

19	MISCELLANEOUS.....	2
19.1	STONE PITCHING.....	2
19.1.1	Scope	2
19.1.2	References	2
19.1.3	Submittals.....	2
19.1.4	Materials.....	2
19.1.5	Installation	2
19.2	GABIONS & PROTECTION MATTRESS	3
19.2.1	Scope	3
19.2.2	References	3
19.2.3	General Requirements.....	4
19.2.4	Specific Requirements for Gabions.....	5
19.2.5	Specific Requirements for Protection Mattress	5
19.3	BOLLARDS	6
19.3.1	Scope	6
19.3.2	References	6
19.3.3	Concrete Bollards	6
19.3.4	Steel Bollards	6
19.4	RUMBLE STRIPS.....	7
19.4.1	Scope	7
19.4.2	Quality Assurance.....	7
19.4.3	Construction	7
19.5	SPEED CONTROL HUMPS	7
19.5.1	Scope	7
19.5.2	General.....	8
19.5.3	Construction of Speed Humps	8

19 MISCELLANEOUS

19.1 STONE PITCHING

19.1.1 Scope

- 1 Stone pitching slope treatment shall consist of the placement and grouting of stone pitching on slopes at the designated locations or at the locations directed by the Engineer to the designated lines, grades, thickness and cross-sections or as directed by the Engineer.

- 2 Related Sections and Parts

This Section

Part 3..... Earthworks

19.1.2 References

- 1 The following standards are referred to in this Subpart:

AASHTO T96Resistance to Abrasion by Use of the Los Angeles Machine

BS 812 Part 2.....Testing Aggregates - physical properties

BS 1881Methods of testing concrete

19.1.3 Submittals

- 1 Samples of the stone to be used shall be submitted to and approved by the Engineer before any stone is placed. These samples shall be kept on site and used for reference purposes for the quality control of delivered material during the work.

19.1.4 Materials

- 1 Stone for pitching shall be hard, sound, durable, erosion resistant rock or cobbles.
- 2 The nominal weight of the stones shall be between 3 to 4 kg (corresponding to a size of about 240mm x 140mm x 100mm). The maximum weight of the stones shall be between 32 kg (corresponding to a size of about 420mm x 230mm x 200mm).
- 3 Tests for specific gravity and absorption, shall be determined in accordance with BS 812 part 2 Testing Aggregates - physical properties. The minimum apparent specific gravity shall be 2.5 and the maximum absorption shall be 3 %.
- 4 The stone shall not have an abrasion loss greater than 45 % when subjected to five hundred (500) revolutions in a Los Angeles Abrasion Machine in accordance with AASHTO T96.
- 5 The size and shape of the stones shall be such to allow for proper placement. The widths of the stone shall be not less than one and one-half times their respective thickness and lengths of not less than two times their respective widths.

19.1.5 Installation

- 1 The bed upon which the stones are to be placed shall be excavated to the designated grades and lines or as directed by the Engineer.
- 2 Prior to commencing any stone pitching operations the Contractor shall prepare a trial laying of not less than 2 m by 2 m using the materials and methods proposed for the work. The trial laying shall establish the aesthetic appearance of the work and shall be used for comparison purposes for acceptance of the final work.

- 3 A footing trench shall be excavated along the toe of the slope as designated or as directed by the Engineer. All footing trenches and excavations shall be approved by the Engineer before placement of stones or concrete.
- 4 Subgrade or base shall be firm and well compacted and approved by the Engineer. A 50 mm thick layer of mortar shall be laid on the subgrade as bedding for the stones.
- 5 Stones shall be placed so as to provide a minimum number of voids; larger stones shall be placed in the footing trench and on the outside surface of the slope. The flattest face of the stone shall be laid uppermost parallel to the slope. Spaces between larger stones shall be filled with the smaller stones.
- 6 The surfaces of the stone shall be cleaned of adhering dirt and clay and shall be moistened immediately prior to grouting.
- 7 The space between stones of stone pitching shall be filled with mortar consisting of one part Portland cement and three parts of fine aggregate, and one-fifth part of hydrated lime with sufficient water to produce a workable mix as approved by the Engineer.
- 8 Sand and cement shall comply with the requirements of Section 5. The compressive strength of the mortar shall not be less than 15 MPa when tested in accordance with BS 1881 Part 108.
- 9 Immediately after placing, the mortar shall be spaded and rodded into place with suitable spades, trowels or other approved method. All the voids between stones shall be completely filled.
- 10 The exposed surface of the rocks shall project not less than 1 cm and not more than 4 cm above the mortar surface. The mortared stone pitching shall be cured by an approved method for a minimum period of four days. Immediately after the expiration of the curing period, the exposed surfaces shall be cleared of all curing mediums.
- 11 Joints will be provided at a maximum interval of 12 m. Joints shall comprise a gap in the stone pitching of 15 mm. The method of forming the gap shall be to the approval of the Engineer.

19.2 GABIONS & PROTECTION MATTRESS

19.2.1 Scope

- 1 This work shall consist of supplying, building and placing of stone-filled gabions or protection mattress as slope or watercourse channel protection.
- 2 Related Sections and Parts
This Section
Part 3..... Earthworks

19.2.2 References

- 1 The following standards are referred to in this Subpart:
ASTM G152 and G153-----Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.

BS 1052Mild steel wire for general engineering purposes
BS 1722 Part 16.....Organic powder coating to be used as a plastics finish to components and mesh

EN 10244Testing zinc coatings on steel wire and for quality requirements
ISO 1461Hot dip galvanised coatings on iron and steel articles

19.2.3 General Requirements

- 1 Gabion boxes and protection mattress shall be made of a hexagonal woven mesh of double twisted hot dip galvanised steel wire. The nominal mesh size shall be 80mm x 100mm. Details of type of mesh proposed for use shall be submitted to the Engineer for approval.
- 2 Wire shall be coated with a minimum thickness of 0.55 mm of dark green or black PVC complying with BS 1722 Part 16 Organic powder coating to be used as a plastics finish to components & mesh.
- 3 Wire shall be capable of resisting the effects of immersion in sea water, exposure to ultraviolet light and abrasion, when tested for a period not less than 3000 h in accordance with ASTM G152 and G153.
- 4 The cages of gabion panels and protection mattress panels shall be selvedged to prevent unravelling of the mesh. Steel wire core used for selvedges shall have a nominal diameter of not less than 3.0 mm. Lacing wire shall have a nominal diameter of not less than 2.2 mm for the wire core. Wire for selvedges and lacing shall otherwise comply with the same specification for the wire used in the mesh.
- 5 Non-metallic material such as extruded polypropylene for gabion boxes may be proposed, for the Engineer's approval. Samples and manufacturer's certificates shall accompany the proposal. The Contractor shall demonstrate that non-metallic materials are suitable for use in the climatic conditions of Qatar.
- 6 Gabion and protection mattress dimensions shall be as designated. A tolerance of $\pm 5\%$ on width and height, and $\pm 3\%$ on length shall be allowed.
- 7 Gabions and protection mattress shall have diaphragms at 1 m centres.
- 8 Wire used in the fabrication of the gabion and protection mattress shall be mild steel to BS 1052 having an average tensile strength, before coating, of 380 to 500 MPa. The core wire diameter shall be 3.0 mm before galvanising. Galvanising shall comply with EN 10244.
- 9 Non-metallic gabion and protection mattress cages of proprietary type shall be constructed according to the manufacturer's instructions.
- 10 All the fixing and binding wires shall be coated with PVC layer complying with BS 1722 Part 16.
- 11 All Gabions and mattresses shall be laid over a layer of geotextile membrane Grade 3000 at all times.

19.2.4 Specific Requirements for Gabions

- 1 Stones for gabion filling shall be hard, sound, durable and highly resistant to erosion. The stone size distribution in each individual box shall be as shown in Table 16.1:

Table 16.1
Stone Size Distribution of Gabions

Size of Stones mm	% of Total (by number)
80 - 125	7 maximum
125 - 200	88 maximum
200 - 250	5 maximum

- 2 Gabions shall be placed and built to the designated lines, levels and patterns on a prepared horizontal foundation surface, excavated as required and compacted as directed by the Engineer.
- 3 Gabion cages shall be securely wired together at comers and cages, and where there is more than one course of gabions, the upper course cages shall be laced to the lower course. Before filling, the cage shall be in its permanent position and laced to adjoining previously filled cages.
- 4 Stones shall be packed by hand inside the cages as tight as practicable with the minimum of voids. Tie wires shall be fixed inside the compartments and the units tensioned in accordance with the manufacturer's instructions.
- 5 The cages shall be overfilled with stones to allow for subsequent settlement and the lid laced down with binding wire to the top of each of the four sides and to the top of the diaphragm panels.

19.2.5 Specific Requirements for Protection Mattress

- 1 The material shall be supplied as a large sheet with partition panels at 1 m centres to form a cellular structure with the sheet turned up to form the sides. A separate sheet shall form the lid.
- 2 The cages of protection mattress panels shall be selvedged to prevent unravelling of the mesh. Steel wire core used for selvedges shall have a nominal diameter of not less than 3.0 mm. Lacing wire shall have a nominal diameter of not less than 2.2 mm for the wire core. Wire for selvedges and lacing shall otherwise comply with the same specification for the wire used in the mesh.
- 3 Stones for protection mattress filling shall be hard, sound, durable and highly resistant to erosion.
- 4 The stone size distribution in each individual box shall be dependent on the design thickness of the mattress as shown on the contract drawings.
- 5 The protection mattress shall be a special type of rectangular gabion with a large plan area to thickness ratio that is divided into compartments by partition panels fixed to the base.
- 6 The thickness of the protection mattress, the installation slope and the panel size shall be as designated. The Contractor may elect to use a manufacturer's standard size of mattress that is thicker than that designated.

- 7 Protection mattress shall be placed and built to the designated lines, levels and patterns on a prepared foundation surface, excavated as required and compacted as directed by the Engineer.
- 8 Protection mattress cages shall be securely wired together at comers and cages. Before filling, the cage shall be in its permanent position and laced to adjoining previously filled cages. Several assembled units should be placed in position and wired together at their edges with the wire passed continuously through each mesh in turn with a double turn at every second mesh.
- 9 Stones shall be packed by hand inside the cages as tight as practicable with the minimum of voids. Tie wires shall be fixed inside the compartments and the units tensioned in accordance with the manufacturer's instructions.

19.3 BOLLARDS

19.3.1 Scope

- 1 Short metal or precast concrete bollards for traffic control in roads or pedestrian areas.

2 Related Sections

Section 5 Concrete

19.3.2 References

- 1 The following standard is referred to in this Part:
ISO 1461Hot dip galvanised coatings on iron and steel articles.

19.3.3 Concrete Bollards

- 1 The use of cast in-situ concrete bollards will not be permitted.
- 2 Precast concrete bollards shall be constructed with the dimensions and details shown in the drawings. The surface finish and colour of the bollards shall be as shown in the drawings, in the Project Specification, per the designated details or as directed by the Engineer.
- 3 All concrete and steel materials and procedures for the precast concrete bollards shall comply with the requirements of Section 5.
- 4 The minimum grade of concrete for bollards shall be C40. Bollards shall be constructed using OPC cement to EN 197-1.
- 5 The minimum cover to all embedded steel items in the bollards shall be 50mm with a tolerance of -0 mm and + 10 mm.
- 6 Where precast concrete bollards are specified the Contractor shall design the bollards such that the durability is ensured for a period of ten years. The Contractor shall submit a performance guarantee for the bollards for a period of ten years. The guarantee shall provide for the replacement of the bollard in the event of any deterioration due to exposure to the elements.
- 7 The supplier shall verify this by a design submission covering the concrete mix design, special admixtures additives, cover to reinforcement type of reinforcement and protective coating. The engineer shall approve the material and design for the bollard based on the particular exposure of the location proposed for use.
- 8 Prior to production of the precast bollards the Contractor shall cast a trial bollard for approval by the Engineer.

19.3.4 Steel Bollards

- 1 Metal bollards shall be constructed of steel tube with the dimensions, details, wall thickness and height shown on the drawings or provided in the Project Specification.
- 2 The top of the bollard shall be ground free of any rough edges and fitted with a tight durable ultraviolet light resistant plastic top.
- 3 All metal parts shall be hot dipped galvanised to ISO 1461 after fabrication.
- 4 All metal parts shall also be painted to the colours and pattern as shown on the drawings or directed by the engineer. The paint system shall be compatible with the hot dipped galvanising and shall provide a service free life for five years.
- 5 Where designated, bollards shall be removable. This shall be achieved by casting a 4 mm thick PVC pipe sleeve into the pavement. The bollard shall be a tight fit into this sleeve. If so designated or directed by the Engineer a locking facility shall be incorporated with the removable bollard.

19.4 RUMBLE STRIPS

19.4.1 Scope

- 1 Rumble strips to provide warning to drivers of vehicles that accidentally stray out of the carriageway.
- 2 Related Parts
This Section
Part 5..... Asphalt Works.

19.4.2 Quality Assurance

- 1 The Contractor shall arrange for a trial installation of a rumble strip to demonstrate the methods and equipment to be used. Approval to proceed with the construction of the rumble strips will only be permitted after the Engineer has approved this trial in writing.

19.4.3 Construction

- 1 Rumble strips shall comprise of shallow formed depressions in the wearing course of the road shoulders. The depth, plan size and layout of the rumble strips shall be as designated or as directed by the Engineer.
- 2 Rumble strips shall be formed by one of the following methods:
 - (a) cold planing
 - (b) Removal shutter boards.
- 3 Cold planing of indentations in the wearing course in the shoulder shall be carried out in accordance with the requirements of the cold planing of Part 5. Edges shall be square and true and free from any loose material.
- 4 Rumble strips may also be formed by the use of removable shutter boards. The boards shall be rigidly located on the base or binder course prior to laying the wearing course. The method of fixing the strip shall be subject to the approval of the Engineer. The laying of the wearing course shall be carried out in accordance with the requirements of Part 5. Care shall be taken to ensure full compaction of material around the edges of the shutter boards. The shutter boards shall be carefully removed not earlier than three days after the laying and compaction of the asphalt.

19.5 SPEED CONTROL HUMPS

19.5.1 Scope

1 Speed control humps to limit the speed of vehicles.

2 Related Parts

This Section

Part 5..... Asphalt Works.

Part 9..... Kerbs, Footways & Paved Areas.

19.5.2 General

1 Speed control humps shall only be installed at the locations designated on the project drawings or specified elsewhere within the contract documents.

2 All speed humps shall be identified by markings on the road surface. The layout of these road markings shall be as the Qatar traffic control manual or as shown on the project drawings or elsewhere in the contract documentation.

3 The profile of the speed hump shall be as shown on the project drawings.

4 The profile shall represent a smooth gradual rise in elevation.

5 Speed humps shall be constructed of the same asphalt mix design as the asphalt wearing course.

6 The use of prefabricated rubber section speed humps or steel checker plate filled with concrete speed humps is not permitted.

7 Speed humps shall be designated as one of two types; for low speed pedestrian areas and for high speed roads. Low speed pedestrian areas speed humps shall comprise of a ramp within elevated section constructed of interlocking concrete paving blocks.

19.5.3 Construction of Speed Humps

1 The dimensions and construction details of speed hump shall be as shown on the drawings.

2 Prior to installation of the speed hump the surface of the wearing course shall be scabbled or abraded to a rough irregular finish to ensure bond with the speed hump. Tack coat shall be applied at the base.

3 Wearing course shall be hand laid for the speed hump. The wearing course shall be compacted and finished to a smooth profile.

4 All the asphalt work for the speed hump shall comply with the relevant clauses in part 5 of the specification. The final profile speed hump shall comply to the profile on the drawings to within $\pm 6\text{mm}$.

5 Heavy traffic or construction plant shall not be permitted to drive over speed humps until 7 days after the construction unless the engineer permits otherwise.

END OF PART