

JKR STANDARD SPECIFICATION FOR DRAINAGE WORKS IN BUILDING PROJECTS



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FOREWORD

The JKR Standard Specification for Drainage Works in Building Projects is prepared to provide Public Works Department engineers and contractors with sufficient information for the drainage works to be carried out to achieve the desired quality and consistency in building construction.

This Specification shall be read in conjunction with the main specification named as JKR Standard Specification For Building Works 2014 and Section 3 : Drainage Works in the Standard Specification For Road Works . This specification is an elaboration of the drainage Works mentioned in both specifications.

It is hoped that this Specification will further enhance the understanding of drainage works in due of MSMA application for building projects in the country.

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1.0 GENERAL

1.1 Scope of works

The works shall include the construction of surface drains, sumps, culverts, subsoil drains and other drainage structures in accordance with this Specification or as directed by the S.O.

All works shall be constructed in compliance to the requirements of JKR Standard Specifications For Building Works 2014, Standard Specification For Road Works (Drainage Works), Jabatan Pengairan dan Saliran, Urban Stormwater Management Manual for Malaysia (MSMA) and the relevant Local Authorities.

All drainage works shall be constructed to the lines, levels, grades and cross-sections shown on the Drawing or as directed by the S.O.

1.2 Drainage Requirement

The site drainage system shall be constructed to direct the runoff from the entire site to the storage area. There shall be no flooding, ponding, silting-up either during construction or after completion of the works. The quantity and quality of runoff from post development area shall be maintained to be the same or less than pre-development condition.

1.3 Discharge Point

Final discharge point shall be identified and approved by the S.O and the relevant authorities. Where necessary, the existing drainage system shall be upgraded in order to ensure they are adequate and fully functional.

1.4 Safety

To ensure the safety of pedestrian and vehicles, all deep drains, sumps, entrances to buildings and public area shall be covered with suitable cover slabs or grating to the approval of the S.O.

2.0 EXCAVATION

2.1 Advance Notice

The Contractor shall notify the S.O. sufficiently in advance of the beginning of any excavation so that cross-section elevations and measurements shall be taken of the undisturbed ground. The natural ground adjacent to the structure shall not be disturbed without permission of the S.O. The excavation works shall be carried out so as not to cause any danger or obstruction to the traffic or public.

2.2 Excavation

2.2.1 The work shall consist of excavation for construction of surface drains, subsoil drains, cast in situ box culverts and other drainage structures.

2.2.2 All excavation works shall be carried out in accordance with this Specification, Standard Specifications For Building Works 2014 or as shown on the Drawings or as directed by the S.O. All excavation shall be inspected and approved by the S.O. prior to further works being carried out.

2.3 Excavation of Drain Trenches

- 2.3.1 The trench shall first be excavated to a depth of 150mm less than the depths intended or shown in the Drawings. The remaining excavation shall be carried out immediately prior to the placing of blinding materials.
- 2.3.2 Should the bottom of the trench be inadvertently excavated below the specified level, it shall be brought back at Contractor's expense to the correct level with good selected earth or sand, carefully rammed into place.
- 2.3.3 The trench bottom shall be of sufficient width to allow adequate working space for the pipe joiners. Trenches deeper than 1.5 m shall be provided with struts.
- 2.3.4 In the event of excavation being made deeper than necessary, they shall be made up of Grade 15P concrete at the Contractor's expense.

2.4 Handling excavated materials

- 2.4.1 Unless otherwise specified, excavated material shall not be deposited within 500 mm of the edges of the trench.

2.5 Backfilling

- 2.5.1 Drainage trenches shall be backfilled immediately after completion of drain laying or installation of culverts and as soon as the S.O. has inspected and given his approval.
- 2.5.2 Backfilling with approved fill materials shall be placed evenly in layers not exceeding 150mm in depth. To provide uniform support, loose thickness of fill materials on both sides of the drain shall be thoroughly

compacted with mechanical rammers. This procedure shall be followed for the whole depth of drain section.

- 2.5.3 All spaces excavated under this Specification and not occupied by culverts, drains or sumps shall be backfilled. Backfill material shall be free from large lumps, wood and other extraneous materials.
- 2.5.4 Each layer of backfill shall be wetted uniformly as necessary and compacted to the same requirements as the adjacent. Unless otherwise approved by the S.O., hand tamping shall not be permitted.
- 2.5.5 Backfill not within the drainage areas shall be placed in layers not more than 150 mm in depth (compacted measurement) and shall be compacted to a density comparable with the adjacent undisturbed material.
- 2.5.6 In placing the backfill, the material shall be to the same height on both sides of the structure. If conditions require backfilling appreciably higher on one side, the additional material on the higher side shall not be placed until the S.O. is satisfied that the structure has enough strength to withstand any pressure created.

3.0 MATERIALS

3.1 Granular Bedding

- 3.1.1 The foundations shall be of granular bedding material, suitably graded broken rubble, crushed stone, crushed gravel, sand or other material as specified on the Drawings or as directed by the S.O.

- 3.1.2 The granular material free of fine particles shall ease compaction as it requires very little tamping effort to achieve a substantial amount of compaction and the crushed aggregates readily move to suitable place around the pipes.

3.2 Concrete Bedding

- 3.2.1 Concrete for blinding, bedding and cast-in-situ drains shall be as shown on the Drawings and as specified in SECTION D : CONCRETE WORKS of JKR STANDARD SPECIFICATIONS FOR BUILDING WORKS 2014.
- 3.2.2 Unless otherwise shown on the Drawings, concrete bedding shall be of grade concrete 20P and blinding for the foundations of structure such as drains, sumps and culvert shall be of grade concrete 15P or as directed by the S.O.

3.3 Cement Mortar

- 3.3.1 Cement mortar, unless otherwise specified, shall contain 1 part ordinary Portland cement to 3 parts fine aggregate by volume. Water shall be added to the mix to produce a suitable consistency for the intended use, all to the approval of the S.O.
- 3.3.2 The ingredients for mortar shall be measured in proper gauge boxes and mixed on a clean boarded platform or in an approved mechanical batch mixer.
- 3.3.3 All mortar shall be used within 30 minutes of mixing and no reworking of mortar shall be permitted thereafter.

3.4 Ordinary Backfill Material

3.4.1 Ordinary backfill material shall be of suitable material such as medium stiff clay, clayey sand or other approved soils. The maximum particle size of the backfill material shall be 50 mm.

3.4.2 Materials from swamps, peats or top soils and other highly organic clay or silt, materials containing logs, stumps or boulders, which are susceptible to combustion, and any other materials which, by virtue of their physical or chemical composition or at their moisture content will not compact properly, shall not be used for filling.

3.5 Granular Backfill Material

3.5.1 Granular backfill material shall be sand, crushed stone, crushed gravel or a mixture of crushed and natural aggregates, shall be essentially free from vegetative and other organic matter and clay, and shall not contain lateritic or concretionary materials. The material shall conform to the following physical and mechanical quality requirements:

- i) the fines shall be non-plastic;
- ii) sand shall have a gradation conforming to the envelope shown in Table S1

TABLE S1 : GRADING LIMITS FOR SAND BACKFILL

B.S. Sieve Size	% Passing By Weight
10.0 mm	100
5.0 mm	90 - 100
1.18 mm	45 - 80
300 um	10 - 30
150 um	2 - 10

- iii) material other than sand shall have a gradation conforming to one of the envelopes shown in Table S2.

TABLE S2 : GRADING LIMIT FOR GRANULAR BACKFILL OTHER THAN SAND

B.S. Sieve Size	% Passing By Weight		
	A	B	C
37.5mm	100	-	-
28.0mm	70 – 100	100	-
20.0mm	60 – 90	70 - 100	100
10.0mm	45 – 75	45 - 75	-
5.0mm	30 – 60	35 - 65	45 – 75
2.0mm	20 – 50	25 - 50	30 – 60
425um	10 – 30	10 - 30	15 – 35
75um	0 – 2	0 – 2	0 – 2

- 3.5.2 The granular backfill shall be placed in layers not to exceed 150 mm in depth and each layer shall be thoroughly compacted by means of packers or mechanical tampers to a relative compaction of not less than 95% Standard Proctor Density for the backfill material at optimum moisture content.

4.0 SURFACE DRAINS

- i) Surface drains shall be constructed with regard to both operation and ease of maintenance as shown on the drawing or as directed by the S.O.
- ii) Where gradient designed is not practical or above the finished level, the Contractor shall submit their proposal for the approval of the S.O.

4.1 Struts

Reinforced concrete strut shall be provided for all drain side walls exceeding 1.0m height.

4.2 Cover/Grating

All drains at the entrances and exits to buildings as well as public area shall be properly covered with suitable cover slabs or grating as shown on the Drawing or as directed by the S.O.

4.3 Construction of Surface Drains

Surface drains of the types shown on the Drawings shall be constructed either unlined or lined using cast in situ concrete, precast concrete drain sections or stone pitching.

4.3.1 Unlined (Earth) Drains

- i) The Contractor shall refer to approved plans for location, extent and construction details as shown on the Drawing, or otherwise directed by the S.O. Clearing shall be done only when is necessary to provide access for personnel and equipment installation. Roots, stumps and other debris shall be removed and disposed properly and not be used to build the bank.
- ii) The drain shall be graded to the specified slope to form the associated embankment with compacted fill. The drain invert shall fall 100 mm for every 10m for each 1% of required channel gradient.
- iii) Excavation for earth drains shall be trimmed to form a smooth, firm surface to the required lines, levels, grades and cross-sections as shown on the Drawings or as required by the S.O.
- iv) Any areas of over excavation shall be made good to the satisfaction of the S.O, all at the Contractor's expense. The drain shall be graded

to the specified slope to form the associated embankment with compacted fill.

- v) The sides of the cut drain shall not be steeper than a 1 : 1.5 (V:H) slope and fill slopes shall not be steeper than 1 : 2 (V:H). The surface water shall be discharged to a stable outlet such that soil erosion is prevented from occurring.

4.3.2 Lined Drain

Unless otherwise stated on the Drawing, the maximum steepness of the side slopes for lined open drains shall be as indicated in Table S3.

TABLE S3 : MAXIMUM STEEPNESS OF THE SIDE SLOPES

Drain lining	Maximum steepness of the side slopes (V:H)
Concrete, brickwork and blockwork	Vertical
Stone Pitching	1 : 1.5
Grassed/Vegetated , rock riprap	1 : 2

4.4 Types of Drains

4.4.1 Perimeter Drain

Perimeter drains shall be constructed with a minimum gradient of 1: 350 at the width of not more than 600 mm unless otherwise stated on the drawing or as directed and approved by the S.O.

4.4.2 Bench / Berm Drains

- i) Bench drains shall be placed longitudinally along the bench of a cut section while berm drains shall be located on the berm of the fill section as shown on the Drawings or as directed by the S.O.
- ii) Bench or berm drains shall be cast in-situ and constructed continuously to overcome dislocation and seepage problems that are normally encountered with precast sections.

5.0 PILING WORKS

Wherever applicable, all piling works shall comply with the requirements mentioned in the JKR STANDARD SPECIFICATIONS FOR BUILDING WORKS 2014.

6.0 SUBSOIL DRAIN

6.1 Installation

This work shall include the supply and installation of subsoil drains constructed in accordance with this Specification at the locations with the lines, levels and gradients as shown on the Drawings or as directed by the S.O.

6.2 Minimum Gradient

Unless otherwise shown on the drawings, minimum gradient of 1: 200 shall be provided for the drain to discharge into existing stormwater system, open drain, creek or pond in the area. The discharge shall not create an unwanted bog.

6.3 Lateral Drain

Unless otherwise shown on the drawings, lateral drains shall have a minimum slope of 1: 200 to ensure water always flowing even though there are undulations and laid at 2 m spacing at 45° to the main pipes/collector drain.

6.4. Pipes

The pipes for subsoil drains shall be made up preferably of the materials/system as stated below or as approved by the S.O :

- i) Perforated Corrugated Double Wall HDPE pipe
- ii) Porous concrete pipes comply to M.S 525
- iii) Bio Ecological Drainage System
- iv) Others

All proposed materials shall be approved by the S.O

6.5 Filter material

- i) Filter material shall consist of hard, clean, sand conforming to the grading limits given in Table S4. The material passing the 425 um sieve shall be non-plastic when tested in accordance with B.S. 1377.

TABLE S4 : FILTER MATERIAL

B.S. Sieve Size	% Passing By Weight
10.0mm	100
5.0mm	90 - 100
2.36mm	75 - 100
1.18mm	55 - 90
600um	35 - 59
300um	8 - 30
150um	0 - 10

- ii) Geotextile shall be of non-woven type thermally bonded, minimum weight 100 g/m² or equivalent as approved by the S.O. Trenches shall be lined with geotextile filter fabric as shown on the Standard Drawings, or otherwise approved by the S.O. Where fabric requires jointing, it shall be stitched and overlapped with a minimum of 500 mm at transverse joints and the full trench width at the top shall be provided. Subsoil drains shall be laid, bedded and jointed as detailed on the Drawings.

7.0 SUMPS

Sumps shall be constructed as in accordance to the Drawing or as directed by the S.O to facilitate changes of level and flow within a drainage system.

All sumps shall be covered either by concrete slab or galvanized steel grating hinged to the seating frame on the sumps for both safety and retaining debris.

The invert levels of Pipe/Drain to the sump inlet shall be at least 150mm above the base of the sump or as otherwise shown on the Drawing.

Sumps shall be spaced at maximum interval of every 100 m with a minimum invert depth of 600 mm.

8.0 CULVERTS

- i) This work shall comprise the supply, delivery and installation of reinforced concrete pipe culverts and precast box culverts, inclusive of excavation, backfilling, jointing, bedding, construction of

headwalls, wing walls, aprons and sumps and channel protection works, all in accordance with this specification and/or the details shown on the Drawings. All culverts shall be laid to the satisfaction of the S.O.

- ii) The S.O. reserves the right to request for the test certificates and further tests to be carried out on samples, all at the Contractor's own cost.

8.1 Defective Culverts

An individual section of pipe culverts shall be rejected due to any of the following:

- i) Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
- ii) Defects that indicate imperfect proportioning, mixing and moulding.
- iii) Surface defects indicating honeycombed or open texture.
- iv) Damaged ends where such damage would prevent making a satisfactory joint.

All pipe culverts damaged during laying, handling, transporting, or any other time shall be replaced, all at the contractor's own cost. Rejected pipes shall be marked and removed from the site.

8.2 Bedding

- i) Type A bedding shall consist of grade 20P concrete or otherwise as specified on the drawing and approved by the S.O.
- ii) Type B bedding shall consist of clean, natural sand or gravelly sand of suitable gradation and quality, approved by the S.O. The material shall have a maximum particle size of not more than 12mm.

8.3 Culvert Components

Culverts shall be constructed with barrel and end treatment including headwalls, end walls, wing walls, outlet protection, inlet improvement and debris control structures.

8.4 Pipe Culverts

Pipe culvert shall be of spun reinforced concrete complying with MS 881 or any equivalent approved by the S.O. In each pipe culvert, the following markings shall be clearly shown:-

- i) Class and size
- ii) Date of manufactured
- iii) Name and trademark of the manufacturer

8.5 Installation of Pipe Culverts

Culverts shall not be installed at any location until the type of pipe, the exact location, the lines, levels and grades, the length of pipe and details of inlet and outlet structures have been confirmed and approved by the S.O. Special requirements recommended by the manufacturer with respect to assembly and installation shall be complied. Where elliptically reinforced pipe sections are used, care shall be taken to ensure that the loading axes are positioned exactly vertically.

8.6 Precast Box Culverts

- i) Box culverts shall be of precast concrete of approved manufacture complying with MS 1293 or any equivalent alternative acceptable and approved by the S.O.

- ii) The maximum gap between each culvert shall not be more than 13mm and the differences in level shall be less than 3mm. The gap shall be filled with cement mortar (1:3) with smooth finished.
- iii) To ensure uniform bearing, a layer of cement grout shall be spread along the top of the walls where the lid shall sit.

8.7 Extension of Existing Culverts

8.7.1 Existing structures

The existing wing walls, aprons and concrete bedding shall be demolished wherever indicated on the Drawings to expose the existing pipe/box culvert on the side(s) to be extended. The end of the existing pipe/box culvert to be extended shall then be wire-brushed or some other means employed to give a clean end.

8.7.2 Extension joints

Extension joints shall be formed as shown on the Drawings by injecting Thioflex 600 or its equivalent to a thickness of not less than 25 mm in the 15 mm wide gap between the existing pipe and the new pipe. The remaining space in the gap shall then be filled with expansion filler.

9.0 STORMWATER PUMPING

Wherever applicable, all works involving storm water pumping shall comply to the requirements mentioned in the Mechanical and Electrical section of the JKR STANDARD SPECIFICATIONS FOR BUILDING WORKS 2014.

All pump house shall be constructed using reinforced concrete structure or as otherwise shown on the Drawing.

The storm water pump station house shall consist of an enclosing structure with access to the pumps and other equipment. The enclosure shall have doors, roof hatches, or covered openings through which equipment can be passed or debris can be removed.

All mechanical and electrical works shall be endorsed to Mechanical and Electrical Engineers.

10.0 DETENTION / ON SITE DETENTION (OSD)

- i) These ponds shall be constructed as shown on the Drawings.
- ii) Unless otherwise shown on the Drawings, depths of dry pond shall not be more than 1.5 m or otherwise fence the pond from public access.
- iii) Side slopes of grassed earthen embankment shall not be steeper than 1(V):4(H) unless otherwise shown on the Drawings.
- iv) Side slopes of stone pitching/gabion embankment shall not be steeper than 1(V):2(H) unless otherwise shown on the Drawings.
- v) The channel bed and banks immediately downstream of stilling basins shall be protected by stone pitching or riprap.
- vi) Unless otherwise shown on the Drawings where the outfall from any stilling basin is a culvert, stone pitching/riprap shall be provided for a distance of at least four (4) times the diameter or height of the culvert.

10.1 Inlet

Gross Pollutant Trap (GPT) shall be provided as shown on the Drawing or as stated in the Table S5.

TABLE S5: GPT's TYPE AND APPLICATION

Class	Function	Installation
Type 1 - Floating Debris Traps -Trash Racks & Litter Control Devices	Litter capture on permanent water bodies Litter capture on drainage conveyance	Proprietary and purposely built Purposely built from modular components
Type 2 -Sediment Basin and Trash Rack (SBTR) Traps	Sediment and litter capture on drainage conveyance	Purposely built
Type 3 - Oil and Grease Interceptor	Oil, grease and sediment capture on drainage	Purposely built and Proprietary

10.2 Outlet

The outlet from the Detention/OSD facility shall be capable to cater outflow discharges without causing adverse effects on downstream properties.

11.0 BIO ECOLOGICAL DRAINAGE SYSTEM (Bio Ecod)

- i) The work shall include the supply and installation of the ecological drainage system in accordance to project specifications and Drawings, or as directed by the S.O.
- ii) Unless otherwise shown on the Drawings, drain reserves for ecological drainage system shall be at least 5 meters from the side of the road pavement.

11.1 Materials

- i) All Subsurface ecological drainage products used shall comply with the specifications and requirements of the manufacturer.
- ii) The material shall be resistant to chemical and bacterial attack.
- iii) Unless otherwise shown on the Drawings, all soil and subsurface product interface shall have a layer of geotextile to prevent fines from entering the drainage system.
- iv) If damage occurs to one of the geotextile fabric during installation, repairs shall be carried out by placing new material over the damaged area by allowing 300 mm excess on all sides and then fixing with silicon adhesive.

11.2 Filter Materials

- i) Filter material shall be of hard and clean river sand normally used in construction of subsoil drains to give better infiltration rates.
- ii) The material passing the 0.425 mm sieve shall be non plastic when tested in accordance with BS 1377.

12.0 TYPES OF LINING

12.1 Stone Pitching

12.1.2 Construction

This work shall consist of the construction of all structures or part of structures to be composed of stone pitching either grouted or ungrouted as shown on the Drawings or as directed by the S.O. including erosion protection pavements and aprons, drain linings, culvert inlets and outlets, etc.

The work shall be carried out to the lines, levels, grades, dimensions and cross-sections shown on the Drawings and as required by the S.O.

12.1.3 Stone

Stone shall be clean roughly quarry stone, or pit or river cobbles, or a mixture of any of these materials, and shall be essentially free from dust, clay, vegetative matter and other deleterious materials.

Unless otherwise specified, individual pieces of stone shall be approximately cubical or spherical and shall have the a minimum dimension of 100mm and a maximum dimension of 250 mm,. The stone shall be hard, tough, durable and dense. They shall be resistant to the action of air and water, and suitable in all respects for the purpose intended.

12.1.4 Grouted Stone Pitching

- a. Prior to construction grouted stone pitching, the surfaces against which it is to be placed shall have been finished to the satisfaction of the S.O. Not with standing any earlier approval of these finished surfaces, any damage to or deterioration of them shall be made good to the satisfaction of the S.O. before grouted stone pitching is placed.
- b. Construction of grouted stone pitching shall commence at the lowest part of each structure or section of a structure and continue progressively upward. Long structures such as drain linings and slope protection pavements shall be constructed in sections of practicable lengths, to the approval of the S.O.

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- c. Stones shall then be firmly set by hand into the mortar, densely packed against adjacent stones and built up to form a stone structure of more or less uniform thickness which shall nowhere be less than 150 mm (measured perpendicularly to the surface covered).
 - d. All voids in the structure shall be packed solidly with mortar and stone spalls; however the surfaces of stones in the exposed faces and edges shall not be covered with mortar.
 - e. The exposed surfaces and edges of the structure shall be constructed such that they have as large a proportion as practicable composed of stone faces. Weep holes shall be provided as shown on the Drawings or as directed by the S.O.
 - f. Mortar which has been mixed for more than 30 minutes shall not be used in the works. The work shall be carried out and finished all to the approval of the S.O.

12.1.5 UngROUTed Stone Pitching

Where shown on the Drawings, ungrouted stone pitching shall be hand set to provide maximum interlocking effect. The stones, the largest of which shall be used at the bottom, shall be well bedded on a 75 mm layer of gravel or aggregate rammed to an even surface. The whole work shall be finished to the approval of the S.O.

12.2 Gabions

This work shall consist of the construction of miscellaneous erosion protection and retaining structures to be composed of stone filled wire mesh gabions. The work shall be carried out as shown on the Drawings and/or as approved by the S.O

12.2.1 Wire Mesh Gabion

- a. Gabions shall be rectangular baskets of the required dimensions as shown on the Drawings or as approved by the S.O. Unless otherwise specified, they shall be of the following standard dimensions :
 - i) width - 1.00 metre;
 - ii) length - 1.00, 2.00 or 3.00 metres;
 - iii) height - 0.50 or 1.00 metre.
- b. Gabions longer than 1.00 m shall be divided into compartments of equal length not exceeding 1.00 m by wire mesh diaphragms securely tied along all edges.
- c. Each gabion or compartment of a gabion shall be provided with at least 4 cross-connecting wires if its height is 0.50 m or less, and with at least 8 cross-connecting wires if its height is in the range 0.50 to 1.00 m.
- d. As a gabion structure is built up, backfilling against finished gabions shall be carried out as necessary for proper progressive construction finished to the satisfaction of the S.O. Unless otherwise specified, vertical joints between gabions shall be staggered in gabion structures in a pattern similar to the joints in running bond brickwork. In no case shall the weight of the finished gabion be less than 1,300 kg per cubic meter.

12.2.2 Materials for gabion

a. Galvanised wire

- i) Gabions shall be fabricated from steel wire manufactured in accordance with B.S. 1052 and galvanised in accordance with M.S. 407, or equivalent standards to the approval of the S.O.. The galvanised wire sizes used shall be in accordance with Table S6.

TABLE S6: GALVANISED WIRE SIZES FOR GABIONS

Type of Wire	Minimum Diameter
Selvage (perimeter) wire	3.50 mm
Mesh wire	2.70 mm
Tying and connecting wire	2.20 mm

- ii) Gabion mesh shall be triple twisted and shall have a uniform hexagonal pattern with openings of 100 mm x 120 mm or less. The mesh shall be securely tied to selvage wires to form rectangular panels which shall be securely wired together to form the completed gabion baskets.
- iii) The ties and connections for each gabion basket shall comprise not less than 8% of its total weight, and the fabrication shall be all to the approval of the S.O.

b. Polyvinyl Chloride Coating

- i) Unless specified on the Drawings, all galvanized wire used in the fabrication and construction of gabions shall be coated with polyvinyl chloride (PVC).
- ii) The minimum thickness of PVC coating shall be 0.55 mm.

c. Stone

- i) Stone fill for gabions shall be of clean rough quarry stone, or pit or river cobbles, or a mixture of any of these materials. It shall be essentially free from dust, clay, vegetative matter and other deleterious materials.
- ii) Individual pieces of stone shall have least dimensions not less than 20 mm larger than the gabion mesh openings and the greatest dimensions of not more than 250 mm.
- iii) The stone shall be hard, tough, durable and dense, resistant to the action of air and water, and suitable in all aspects for the purpose intended. The material shall be approved by the S.O.

13.0 BRICKWORK

The bricks shall comply with the requirements of M.S. 76. and as specified in the JKR Standard Specifications For Building Works 2014. All bricks shall be clean, sound, hard, well burnt, proper size and shall give a clear ring when struck.. Bricks shall be obtained from manufacturers approved by the S.O.

13.1 Brick Laying

- i) Brickwork shall be executed with cement mortar and shall be of the thickness and bonds as shown on the Drawings. Bricks shall be kept damp until used and shall be laid on a full bed of mortar.
- ii) The brickwork shall be true to line and plumb, and courses shall be kept truly level. The thickness of mortar joints shall not exceed 10 mm and shall be such that 4 courses of brickwork forms a height of 300 mm.
- iii) Any brickwork that is damaged shall be taken down and rebuilt and the joints raked out and pointed as directed by the S.O. Any such remedial work shall be at the Contractor's own expense.

13.2 Plastering Brickwork

- i) All exposed brickwork surfaces shall be plastered. The plaster shall be applied in 2 coats generally to a total thickness of 20 mm and shall be finished with a steel trowel for internal surfaces and with a wooden float for external surfaces.
- ii) Application of plain plaster shall comply with M.S. 794
- iii) Weep holes shall be provided as shown on the Drawings or as directed by the S.O.