



Republic of Indonesia
Ministry of Public Works
Directorate General of
Highway



Australia Indonesia Partnership
Kemitraan Australia Indonesia



**THE EASTERN INDONESIA NATIONAL ROAD
IMPROVEMENT PROJECT
(EINRIP)**

AIP LOAN NO: AIPRD - L002

PACKAGE NO : ESS – 04
PACKAGE NAME : BULUKUMBA-TONDONG
PROVINCE : SOUTH SULAWESI

PART 2
SECTION VI.1 – SCOPE OF WORK
SECTION VI.2A – SPECIAL SPECIFICATIONS

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SECTION VI-1 SCOPE OF WORKS

The project is located in South Sulawesi Province on the Sulawesi Island, Indonesia. The start of project is located in Kabupaten Bulukumba at KM 154.000 and the end of project is located at KM 174.737 from Makassar. Makassar is the capital city of South Sulawesi Province where there is an airport and sea port. Details of the location are shown on the Drawings.

Total length of the road treatment is 20.74 km

Scope of Road Work

The project consists of road betterment, bridge rehabilitation and culvert replacement. The road betterment comprises reconstruction, overlay and widening. The work also includes cutting on existing hillside at a few locations, improvement on existing road alignment and providing drainage system.

The carriageway is being widened from 4.5 metre to 6 metre plus 2 by 1.5 metre hard shoulders.

The bridge treatment is comprises rehabilitation (5 bridges) and replace with new box culvert (1 bridge).

General

The project has been designed in detail including pavement, drainage, line marking, safety zone for school (ZoSS), traffic signs, bus bay and pedestrian facilities. There is no allowance in the construction contract for field design review with the exception of correcting errors in measurements or deterioration of road pavement and any changes in physical characteristics or structures that may have occurred since the design was carried out.

Major items of work include:

Pay Item No.	Description	Unit	Est Qty
2.3.9.2	U Ditch Type DS-2	Ln.M	19,906
3.1.1	Common Excavation	Cu.M	63,258
3.1.7	Excavation of Existing Asphaltic Pavement without Cold Milling Machine	Cu.M	10,646
3.2.1	Common Embankment	Cu.M	71,064
4.2.1	Aggregate Base Class A	Cu.M	13,831
4.2.2	Aggregate Base Class B	Cu.M	12,962
5.1.1	Aggregate Base Class A	Cu.M	13,388
5.1.2	Aggregate Base Class B	Cu.M	13,543
6.3.5a	Asphaltic Concrete – Wearing Course (AC - WC) 4 cm (fine/coarse)	Sq.M	127,246
6.3.6a	Asphaltic Concrete - Binder Course (AC – BC) (fine/coarse)	Cu.M	11,636
6.3.6c	Asphaltic Concrete - Binder Course Leveling (AC - BC(L))(fine/coarse)	Tonne	3,991
8.4.7a	Guard Rail (excluding terminal lengths)	Ln.M	4,158

SECTION VI.2A - SPECIAL SPECIFICATION

DIVISION 1 - GENERAL

SECTION 1.2 - PROJECT SIGN BOARD

SS 1.2.1 GENERAL

SS 1.2.1.1. Description

The work shall consist of the supply, assembly, installation, maintaining and removing of Project Sign Boards as shown in the Standard Drawings and at both ends project locations or as shown on the Drawings or as directed by the Engineer. The installation work for project sign boards shall include all necessary excavation, foundation, backfill, anchorages, fixtures, fastenings and brackets.

SS 1.2.1.2. Issue of Arrangement Drawings and Construction Details

Arrangement drawings showing the project sign boards are included in the Standard Drawings of Contract Documents. The exact location of project sign boards shall be as instructed by the Engineer. The Contractor is required to provide two types of project sign board as follows:

1. Project Information Sign Boards
2. Australia Indonesia Partnership (AIP) Sign Boards.

Each sign board shall be positioned at the beginning and at end of project location. The Project Information Sign Boards are intended to provide brief information related to the construction implementation. The contractor shall provide all necessary work including painting the project information as shown in the Drawings For the AIP Sign Boards, the contractor shall also provide all necessary works except the painting of information which will be given directly by AusAID in the form of sticker. However, the contractor is required to provide necessary arrangement to put the sticker on the prepared plates.

SS 1.2.1.3. Reference Standard

(a) The configurations, dimensions, and color of project sign boards shall conform to the Standard Drawings.

SS 1.2.1.4. Submittals

- (i) Submit one galvanized steel tubular post for the road signs
- (ii) Submit one sign plate with painting already completed

SS 1.2.1.5. Work Scheduling

In order to provide information regarding the ongoing project construction, the project sign boards shall be properly installed within the first three months or as early as possible within the Mobilization Period.

The removal of project sign boards shall be done after the Defect Liability Period and shall be responsibility of the contractor.

SS 1.2.1.6. Maintenance of Accepted Work

Notwithstanding the Contractor's obligation to carry out rectification of unsatisfactory or failed work, in order to keep the people aware of the ongoing project

the Contractor shall also be responsible for maintenance to prevent the project sign boards from any damages, non-visibility and loss throughout the Contract Period, including the Defect Liability Period.

SS 1.2.2. MATERIALS

SS 1.2.2.1. Project Sign Board Plates

Aluminum alloy, flat sheet, hard alloy 5052-H34 complying with ASTM B209 and having a minimum thickness of 2 mm. Such sheets are to be degreased, etched, neutralized and processed prior to use as project sign board plates.

SS 1.2.2.2. Project Sign Board Plate Frames and Stiffening

Aluminum alloy extruded sections of alloy 6063-T6 complying with ASTM B221. Stiffening of traffic sign plates shall take place when the dimensions of the sign exceed 1.0 Metre.

SS 1.2.2.3. Project Sign Board Posts

Steel H-beam or steel pipe, hot dip galvanized, to comply with ASTM A572 or A120 as shown in the Drawings. This includes steel H-beam or pipe fittings and post caps. All open ends shall be capped to prevent water entry.

SS 1.2.2.4. Hardware, Screws, Nuts, Bolts and Washers

Shall be of aluminum or high tensile stainless steel for sign posts and galvanized.

SS 1.2.2.5. Concrete and Cement Mortar

Concrete to be used for road sign foundation shall be Class K175 as specified in Section 7.1.

SS 1.2.2.6. Steel Plate and Trigonal Piling Post

Base plate and trigonal piling post shall be of steel to comply with ASTM A572 as shown in the Drawings.

SS 1.2.2.7. Reflective Sheeting

Shall be “Scotchlite” Engineering grade or High Intensity Quality grade or other approved colorfast reflective material. The face of each sign shall be reflectorised in accordance with DLLAJR requirements and the face of each guide post shall be reflectorised.

SS 1.2.3. EXECUTION

SS 1.2.3.1. Placing Posts, Signs and Guard Rail

The number, type and location of each road sign, guide post and kilometre post and section of guard rail shall be as instructed by the Engineer.
All posts shall be set accurately at the required location and elevation and in such a manner as to ensure it being held firmly in place, especially during setting of any concrete.

SS 1.2.4. MEASUREMENT AND PAYMENT

Payment for the project sign boards will be paid under the Lump Sum payment for Mobilization and Demobilization in accordance with Section 1.2 of these Specifications, which payment shall be considered full compensation for supply, assembly, installation, maintaining, removing and incidentals necessary for the satisfactory completion of the project sign boards in accordance with this Section of the Specifications.

DIVISION 2 – DRAINAGE

SECTION 2.3 - CULVERTS AND CONCRETE DRAINS

SS 2.3.1 GENERAL

This article shall be read in conjunction with Section 2.3 of the General Specifications which is modified as follows:

SS 2.3.2 MEASUREMENT AND PAYMENT

SS 2.3.4.2 Basis for Payment

The quantities of Pipe Culvert, U ditches, V ditches, box culverts and other minor concrete drainage structures, measured as provided above, shall be paid for at the Contract Price per unit of measurement respectively for each of the Pay Items listed below and shown on Bill of Quantities, which price and payments shall be full compensation for furnishing and placing all materials and for all excavation and disposal of materials, compaction, form work, backfilling, weep holes, and all other costs necessary or usual for the proper completion of the works prescribed in this Section.

Pay Item No.	Description	Unit of Measurement
SS 2.3.9.2b	U ditch Type DS 2b	Linear Metre
SS 2.3.9.2c	U ditch Type DS 2c	Linear Metre
SS 2.3.9.3b	U ditch Type DS 3b	Linear Metre
SS 2.3.9.3c	U ditch Type DS 3c	Linear Metre
SS 2.3.9.4b	U ditch Type DS 4b	Linear Metre
SS 2.3.9.4c	U ditch Type DS 4c	Linear Metre
SS 2.3.9.5b	U ditch Type DS 5b	Linear Metre
SS 2.3.9.6	U ditch Type DS 6	Linear Metre
SS 2.3.9.6a	U ditch Type DS 6a	Linear Metre
SS 2.3.9.6c	U ditch Type DS 6c	Linear Metre
SS 2.3.9.7a	V ditch Type 1	Linear Metre
SS 2.3.9.7b	V ditch Type 2	Linear Metre

DIVISION 3 – EARTHWORKS

SS 3.5 – GEOGRID and GEOTEXTILE

SS 3.5.2 GEOTEXTILE

SS 3.5.2.1 Description

This work shall consist of the provision and installation of approved geotextiles for the construction of embankments and any associated works in accordance with the Drawings and these Specifications.

All geotextiles shall conform with the requirements of AASHTO M288 –97 “Geotextile Specification for Highway Applications” but particular attention must be paid to any specific requirements annotated on individual Drawings. All materials must be approved by the Engineer prior to use in the permanent works.

SS.3.5.2.2 Reference Documentation

SNI and AASHTO

M 288 - 97	Geotextile Specification for Highway Applications
SNI 03-3422-1994	Particle Size Analysis of Soils
SNI 03-1966-1990	Determining the Plastic Limit and Plasticity Index of Soils
SNI 03-1742-1989	The Moisture – Density Relationships of Soils using a 2.5 Kg Rammer and a 305 mm Drop

ASTM

D 123	Standard Terminology Relating to Textiles
D 276	Standard Test Methods for Identification of Fibers in Textiles
D 3786	Standard Test Method for Bursting Strength of Textile Fabrics- Diaphragm Bursting Strength Tester Method
D 4354	Standard Practice for Sampling of Geosynthetics for Testing
D 4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
D 4439	Standard Terminology of Geosynthetics
D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
D 4595	Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
D 4759	Standard Practice for Determining the Specification Conformance of Geosynthetics

- D 4833** Standard Test Methods for Index Puncture Resistance of Geotextiles, Geo membranes and Related Products
- D 4873** Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples,
- D 5141** Standard Test Method for Determining Filtering Efficiency and Flow Rate of a Geotextile for Silt Fence Application Using Site-Specific Soil.
- D 5261** Standard Test Methods for Measuring Mass per Unit Area of Geotextile

SS.3.5.2.3 Materials

(1) Quality Assurance and Selection

The geotextile shall be a proprietary woven or non woven synthetic geotextile fabric approved by the Engineer. The actual type of geotextile will be selected by following the general rule of woven fabrics to be used where the primary requirement is strength and non-woven to be used where the primary requirement is filtration or separation. The Contractor shall submit the result of all tests to the Engineer.

All physical property value requirements in this Specification refer to Minimum Average Roll Values (MARV) except for the Apparent Opening Size (AOS) which refers to Maximum Average Roll Value (MARV). MARV requirements are the main qualifier for material acceptance.

SS. 3.5.2.4 Physical and Chemical Requirements

- (1) The fibres of the geotextile and thread used in joining lengths must consist of long chain synthetic polymers composed of at least 95% by mass of polyolefins or polyesters.
- (2) The geotextile filaments must be rot proof, chemically stable and must have low water absorbency. Filaments must resist delamination and maintain their relative dimensional stability in the geotextile.
- (3) **Non woven geotextiles** must have filaments bonded by needle punching, heat or chemical bonding processes
- (4) **Woven geotextiles** must have filaments interlaced in two sets, mutually at right angles. One set must be parallel to the longitudinal direction of the geotextile.
- (5) Geotextiles must be free of any flaws which may have an adverse effect on the physical and mechanical properties of the geotextile.
- (6) Recycled materials may be used under controlled conditions in the manufacture of the geotextile. Each batch of geotextile must conform with the requirements of this Specification and must be homogenous, particularly with respect to the content of recycled material.
- (7) Geotextile must be stabilized against ultraviolet radiation when tested in accordance with ASTM D 4355.

- (8) All numeric values (MARV) in the weakest principal direction (i.e, average test results of any roll in a lot sampled for conformance or quality assurance testing shall meet or exceed the minimum values) except that values for AOS represent maximum average roll values.

SS.3.5.2.5 Certification

- (1) The Contractor shall provide to the Engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile.
- (2) The manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request.
- (3) The manufacturer's certificate shall state that the furnished geotextile meets MARV requirements of the specification as evaluated under the manufacturer's quality control program. The certificate shall be attested to be a person having legal authority to bind The Manufacturer.
- (4) Either mislabeling or misrepresentation of materials shall be reason to reject those geotextile products.

SS.3.5.2.6 Sampling, Testing and Acceptance

- (1) Geotextiles shall be subject to sampling and testing to verify conformance with this specification. Sampling for the testing shall be in accordance with ASTM D 4354. Acceptance shall be based on testing of either conformance samples obtained using Procedure A of ASTM D 4354, or based on manufacturer's certification of quality assurance samples obtained using procedure B of ASTM D 4354. A lot size for conformance of quality assurance sampling shall be considered to be the shipment quantity of the given product or a truckload of the given product, whichever is smaller.
- (2) Testing shall be performed in accordance with the methods referenced in AASHTO M 288 for the indicated application. The number of specimens to test per sample is specified by each test method. Geotextile product acceptance shall be based on ASTM D 4759. Product acceptance is determined by comparing the average test results of all specimens within a given sample to the specification MARV.

SS.3.5.2.7 Geotextile Property Requirements

Geotextile property requirements will be as stipulated in AASHTO M288 - 97 under the various strength and application classes or as shown on the drawings.

Geotextile property requirements shall generally be as stipulated in the following table with Class 1 strength properties and separation and stabilization properties as shown in the table below although occasionally other properties may be specified on the Drawings.

Test	Test Method ASTM	Units	Elongation <50%	Elongation ≥50%
Grab Strength	D 4632	N	1400	900
Sewn Seam Strength	D 4632	N	1200	810
Tear Strength	D 4533	N	500	350
Puncture Strength	D 4833	N	500	350
Burst Strength	D 3786	kPa	3500	1700
Permittivity	D 4991	sec ⁻¹	.05 ²	
Apparent Opening Size (AOS)	D 4751	mm	0.43 max	
Ultraviolet Stability	D 4355	%	50% retained after 500 hours of exposure	

All acceptance testing will be done in accordance with the test procedures outlined in the tables in AASHTO M288 and actual acceptance governed by the requirements of ASTM D 4759.

SS.3.5.2.8 Shipment and Storage

- (1) Geotextile labeling, shipment, and storage shall follow ASTM D 4873. Product labels shall clearly show the manufacturer or supplier name, style number, and roll number. Each shipping document shall include annotation certifying that the material is in accordance with the manufacturer’s certificate.
- (2) Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due shipment, water, sunlight, and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.
- (3) During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from site construction damage, precipitation, extended ultra violet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 71⁰ C (160⁰ F), and any other environmental condition that may damage the physical property values of the geotextile.

SS.3.5.2.9 Construction

- (1) General.

Atmospheric exposure of geotextiles to the elements following lay down shall be a maximum of 14 days to minimize damage potential.

(2) Seaming.

- (a) If a seam is to be used for the seaming of the geotextile, the thread used shall consist of high strength polypropylene. Nylon thread shall not be used. For erosion control applications, the thread shall also be resistant to ultraviolet radiation. The thread shall be of contrasting colour to that of the geotextile it self.
- (b) For seams which are sewn in the field, the Contractor shall provide at least a 2 m length of sewn seam for sampling by the Engineer before the geotextile is installed. For seams which are sewn in the factory, the Engineer shall obtain samples of the factory seams at random from any roll of geotextile which is to be used on the project.
- (c) For seams that are field sewn, the seams sewn for sampling shall be sewn using the same equipment and procedures as will be used for the production of seams. If seams are to be sewn in both the machine and cross machine directions, samples of seams from both directions shall be provided.
- (d) The seam assembly description shall be submitted by the Contractor along with the sample of the seam. The description shall include the seam type, stitch type, sewing thread, and stitch density.

(3) Site Preparation.

The installation site shall be prepared by clearing, grubbing, and excavation or filling the area to the design grade. This includes removal of top soil and vegetation.

Soft spot and unsuitable areas will be identified during site preparation or subsequent proof rolling. These areas shall be excavated and backfilled with select material and compacted using normal procedures.

(4) Geotextile Placement.

- (a) The geotextile shall be laid smooth without wrinkles or folds on the prepared sub grade in the direction of construction traffic. Adjacent geotextile rolls shall be sewn or joined as required in the plans.
- (b) On curves the geotextile may be folded or cut to conform to the curves. The fold or overlap shall be in the direction of construction and held in place by pins, staples, or piles of fill or rock.
- (c) Prior to covering, the geotextile shall be inspected to ensure that the geotextile has not been damaged (i.e, holes, tears, rips)

during installation. Any damaged geotextile shall be repaired immediately by covering the damaged area with a geotextile patch which extends an amount equal to the required overlap beyond the damaged area.

- (d) Any material to be placed directly on the geotextile shall be end dumped and graded level onto the geotextile. Construction vehicles shall not be allowed directly on the geotextile. The graded material shall be placed such that at least the minimum specified lift thickness shall be between the geotextile and equipment tires or tracks at all times. Turning of vehicles shall not be permitted on the first lift above the geotextile.

SS.3.5.2.10 Measurement and Payment

(1) Measurement

- (a) The geotextile shall be measured by the number of square metres computed from the payment lines shown on the plans or from payment lines established in writing by the Engineer. This Excludes seam overlaps, but shall include geotextile used in crest and toe of slope treatments.
- (b) Slope preparation, excavation and backfill, bedding, and cover material are separate pay items.
- (c) The accepted quantities of geotextile shall be paid for per square metre in place.

(2) Basis of Payment

The quantities, determined as provided above, shall be paid for at the Bid Price per unit of measurement for the Pay Item listed below and shown in the Bid Schedule, which price and payment shall be deemed full compensation for furnishing and placing materials, and for labor, equipment and tools for the proper completion of the work prescribed in this section.

Pay Item No.	D e s c r i p t i o n	Unit of Measurement
SS.3.5.2a	Woven Geotextile	Square Metre
SS.3.5.2b	Non-Woven Geotextile	Square Metre

DIVISION 7 - STRUCTURES

SS 7.10 - PVC COATED MESH GABION, PVC COATED STONE MATTRESSES AND SOIL REINFORCEMENT MESH

SS 7.10.1 GENERAL

SS 7.10.1.1 Introduction

The specification below applies to PVC Coated Mesh Gabions, PVC Coated Stone Mattresses and/or Soil Reinforcement Mesh to be used for erosion protection and/or retaining walls at bridge approach embankments where specified on the Drawings.

PVC Coated Mesh Gabions and Stone mattresses shall be made using flexible woven wire heavily galvanized and PVC coated (8 x 10) type mesh boxes with integral panels for gabions and (6 x 8) type mesh boxes for soil mattresses with dimensions as specified in the Contract drawings or an approval equivalent. Soil Reinforcement Mesh shall be the same material as used for the Gabions.

The front face box and the Soil Reinforcement Mesh if required, as shown on the Drawings, shall be made from one continues mesh panel.

For Soil Reinforcement Mesh, the mesh twists shall be oriented vertically on the gabion face and perpendicular to the front face in the reinforcement panel. The soil reinforcement mesh shall be mesh which comprises a continuous sheet of mesh extending from the gabion base without any selvedge or join of any type. No jointing between the reinforcement mesh and frontal gabion shall be allowed.

SS 7.10.1.2 Reference Standards

Standar Nasional Indonesia (SNI) :

SNI 03-3046-1992 Kawat Bronjong Dan Bronjong Berlapis PVC (Polivinil Chlorida)

ASTM / BBA / BS :

BBA 93/075-1998 Standard/Certificate Agreement for Gabion in Roads and Bridges Construction.

BBA 00/R119-2000 Standard/Certificate Agreement for Soil Reinforcement Mesh in Roads and Bridges Construction.

BS 1052/1986 Mild Steel Wire for General Engineering Purposes.

BS 443/1990 Testing of Zinc Coating on Steel Wire and for Quality Requirements.

ASTM A975-1997 Standard Specification for Double-Twisted Hexagonal Mesh Gabions and Revet Mattresses (Metallic-Coated Steel Wire or Metallic-Coated Steel Wire with PVC Coating)

ASTM D792/08 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

ASTM D2240/05 Standard Test Method for Rubber Property—Durometer Hardness

ASTM / BBA / BS :

ASTM D412/06	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
ASTM D1499/05	Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Plastics
ASTM D746/07	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D2287/96	Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D2124/99	Standard Test Method for Analysis of Components in Poly(Vinyl Chloride) Compounds Using an Infrared Spectrophotometric Technique

SS 7.10.1.3 Submittals

Sample of Wire with Manufacturer’s certificate that satisfy Reference Standards in Section SS 7.10.1.3

SS 7.10.2 MATERIALS

SS 7.10.2.1 Steel Wire

All steel wire used in the fabrication of the PVC Coated Mesh Gabion, and Soil Reinforcement Mesh as well as that used in the wiring operations during construction shall comply with BS 1052/86, having a tensile strength of not less than 40 kg/mm²

Wire diameters and relevant tolerances shall be in accordance with the following table:

Wire Diameter Mm	Tolerance Mm
2.20	± 0.06
2.70	± 0.08
3.00	± 0.08
3.40	± 0.10

All wire used in the fabrication of the gabions, and in the wiring operations during construction shall be Heavily Galvanized and PVC Coated in accordance with BS 443/82. The minimum mass of the zinc coating shall be as shown in the table below:

Diameter of Wire Mm	Weight of Coating g/sq.m
2.20	240
2.70	260
3.00	275
3.40	275

The adhesion of the zinc coating to the wire shall be such that when the wire is wrapped six times around a four wire diameter size mandrel it shall not flake or crack to such an extent that any zinc can be removed by rubbing with bare fingers.

All wire used in the fabrication of Gabions, and Soil Reinforcement Mesh and also in the wiring operations during construction shall have extruded onto it, after coating it with zinc in accordance with the foregoing specification, a coating of Poly Vinyl Chloride, otherwise referred to as “PVC” or other plastic material having equal characteristics than PVC as otherwise approved.

The PVC coating shall be 0.50mm average thickness with a tolerance of \pm 0.05mm.

The PVC shall be capable of resisting deleterious effects of natural weather exposure, immersion in salt water and not show any material difference in its initial characteristics which are:

- a. Specific Gravity of PVC shall be 1.30 to 1.35 in accordance with ASTM D 792-08
- b. Durometer Hardness of PVC shall be 50 to 60 shore D, in accordance with ASTM D 2240-051 (ISO 868-1985)
- c. Volatile Loss of PVC at 105°C for 24 hours shall not be greater than 5% in accordance with ASTM D 2287-96.
Residual Ashes shall be less than 2% according to ASTM D2124-62T.
- d. Tensile Strength of PVC shall not be less than 210 kg/sq.cm in accordance with ASTM D 412-06.
- e. Elongation of PVC shall not be less than 200% and not greater than 280% in accordance with ASTM D 412-06
- f. Modulus of Elasticity at 100% of Elongation of PVC shall not be less than 190 kg/sq.cm in accordance with ASTM D 412-06
- g. Creeping Corrosion
Maximum penetration of corrosion of the wire core from a square cut end shall not be greater than 25mm when the specimen has been immersed for 2000 hours in a 50% solution of HCL (Hydrochloric Acid 12 BE).

All steel wire used in the fabrication of Stone Mattresses shall be zinc coated and have the following properties

- a. Tensile Strength: both the wire used for the cages and the lacing wire shall have a maximum tensile strength of 515 MPa in accordance with ASTM A641/A641M-03

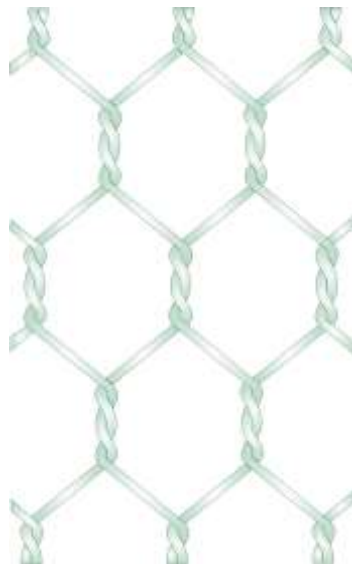
- b. Elongation: Elongation shall not be less than 12% in accordance with ASTM A370-97a
- c. Zinc Coating: minimum quantities of zinc shall be in accordance with ASTM A641/A641M-03.
- d. Adhesion of Zinc coating shall be the same requirement as zinc coating for PVC Coated Mesh Gabions.

SS 7.10.2.2 Wire Mesh

A. PVC Coated Mesh Gabions and Soil Reinforcement

The minimum mesh tensile strength shall be 40 kN/m width of mesh.

Wire mesh shall be mechanically pre-PVC Coated Mesh to become a uniform hexagonal woven mesh wherein the joints are formed by twisting each pair of wires through three half-turns (commonly known as double twist), in such a manner that unraveling is prevented. Double-twist mesh is demonstrated in the sketch below :



The standard core wire diameters shall be as follows:

Mesh Type	Zinc Body Wire diameters	PVC Wire Diameter	Remarks
8 x 10	2.7	3.7	PVC Coated Mesh Gabion and Soil Reinforcement Mesh
6 x 8	2.2	3.2	PVC Coated Mesh for Stone Mattresses

Certain other wire diameters may be utilized if the contract drawings and/or Engineer allow alternative sizes.

B. PVC Coated Stone Mattresses

The steel mesh shall have the following minimum properties

- a. The mesh shall have a minimum tensile strength of 33.6 kN/m in accordance with ASTM A975 section 13.1.1
- b. The mesh shall have a minimum punch test resistance of 17.8 kN when tested in accordance with ASTM A975 section 13.1.4
- c. Connections to selvages shall have a minimum resistance of 10.2 kN/m when tested in accordance with ASTM A975.

SS 7.10.2.3 Selvages

The cut edges of all mesh used in the construction of PVC Coated Mesh Gabion, also the bottom edges of diaphragms and the end of the soil reinforcing tail in Soil Reinforcement Mesh shall have a tight selvedge with a wire having a diameter of at least 3.4mm.

The selvedge wire for Stone Mattress cages shall be 2.2 mm dia galvanized and PVC coated wire with a minimum tensile strength of 40 gr/mm²

SS 7.10.2.4 Diaphragms and End Panels

The rear/side panels shall have a selvedge on the top, bottom and vertical sides as described in section SS 7.10.2.3 The diaphragms shall be selvedge and on the top and vertical sides.

The rear and side panels of the box gabion shall be formed by a continuous panel connected to the main panel, along the bottom of the rear panel, either by a spiral wire through the mesh openings or mechanically placed by four connecting rings.

SS 7.10.2.5 Lacing and Bracing Wire

Sufficient lacing and bracing wire must be supplied with the gabion cages to perform all the wiring operations to be carried out in the construction of the PVC Coated Mesh Gabion, PVC Coated Stone Mattresses and Soil Reinforcement Mesh work.

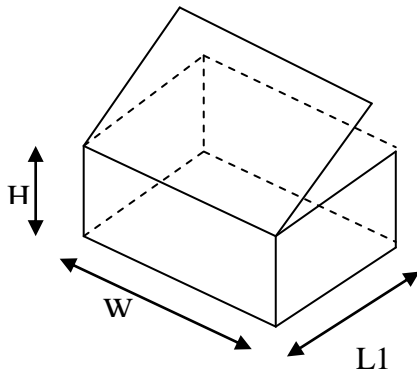
The lacing and bracing wire shall be made from Heavily Galvanized Wire with PVC Coating and have a core diameter of 2.20 mm.

SS 7.10.2.6 Box Sizes

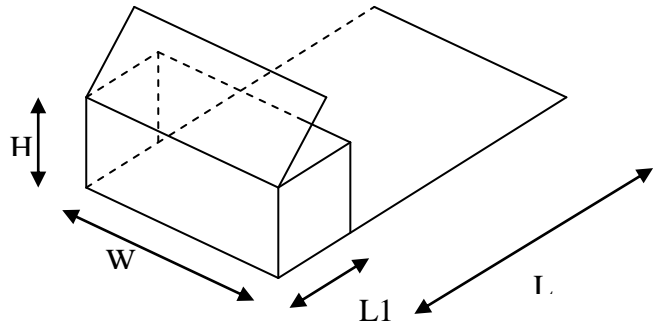
PVC Coated Mesh Gabion and Soil Reinforcement Mesh shall be mechanically pre-PVC Coated Mesh in such a manner that the sides, ends and diaphragms can be assembled at the construction site into rectangular baskets of the standard sizes indicated below or as specified and shown in the Drawings.

Mesh type	80 x 100 mm
Width (W)	1m or 2m
Length (L1)	1m
Length (LS)	3m, 4m, 5m and 6m, or as shown on the Drawings
Depth (H)	0.5m or 1m
Diaphragm	every 1m

Picture of the PVC Coated Mesh Gabion and Soil Reinforcement Mesh below:



PVC Coated Mesh Gabion



Soil Reinforcement Mesh

All PVC Coated Mesh Gabion and Soil Reinforcement Mesh dimensions shall be within a tolerance limit of 5% of the required size.

PVC Stone Mattresses shall have panels with dimensions of 4 m x 2 m x 230 mm complete with diaphragms in accordance with the manufacturer's recommended spacing.

SS 7.10.2.7 Stone Fill

The stone fill material used for PVC Coated Mesh Gabion, PVC Coated Stone Mattresses and Soil Reinforcement Mesh facing box fill shall be clean, dense hard and durable stone, rounded and angular shape.

The size of the rock fill for PVC Coated Mesh Gabions and Soil Reinforcement Mesh shall be between 150 mm – 250 mm with a 5% tolerance. No rock shall pass through the mesh.

The size of the rock fill for PVC Coated Stone Mattresses shall be between 80 mm – 130 mm with a 5% tolerance of oversize and a 5% tolerance of undersize provided it is not placed on the mattress exposed surface. The rock size shall be such that a minimum of two layers of rock are placed in the mattress.

SS 7.10.3 ASSEMBLY AND ERECTION FOR PVC COATED MESH GABION AND SOIL REINFORCEMENT MESH UNITS

SS 7.10.3.1 Scope

This specification details the requirements from the assembly stage through to the final wiring of the completed PVC Coated Mesh Gabion, PVC Coated Stone Mattresses and Soil Reinforcement Mesh units.

The contractor shall provide to the Engineer, for his approval, full details and specifications of the PVC Coated Mesh Gabion, PVC Coated Stone Mattresses and Soil Reinforcement Mesh he proposes to use in this contract. Only those products so approved by the Engineer shall be allowed to be incorporated in the works.

SS 7.10.3.2 Preparation

The site shall be surveyed, cleared, trimmed level and the ground compacted accordingly.

Prior to assembly, the PVC Coated Mesh Gabion, PVC Coated Stone Mattresses and Soil Reinforcement Mesh units shall be opened out flat on the ground and stretched to remove all kinks and bends.

The PVC Coated Mesh Gabion and Soil Reinforcement Mesh unit shall be assembled individually by raising the front panel (with lid), the hinged rear panel, and the two ends vertical ensuring that all creases are in the correct position and that tops of all four sides are even. The diaphragm panel should be located in a vertical plane centrally within the facing box.

The four corner edges of the facing box shall be laced first followed by the edges of the internal diaphragm to the sides.

In all cases, lacing shall commence by twisting the end of the lacing wire tightly around the selvages. It shall then pass round the two edges being joined using alternate single and double loops at 100mm intervals and be securely tied off at the bottom. The ends of all lacing wires shall be turned to the inside of the box on completion of each lacing operation. Each loop shall be pulled tight to prevent the joint opening during filling.

SS 7.10.3.3 Erection

Only assembled boxes, or groups of boxes, shall be positioned in the structure. The side, or end, from which work is to proceed, shall be secured either to the completed work, or by rods or stakes driven into the ground at the corner. These stakes must be secure and reach at least to the top of the gabion box.

Further gabion boxes shall be positioned in the structure as required, each being securely laced to the preceding one along all common corners and diaphragms. Using the lacing technique described above.

Adjacent panels in Soil Reinforcement Mesh shall be laced longitudinally to provide a homogeneous reinforcement layer.

All lacing wire in Soil Reinforcement Mesh shall be PVC coated.

SS 7.10.3.4 Geotextile

Non-woven geotextile as specified in S.S. 3.5.2 shall be placed at the back of each gabion layer in PVC Coated Mesh Gabion, not in Soil Reinforcement Mesh work. The non-woven geotextile shall be placed at the back of each gabion layer and extend 0.5m above the lower panel and 0.5m below the higher panel to prevent migration of fines.

Non –woven geotextile as specified in SS 3.5.2 shall be placed under each PVC Coated Stone Mattress

SS 7.10.3.5 Stretching

Final stretching of the gabion boxes shall be carried out using a pull-lift of at least one tonne capacity, firmly secured to the free end of the assembled gabion boxes.

Whilst under tension, the gabion boxes shall be securely laced along all edges (top, bottom and sides) and at diaphragm points, to all adjacent boxes.

SS 7.10.3.6 Filling

Filling shall be carried out whilst gabion and stone mattress boxes are under tension.

The front face and all other faces which will be exposed in the completed structure shall be “hand packed” with the stones placed so as to produce a neat face free from excessive bulges, depressions and voids.

Internal bracing wires shall be provided on the exposed faces at the rate of 4/cu.m at 330mm centres to prevent distortion of the gabion units during filling and in the completed structure. These bracing wires shall be wrapped around two of the mesh wires and extend from front to back. Additional bracing wires shall be provided on exposed ends at a rate of 4/sq.m of face.

Mechanical filling equipment may be used with the approval of the Engineer and providing adequate precautions are taken to protect the PVC coating from abrasion during filling operations.

Tension on the gabion boxes shall be released only when fully laced and sufficiently full to prevent the mesh from slackening.

All gabions and stone mattresses shall be overfilled by 25mm using flat stone to allow for minor settlement and to provide a level surface for subsequent layers.

SS 7.10.3.7 Structural Embankment Material

Backfill as specified elsewhere shall be placed between each subsequent mesh panel layer to the full extent of the mesh reinforcement at each level.

SS 7.10.3.8 Compaction

The backfill shall be compacted as specified elsewhere in these specifications for embankment construction unless otherwise specified on the drawings.

Care shall be taken to ensure heavy compaction equipment does not come into contact with the mesh panels or within 1.0m of the gabions.

Compaction adjacent to the gabions should be done using hand operated rollers or plate compactors.

SS 7.10.4 **MEASUREMENT AND PAYMENT**

SS 7.10.4.1 Method of Measurement

The quantity to be measured for payment for PVC coated mesh gabion and PVC coated stone mattresses shall be the number of cubic metres of the PVC Coated Mesh Gabions or PVC Coated Stone Mattresses complete in place and accepted. The dimensions to be used in calculating this quantity shall be the nominal dimensions of each basket as prescribed in the Drawing or as directed by the Engineer.

The quantity to be measured for payment of Soil Reinforcement Mesh shall be the number of square metres of the Soil Reinforcement Mesh measured outside the perimeter of the attached PVC coated mesh gabion complete in place and accepted. The dimensions to be used in calculating this quantity shall be the nominal dimensions as prescribed on the Drawings or as directed by the Engineer.

Geotextile shall be measured and paid separately in accordance with Section SS 3.5.2 of these Specifications.

SS 7.10.4.2 Basis of Payment

The quantity, determined as provided above, shall be paid for at the contract price per unit of measurement, for the Pay Items listed below and shown in the Bill of Quantities, which price and payment shall be full compensation for all necessary excavation and backfill, for supplying, fabricating and placing all materials, wire baskets and rock fill including all labor, equipment, tools, testing and other work necessary for the satisfactory completion of the work as prescribed in the Drawing and this Specification.

Pay Item	Description	Unit of Measurement
SS 7.10.3a	PVC Coated Mesh Gabions	Cubic Metres
SS 7.10.4	Additional Price for Soil Reinforcement Mesh to PVC Coated Mesh Gabions	Square Metres
SS 7.10.5	PVC Coated Stone Mattresses	Cubic Metres

SS 7.18 - PATCHING, GROUTING, PAINTING AND ANTI-CORROSION RIMING OF CONCRETE

SS.7.18.1. DESCRIPTION

This patching and grouting works shall consist of repair to concrete suffering from spalling, scaling, honeycombing, drumminess and lack of thickness of concrete cover, and painting is designed to provide protection to concrete structure in aggressive conditions. Anti-corrosion priming is designed to actively resist corrosion for exposed and rusted steel reinforcement and existing steel structure.

SS.7.18.2. MATERIALS

(a) Material

Material to be used for patching concrete shall be a special material which has a non shrink property and is capable of adhering to the old concrete.

For repair of spalling, scaling and land thickness of concrete cover, cement which has a non-shrink property and has polymer content shall be used. The material shall be a mixture which consists of liquid material (polymer) and modified cement.

The patching materials property shall meet the following requirements:

- Specific Gravity of Polymer Liquid	1.015 ± 0.005 kg/cm ³
- Specific Gravity of Cement	1.8 kg/cm ³
- Specific Gravity of Mixtures	2.15 - 2.25 kg/cm ³
- 28-day Compressive Strength, at 25 °C	450 kg/cm ²
- 28-day Adhesive Strength	25 kg/cm ²
-	

The grout material property shall meet the following requirement:

- Initial Setting Time	6 - 9 hours
- Expansion	0.30 - 1.40%
- Bleeding	Nil
- 28-day Compressive Strength ¹⁾	750 kg/cm ²
- 28-day Adhesive Strength	35 kg/cm ²
- 28-day Flexural Strength	90 kg/cm ²

¹⁾ at condition flow able and water demand at this consistency is around 16%

The painting, a high performance epoxy concrete coating, material property shall meet the following requirement:

- Pot life, at 35o C	1.5 hours
- Time between coats, at 35o C	4 - 16 hours
- Initial hardness	18 hours
- Full cure	5 hours

For repair honeycombing or drumminess, special cement which has a non-shrink or expansion property shall be used and the painting is formulated to be applied to achieve a minimum total-dry-film coating thickness of 100 microns (2 coats).

The anti-corrosion primer for exposed and rust steel reinforcement is active epoxy zinc-rich system to prevent corrosion by electro-chemical means. This material property shall meet the following requirement:

-	Specific gravity	2.0
-	Drying times, touch dry at 35oC	15 minutes
-	Drying times, fully dry, at 35o C	45 minutes
-	Thickness per coat dry	40 microns
-	Thickness per coat wet	135 microns

(b) Selection of Material

For patching work, locations of areas to be repaired shall be considered in selecting of material. Patching work on the underside and patching work on the top surface, for example, will use different material from each other, whichever is suitable.

Patching, grouting, painting and priming works shall be carried out in accordance with the requirements of the manufacturer.

Material to be used shall be in accordance with the requirement of the manufacturer shall conform with the requirements of these Specifications and shall be approved by the Engineer.

(c) Equipment

Equipment to be used in patching work may be equipment which is usually used for mixing mortar. Mixing of material shall be carefully carried out and in accordance with the requirements of the manufacturer to ensure that the property requirements can be attained.

SS.7.18.3. CONSTRUCTION

(a) Cleaning

Concrete shall be cleaned prior to repair work. Concrete repair will be as follows:

- (i) Concrete parts which are spalled, honeycombed, or have lack of thickness of concrete cover shall be cleaned to get concrete, with sufficient adhesive strength and quality, to approximately 2 cm inside the reinforcing steel.
- (ii) Concrete surface shall be cleaned using high pressure water jet to get the concrete surface free of oil, lubricant, etc.

- (iii) Any corrosion will be removed from the reinforcing steel then it shall be coated with anti-corrosion paint (epoxy zinc prime ± 3.5 m²/kg or 50 microns).

(b) Patching Work

- (i) The concrete surface shall be made water-saturated prior to patching work using modified cement polymer as mentioned above.
- (ii) Mixing shall be evenly distributed to ensure that there are no cement lumps.
- (iii) Materials for patching work shall be ready to use using specified equipment.

(c) Final Result

The final result shall match the color and texture of surrounding concrete as closely as possible, and shall be in accordance with the Drawings or as directed by the Engineer. If the final result is not to the satisfaction of the Engineer, he may instruct the Contractor to repair at his own expense.

SS.7.18.4. METHOD OF MEASUREMENT

The quantity to be measured for payment is the volume of material in cubic metres used for patching, grouting and epoxy zinc primer in kilogram but not including wastage.

SS.7.18.5. BASIS OF PAYMENT

Quantities to be paid for concrete repair using polymer modified cement or special cement will be based in material on site of a type and quality as approved by the Engineer. The Contractor may request a payment based on the material on site in the amount 60% material on site times the unit price. These cumulative payments shall not exceed 60% of the estimated price for the Pay Item given in the Bill of Quantities. The Contractor shall store materials in a site warehouse with the materials identified and the date of acceptance recorded, in the presence of the Engineer, to ensure that this material is kept separate from the materials which will come later.

The accepted quantities specified above will be paid for at the Contract unit price for the Pay Item listed below and shown in the Bill of Quantities. Such payment will be deemed full compensation for supplying and furnishing including labor, equipment and other incidentals necessary to complete the work.

Pay Item No.	Description	Unit of Measurement
SS 7.18.1	Patching Concrete with Polymer Modified Cement Material	Cubic Metre
SS 7.18.2	Grouting with Special Cement Material	Cubic Metre
SS.7.18.3	Grouting with Polymer Modified Cement Material	Cubic Metre
SS.7.18.4	Concrete Surface Treatment	Square Metre
SS.7.18.5	Concrete Coating Painting	Square Metre
SS.7.18.6	Epoxy Zinc-rich Priming	Square Metre

SS. 7.19 - INJECTION GROUTING

SS.7.19.1 GENERAL

SS 7.19.1.1 Description

This work shall consist of injecting an epoxy resin by injection into cracks in concrete structures with widths of cracks ranging from 0.04 to 2.00 mm
The main objective of this method is to integrate the floor slabs or beams to form a homogenous structure capable of transferring the forces necessary to carry the applied loads, and to prevent water getting into cracks and causing deterioration of the reinforcing steel

SS 7.19.1.2 Reference Standards

	<u>Standard</u>	<u>JIS</u> <u>Equivalent</u>	<u>Specification</u>
Specific Gravity	ASTM D 79M	JIS K 7112	1.10 – 1.20
Viscosity (Mixture)	ASTM D 968	JIS K 6838	370 – 480 cps
Compressive strength	ASTM D 695	JIS K 7208	> 800 kg/cm ²
Tensile strength	ASTM D 638 M	JIS K 7113	> 150 kg/cm ²
Flexural strength	ASTM D 638 M	JIS K 7113	> 280 kg/cm ²
Length Change	ASTM C 883	-	Non-shrink after curing
Characteristics	Solvent free, two component system		
Chemical resistant	Resistant to oil, Grease, mils acids & Alkalis, rain water, sea water		

SS 7.19.1.3 Limitations

- (a) Grouting materials shall be applied into cracks in slabs or beams with widths not more than 2.0 mm wide or as directed by the Engineer.
- (b) If damage is affecting structural capacity, the concrete slabs or beams may be subject to demolishing and reconstruction.
- (c) Structures with concrete grades under K-225 may be subject to demolishing and reconstruction as directed by the Engineer.

SS 7.19.1.4 Quality of Work and Rectification of Unsatisfactory Work

The finished work shall completely cover the area treated and be uniform. The Engineer may ask the Contractor to prove that the grouting material has injected fully into the cracks by using core drilling. Rectification of unsatisfactory work shall be as directed by the Engineer and may include removal or the application of additional grouting materials as required.

(1) Submittals

- (a) A sample of any grout material that the Contractor proposes to use in the work, together with a statement as to its source and test data giving its properties, must be submitted to the Engineer and approved by him before construction begins. The Contractor shall perform a sample grouting on existing structure and core sample will be taken to check the effectiveness of the method before proceeding with the work.
- (b) The test data supplied shall include the requirement of tests specified in SS.7.19.1. (2).

(2) Work Conditions

- The work shall be carried in such a manner as to offer the least inconvenience to traffic flow.
- No grouting material shall be discharged into any side ditch, drain or river.
- The Contractor shall provide first aid supplies, and facilities.

SS.7.19.2 MATERIALS

SS 7.19.2.1 Grouting Materials

The quality of epoxy grout used shall be of the following standard or equivalent as directed by the Engineer:

	<u>Standard</u>	<u>JIS Equivalent</u>	<u>Specification</u>
Specific Gravity	ASTM D 79M	JIS K 7112	1.10 – 1.20
Viscosity (Mixture)	ASTM D 968	JIS K 6838	370 – 480 cps
Compressive strength	ASTM D 695	JIS K 7208	> 800 kg/cm ²
Tensile strength	ASTM D 638 M	JIS K 7113	> 150 kg/cm ²
Flexural strength	ASTM D 638 M	JIS K 7113	> 280 kg/cm ²
Length Change	ASTM C 883		Non-shrink after curing
Characteristics	Solvent free, two component system		
Chemical resistant	Resistant to oil, Grease, mils acids & Alkalis, rain water, sea water		

- Must be able to penetrate evenly into the innermost parts of cracks even when injected from below.

- Must not contain solvent to prevent shrinkage after curing
- Must be resistant to rain water, sea water, carbon monoxide or sulphurous acid, and other commonly occurring chemical compounds.

SS 7.19.2.2 Sealing Agent

The quality of the material used shall be as directed by the Engineer or as follows:

- Specific Gravity	(JIS K 7112)	1.70 ± 0.10
- Bending strength	(JIS K 7203)	≥ 400 kg/cm ²
- Compressive yield strength	(JIS K 7208)	≥ 600 kg/cm ²
- Compressive young's strength	(JIS K 7208)	(4.0 – 8.0) x 10000 kg/cm ²
- Tensile strength	(JIS K 7113)	≥ 200 kg/cm ²
- Impact strength	(JIS K 7111)	≥ 1.5 kg.cm/cm ²
- Hardness	(JIS K 7215)	≥ 85 Hd D
- Tensile shear strength	(JIS K 6850)	≥ 110 kg/cm ²

(1) Balloon or Nipple Injectors

The balloon or nipple injection is a tool formed by a rubber or plastic tube and ABS resin, composed of a fitting pipe section and the balloon or nipple injector section that comprises an injection pipe joined to be a rubber tube.

The standard quality of the balloon or nipple injector shall meet the following the requirements:

- The outside diameter the rubber tube must be able to expand to approx 25 mm, roughly twice its original diameter.
- The rubber or plastic tube must be able to exert or pass by with approx. 1.5 – 3.0 kg/cm² pressure continuously and constantly during the grouting process.

SS.7.19.3 **EQUIPMENT**

SS 7.19.3.1 General Requirements

The items of equipment used are: pump, electric disc sander and wire brush.

SS 7.19.3.2 Pump

A manual pump is used for pumping or injecting the grouting material into the balloon or nipple injector.

SS 7.19.3.3 Electric Disc Sander and Wire Brush

These are used for removal of all laitance, dust, etc. from the area along the crack.

SS 7.19.4 SCOPE OF WORK

SS 7.19.4.1 Surface Treatment

Using the disc sander and wire brush, remove all laitance, dust, etc. from the area along the crack for a width of about 5 cm. Oil and grease should be wiped off with a piece of waste cloth dipped into thinner.

SS 7.19.4.2 Adhesion of Fitting Pipe

Attach the fitting pipe to the crack by using the sealing agent. It is necessary to investigate the crack in advance to determine the fitting pipe spacing around 20cm or as directed and agreed by the Engineer.

SS 7.19.4.3 Sealing

By using the sealing agent, seal the area around the fitting pipe and along the crack and let the sealant cure. After curing, screw the connector terminal of the balloon or nipple injector into the fitting pipe.

SS 7.19.4.4 Injection

After mixing the grout's base agent with the hardener at the specified mix proportion or as directed by the Engineer, pour the mixture into the pump. Injection work is performed by fitting the hose of the injection pipe to the balloon injector or nipple.

Stop injection when the outside diameter of the balloon injector has increased to about 25 mm or grout materials spilled. Repeat the produce for all injectors.

SS 7.19.4.5 Finishing

Remove the fitting pipe and make good the repaired area.

SS 7.19.5 METHOD OF MEASUREMENT

SS 7.19.5.1 Measurement of the work

- (a) The quantity of grouting material to be measured for payment shall be the number of kilograms of the material injected and accepted by the Engineer.
- (b) The quantity of sealing agent to be measured for payment shall be the number of kilograms of the material used and accepted by the Engineer.
- (c) The quantity of injectors to be measured for payment shall be the number of injectors used for injecting the grouting material and accepted by the Engineer.

SS 7.19.5.2 Measurement of Rectified Works

Where rectification of unsatisfactory injection work has been directed by the Engineer in accordance with Article SS.7.19.1.(4), no additional payment will be made for additional work.

SS 7.19.6 BASIS OF PAYMENT

The quantities, determined as provided above, shall be paid for at the Contract price for the pay item listed below and included in the Bill of Quantities, which prices and payment shall be considered full compensation for finishing and placing all material and for all labour, equipment, tools and incidentals necessary to complete the work prescribe in this Section.

Pay Item No.	Name	Unit of Measurement
SS.7.19.1	Liquid Grouting Material	Kilogram
SS.7.19.2	Sealing Agent	Kilogram
SS.7.19.3	Injector	Each

DIVISION 8 – REINSTATEMENT AND MINOR WORKS

SECTION 8.4 - ROAD FURNITURE AND TRAFFIC CONTROL DEVICES

SS 8.4.1 GENERAL

This article shall be read in conjunction with Section 8.4 of the General Specifications which is modified as follows:

SS 8.4.1.1 Description

The work shall consist of the supply, assembly and installation of replacement or additional road furniture such as road signs, guide posts, kilometer posts, guard rails, road studs, cat eyes, curbs, sidewalk, traffic light and road illumination, including erection of posts and other fitting in accordance with these Specifications, relevant Local Authority regulations, coloured surfacing for road on the school safety zone (ZoSS, Zona Selamat Sekolah) and the application of pavement markings to either new or newly overlaid pavement surfaces, at locations shown on the Drawings or as directed by the Engineer.

The installation work for road furniture shall include all necessary excavation, foundation, backfill, anchorages, fixtures, fastenings and brackets.

SS 8.4.1.2 Work Scheduling

Before commencements of installation work on any new road lighting systems, the Contractor shall liaise with, and make all necessary arrangements with, the relevant Local Authorities, including the obtaining of any permits and approvals required, in accordance with the provisions of these Specifications.

After completion of the installation of the lighting they shall be proof tested for a continuous commissioning period of 30 days to check that all components are operating and functioning correctly. The testing shall be carried out by the Contractor under the supervision of PLN (Perusahaan Listrik Negara or State-owned Electricity Company) and DLLAJR (Dinas Lalu Lintas Angkutan Jalan Raya), as well as the Engineer and shall conform with PLN and DLLAJR requirements. Any defects occurring during this period shall be corrected by the contractor regardless of cause and at his own expense. After correction a subsequent 30 days commissioning period shall begin. When each system is fully operational and has been commissioned to the satisfaction of the Local Authorities and the Engineer, the Contractor may apply for Taking Over of the system, as provided of the general Conditions of Contract. Following acceptance by the Employer of Taking Over of the system, a twelve month Defect Notification Period shall commence during which time the Contractor shall be responsible for repairing at his own cost any defects that occur in the system

SS 8.4.2 MATERIAL

SS 8.4.2.1 Road Paint

Material for color surfacing marking on the safety school zone (ZoSS, Zona Selamat Sekolah) shall consists of :

- white Portland cement,
- methyl methacrylate resin or acrylic base material or anionic elastomeric polymer.
- pigment material
- water

The cement used shall be Portland cement conforming to SII-13-1977 (AASHTO M85).

Water used in mixing, curing, or other designated applications shall be clean and free from harmful matter such as oil, salt, acid, alkali, sugar, or organic materials. Water shall be tested in accordance with, and shall meet the requirements of SNI 03-6817-2002 (AASHTO T26). Water known to be of potable quality may be used without being tested.

Proportion and mixing instruction shall be as the manufacturer's guideline. The mixture shall provide a medium texture, non-skid surface that is well suited for medium to high traffic areas. The diluted material shall be homogeneous. Segregation before or during application will not be permitted. A mechanical drill mixer is recommended and mixture should be stirred until homogeneous. Periodic mixing should take place as job progresses to ensure consistent application. Over dilution will cause streaking, foaming, adhesion failure, sand fall-out and poor overall durability of the coating.

SS 8.4.2.6 Concrete and Cement Mortar

- (a) Concrete to be used for the foundation of road sign, road illumination pole and traffic sign shall be Class K250 as specified in Section 7.1.

SS 8.4.2.15 Reinforcing Steel

Reinforcing steel for foundation shall comply with the provisions of Section 7.3 of these Specifications.

SS 8.4.2.16 Road Illumination Lights

Lights for road lighting shall be of a type approved by the city authority and shall be so mounted and of sufficient power to ensure an illumination of no less than 1.0 candela/m² (or as otherwise specified by the city authority) on the payment surface in all areas required to be lighted, as established by the Engineer.

SS 8.4.3 EXECUTION

SS 8.4.3.1 Painting of Pavement Markings

(a) Preparation of Road Surface

New hot-mix asphalt surfaces must be allowed 14 days minimum cure time prior to application. For new Portland cement concrete surfaces, a minimum of 28 days cure time is required

No part of the application of colour surfacing marking on the safety school zone should be conducted during rainfall, or when rain is imminent.

(b) Application of Pavement Marking Paint

(xi) Mixture for colour surfacing marking on the safety school zone shall be applied by rubber bladed squeegee on the clean, dry surface. The finish surface shall have a uniform appearance and be free from ridges and tool marks

SS 8.4.3.2 Placing Poles, Posts, Signs and Guard Rail

The number, type and location of each road sign, Bollard posts, guide post and kilometre post and traffic posts and section of guard rail and road illumination poles shall be as shown on the drawings or as instructed by the Engineer.

Removal, relocations, or temporary disruption of existing lighting systems and the removal of traffic signal systems shall be carried out as directed by the Engineer.

For either new or relocated items, the Contractor shall carry out the work in accordance with the Contract Documents and in full compliance with the relevant regulations, codes, specifications and other requirements or directions from the Local Authorities Concerned.

SS 8.4.4. MEASUREMENT AND PAYMENT

SS 8.4.4.1. Method of Measurement

- (d) The quantity of paint pavement marking or thermoplastic pavement marking or colour surfacing marking on the safety school zone to be paid for shall be the number of square metres of road or thermoplastic or colour surfacing marking applied to the surface in accordance with the Drawings and accepted by the Engineer.
- (h) Road Illumination will be measured on the basis of the number of new road lighting units installed and commissioned by the Contractor and accepted by the Engineer. A road lighting unit shall be considered to comprise of lamps of the type and power rating required to meet City standards together with a pole, single or double mounting brackets or other approved mounting system

and all associated fittings, cables and electrical or other accessories required to install the lamp and make it operational.

- (n) No separate measurement will be made under this article for any relocation of existing road lights or traffic signal systems, such work being measured and paid for as described under these specifications.

SS 8.4.4.2. Basis of Payment

The quantities measured as provided above shall be paid at the Contract unit price per unit measurement for the Pay Items listed below and given in the Bill of Quantities, which price and payment shall constitute full compensation for obtaining authority approval, supplying installing, writing, surface treating and commissioning each new road lighting unit, including the supply of all materials, labor, equipment, tools and incidentals necessary for the satisfactory completion of the work in accordance with this Section of the Specifications.

Pay Item No.	Description	Unit of Measurement
SS 8.4.3h	Additional sign with reflector of engineering grade, without post	Each
SS 8.4.13	Coloured surfacing for road	Square Metre
SS 8.4.13a	Road Lighting Single Arms	Each