be provided for contiguous bored pile walls in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Contiguous bored pile walls
	2 Empty bores
II	1 Different diameters of piles
	2 Different spacings of piles
III	1 Contiguous bored pile walls 0 metres to 5 metres in depth
	2 Contiguous bored pile walls 0 metres to 10 metres in depth and so on in steps of 5 metres

Contiguous Bored Pile Walls and Empty Bores	74	The items for contiguous bored pile walls and empty bores shall in accordance with the Preambles to Bill of Quantities General Directions include for:
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- | | |
|---------------|--|
| Item coverage | <ul style="list-style-type: none"> (a) pre-boring or jetting; (b) casing or lining; (c) boring or augering to a given level and removing and disposing of surplus material; (d) excavation, removal, and disposal of material (as Series 600 paragraphs 17, 18, 19, 23 and 39); (e) support fluid and disposal; |
|---------------|--|

- (f) taking observations and maintaining the boring record and concreting or grouting record of each pile and supplying one copy to the Employer ;
- (g) precautions to prevent ingress of surface water and foreign matter;
- (h) in situ concrete and precast members and the like (as Series 1700 paragraphs 4 and 9) and stripping concrete to required level and exposing reinforcement;
- (i) trimming concrete at top of wall;
- (j) formwork (as Series 1700 paragraph 14);
- (k) taking undisturbed soil samples from the bore at any level;
- (l) filling of empty bore and around the top of piles and subsequent removal and disposal;
- (m) additional measures for water retention;
- (n) systems for monitoring construction of the piles;
- (o) measures for reduction of friction;
- (p) cleaning and treatment of faces.

Reinforcement for Embedded Retaining Walls

- Units **75** The unit of measurement shall be:
- (i) bar and helical reinforcement tonne.
 - (ii) rolled sections tonne.
- Measurement **76** The mass of plain bar reinforcement to embedded retaining walls shall be calculated on the basis that the nominal density of steel is 0.00785 kilogrammes per square millimetre of cross-sectional area per linear metre; the mass of deformed bar reinforcement shall be calculated on the basis of the nominal rolling mass of the reinforcement.
- The mass of rolled sections shall be calculated on the basis that the density of steel is 7850 kilogrammes per cubic metre.
- Itemisation **77** Separate items shall be provided for reinforcement for embedded retaining walls in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Bar reinforcement
	2 Helical reinforcement
	3 Rolled sections
II	1 Nominal size 16 millimetres and under
	2 Nominal size 20 millimetres and over
III	1 Different types and grade of steel
IV	1 Bars or sections not exceeding 12 metres in length

2	Bars or sections exceeding 12 metres in length but not exceeding 13.5 metres and so on in steps of 1.5 metres
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Note: Group I Feature 3 Rolled Sections shall not be separately identified by any Group II Feature.

Reinforcement for Embedded Retaining Walls

Item coverage

- 78** The items for reinforcement for embedded retaining walls shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) reinforcement (as Series 1700 paragraph 25);
 - (b) bending projecting reinforcement;
 - (c) rolled sections (as Series 1800 paragraphs 6 and 9);
 - (d) guides and hole spacers.

King Post Wall Plant

Units

- 79** The units of measurement shall be:
- (i) establishment of piling plant for king posts item.
 - (ii) moving piling plant for king posts number.

Measurement

- 80** The establishment of piling plant for king posts shall be measured once only for each king post wall.

Itemisation

- 81** Separate items shall be provided for piling plant for king posts in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature	
I	1	Establishment of piling plant for king posts
	2	Moving piling plant for king posts
II	1	Bored cast-in-place piles
	2	Driven cast-in-place piles
III	1	Different types
IV	1	Different diameters
V	1	Different locations

Establishment of Piling Plant for King Posts

Item coverage

- 82** The items for establishment of piling plant for king posts shall in accordance with the Preambles to Bill of Quantities General Directions include for:
- (a) establishment of piling plant (as this Series paragraph 5).

Moving Piling Plant for King Posts 83 The items for moving piling plant for king posts shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage (a) moving piling plant (as this Series paragraph 6).

King Posts

Units 84 The unit of measurement shall be:

(i) king post pile shafts, empty bores linear metre.

Measurement 85 The measurement of king post pile shafts shall be the length of the pile measured along the axis from the toe of the shoe or the bottom of the excavation, whichever is appropriate, to the specified finished level of the concrete pile head.

Where an empty bore is specified above a pile shaft, the length classification of the pile shaft shall be based on the overall bored or driven depth including the empty bore.

86 Empty bores shall only be measured where a particular level is specified from which boring or driving shall commence and shall be the length of empty bore or drive measured from the specified finished level of the concrete pile head, to that particular commencing level.

Itemisation 87 Separate items shall be provided for king post piles in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 King post pile shafts
	2 King post empty bores
II	1 Vertical
	2 Raking
III	1 Different types
IV	1 Different materials
V	1 Different cross-sections
VI	1 King post pile shafts not exceeding 5 metres in length
	2 King post pile shafts exceeding 5 metres in length but not exceeding 10 metres and so on in steps of 5 metres

King Post Pile Shafts and Empty Bores 88 The items for king post pile shafts and empty bores shall in accordance with the Preambles to Bill of Quantities General Directions include for:

Item coverage (a) pile shafts and empty bores (as this Series paragraph 23).

Reinforcement for King Post Piles

Units **89** The units of measurement shall be:

- (i) bar and helical reinforcement tonne.
- (ii) rolled section members tonne.
- (iii) precast concrete members linear metre.

Measurement **90** The mass of plain bar reinforcement to king post piles shall be calculated on the basis that the nominal density of steel is 0.00785 kilogrammes per square millimetre of cross-sectional area per linear metre; the mass of deformed bar reinforcement shall be calculated on the basis of the nominal rolling mass of the reinforcement.

The mass of rolled section members shall be calculated on the basis that the density of steel is 7850 kilogrammes per cubic metre.

The measurement of precast concrete members shall be the length required by the Contract.

Itemisation **91** Separate items shall be provided for reinforcement for king post piles in accordance with Chapter II paragraphs 3 and 4 and the following:

Group	Feature
I	1 Bar reinforcement
	2 Helical reinforcement
	3 Rolled section members
	4 Precast concrete members
II	1 Nominal size 16 millimetres and under
	2 Nominal size 20 millimetres and over
III	1 Different grades of steel and types of steel and concrete
IV	1 Bars or members not exceeding 12 metres in length
	2 Bars or members exceeding 12 metres in length but not exceeding 13.5 metres and so on in steps of 1.5 metres

Note: Group I Features 3 and 4 shall not be separately identified by any Group II Feature

Reinforcement for King Post Piles

Item coverage **92** The items for reinforcement for king post piles shall in accordance with the Preambles to Bill of Quantities General Directions include for:

- (a) reinforcement (as Series 1700 paragraph 5);
- (b) bending projecting reinforcement;
- (c) rolled section members (as Series 1800 paragraphs 6 and 9);
- (d) guides and hole spacers;
- (e) precast concrete members (as Series 1700 paragraph 9).

King Post Walling

Units	93	The unit of measurement shall be: <ul style="list-style-type: none"> (i) king post walling square metre. 								
Measurement	94	The measurement shall be the superficial area of king post walling required by the Contract.								
Itemisation	95	Separate items shall be provided for king post walling in accordance with Chapter II paragraphs 3 and 4 and the following:								
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Group	Feature									
I	1 King post walling									
II	1 Different types									
III	1 Different thicknesses									
King Post Walling	96	The items for king post walling shall in accordance with the Preambles to Bill of Quantities General Directions include for: <ul style="list-style-type: none"> (a) excavation, removal and disposal of material (as Series 600 paragraphs 17, 18, 19, 23 and 39); (b) preservation of timber. 								
Item coverage										



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