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**DIVISION 8  
MISCELLANEOUS**

**SECTION 8.1  
REINSTATEMENT OF EXISTING PAVEMENT**

**8.1.1 GENERAL**

8.1.1.1 Description

The work covered by this Section shall comprise the reinstatement of pavement that has deteriorated to the point of containing large potholes, having extensive failed edges or corrugations greater than 3 cm deep, having wide cracks, Structural cracking or extensive fine cracking, or showing evidence of subgrade failure such as heaving, or severe deformation. The objective shall be to ensure that:

- (a) Areas of pavement not designed for resurfacing can be easily and routinely maintained under Division 10 of these Specifications.
- (b) For areas where resurfacing is envisaged, user benefits can be maintained until the resurfacing is undertaken.
- (c) All areas to be resurfaced are structurally sound.

8.1.1.2 Scheduling of Reinstatement Work

Reinstatement work shall be scheduled early in the construction program to maximize user benefits. Areas which are to be overlaid shall be fully reinstated as required by this Section of the Specification before the overlay is placed.

8.1.1.3 Payment and Pricing Philosophy

Works designated by the Engineer as reinstatement works under this Section of the Specifications, shall be paid for from the Contract Unit Prices bid for the various Pay Items listed in Section 8.1 or under Divisions 2 or 3 of these Specifications as appropriate. Works designated as part of the major periodic maintenance scope of the Contract, aimed at improving the surface cross fall, shape or structural strength of large areas of the pavement shall not be considered as part of reinstatement works and shall be measured and paid for under the relevant major works sections of these Specifications for the materials used, such as Aggregate Base Class A, Hot Rolled Sheet – Base, Hot Rolled Sheet – Wearing Course and so on. Particular care shall be taken to differentiate between Reinstatement and Minor Works paid under this Section and Routine Maintenance Works paid under Division 10 of these Specifications.

8.1.1.4 Location of Areas Requiring Reinstatement

Areas of pavement requiring reinstatement will be designated by the Engineer based on data provided in the drawings, on the Engineers joint inspection with the Contractor and on any tests required by the Engineer. The initial joint inspection shall be carried out at the beginning of the Mobilization Period. All areas showing evidence of deep seated failure shall be identified for excavation and reconstruction. Actual details of the method and extent of the reinstatement work for each designated area will be furnished by the Engineer in writing after the field survey has produced sufficient detail of the existing pavement

condition. The Engineer's written instructions shall also specify a reasonable time for completion.

#### 8.1.1.5 Classification of Existing Pavement Reinstatement Work

Pavement repair and improvement work covered by this Section of the Specification shall include:

- (a) Pothole repairs and patching (failed areas requiring excavation and reconstruction of pavement or subgrade layers) with a total volume after excavation of less than 10 cubic metres per kilometre.
- (b) Seal coating of permeable or cracked pavement when the required seal area affects between 10% and 30% of any 100 m length of the total sealed pavement length of the project and individual seal coating areas do not exceed 40 square metres.
- (c) Sealing of wide cracks requiring individual treatment.
- (d) Spot leveling of depressions in sealed pavements, where the quantity of materials required does not exceed 10 cubic metres in any one kilometre length.
- (e) Pavement edge correction involving restoration of the sealed pavement width.
- (f) Heavy grading of unsealed road pavements to level deep ruts or to maintain the correct cross-fall;
- (g) Addition of aggregate materials to unsealed road pavements not requiring more than 50 cubic metres (truck measure, loose) in any one kilometre length.

These works may include filling potholes, digging out and patching soft areas or areas containing structural cracking, minor spot leveling and camber connection with base material, correction of base grading by blending with coarse or fine aggregate and the replenishment of running course.

Larger scale work than that classified as Reinstatement Work shall be compensated under the relevant Divisions 2, 3, 5 or 6 pay items. Minor works including repair of potholes smaller than 40 cm x 40 cm and spot sealing involving less than 10 % of any 100 m length shall be deemed to be fully compensated under Division 10 of these Specifications.

#### 8.1.1.6 Related Work Specified Elsewhere

- (a) Mobilization and Demobilization : Section 1.2
- (b) Traffic Management and Safety : Section 1.8
- (c) Field Engineering : Section 1.9
- (d) Construction Schedules : Section 1.12
- (e) Environmental Safeguards : Section 1.17
- (f) Fill : Section 3.2
- (g) Aggregate Base : Section 5.1
- (h) Unsealed Road Base : Section 5.2
- (i) Prime Coat and Tack Coat : Section 6.1
- (j) Hot Asphaltic Mixtures : Section 6.3
- (k) Lasbutag and Latasbusir : Section 6.4
- (l) Cold Asphaltic Mixtures : Section 6.5
- (m) Daywork : Section 9.1
- (n) Routine Maintenance of Pavement, Shoulder,

Drainage, Road Furniture and Bridges : Section 10.1

8.1.1.7 Submittals

The Contractor shall prepare a progress statement of Reinstatement and Minor Works which shall be submitted to the Engineer weekly for certification. The statement shall show, for each kilometre of the project, the quantity of material used in each class of work during the preceding week, the previously completed quantity and the total quantity to date.

Any delay by the Contractor in carrying out the reinstatement works which causes the development of further pavement deterioration shall become the Contractor's responsibility to repair at his own expense. If the reinstatement works are not carried out by the Contractor after receiving written notice from the Engineer, the Engineer may order other parties to carry out the reinstatement works. In such circumstances the Contractor shall be charged with the full actual cost for the reinstatement works which have been carried out as directed by the Engineer.

8.1.1.8 Rectification of Unsatisfactory Reinstatement

Areas of pavement that, in the opinion of the Engineer, have been unsatisfactorily reinstated or are considered unsatisfactory in any other respect shall be rectified as directed by the Engineer. Rectification may include removal and replacement of the total area of reinstatement or any other measure which the Engineer deems necessary.

8.1.1.9 Maintenance of satisfactorily Reinstated Areas

Notwithstanding the Contractor's obligation to carry out rectification of unsatisfactory reinstatement as specified in Article 8.1.3.8 above, the Contractor shall also be responsible for routine maintenance of all completed and accepted reinstated areas throughout the Time for Completion, or until the area is overlaid with an appropriate improvement surfacing treatment, whichever is the lesser period. Such routine maintenance work is to be carried out in accordance with Section 10.1 of these Specifications and shall be paid for separately under Article 10.1.7.

**8.1.2 MATERIALS**

Only new materials shall be used in the pavement layers. Sound excavated pavement materials may be used as selected embankment.

8.1.2.1 Pavement Patching, Spot Leveling and Pavement Edge Correction of Sealed and Unsealed Pavements

The type of material to be used in the patching, pothole or edge repair of broken areas of existing pavement shall be as directed by the Engineer and may include Selected Embankment, Aggregate Base Class A or B, Unsealed Road Base, Prime Coat, Tack Coat and/or one of the Hot or Cold Asphaltic Mixtures, Lasbutag or Latasbusir meeting the requirements of Divisions 3, 5 and 6 of these Specifications.

8.1.2.2 Pothole Repair

Materials used for pothole patching shall be the same or equivalent to the materials in the surrounding layer being patched unless otherwise directed by the Engineer. (For example, a road pavement consisting of aggregate sub-base, HRS-Base and HRS-WC should have the sub-base and base layer patched with aggregate, the asphalt base layer patched with HRS-

Base and the surface patched with HRS-WC). The material used may consist of selected fill material, Class Aggregate Base or (for sealed roads), HRS-Base, HRS-WC, Cold Mix, Lasbutag or Latasbusir Mixes, Penetration Macadam, Prime Coat, Tack Coat, Asphaltic Concrete or any other pavement construction material, according to the pavement layer being patched. These materials should generally comply with the relevant Sections of these Specifications or the relevant technical specification, as directed by the Engineer.

8.1.2.3 Addition of Aggregates to Unsealed Roads

The types of aggregate to be added to unsealed roads will be instructed by the Engineer and may include Aggregate Class C, Water-bound Macadam Coarse Aggregate, Water-bound Macadam Fine Aggregate, meeting the requirements of Section 5.2 of these Specifications. Where the existing unsealed Road Base is deficient in coarse or fine aggregate, the Engineer may direct that coarse or fine material be added, blended and compacted with the existing base so that it meets the requirements of Section 5.2.

8.1.2.4 Spot Sealing and Seal Coating

The material used for spot sealing or seal coating of cracked pavement shall be AC 10 or AC 20 penetration grade bitumen, MC 250 or MC 800 cut-back bitumen or a suitable bitumen emulsion. AC 10, AC 20 or bitumen emulsion shall be used for crack filling.

8.1.2.5 Spot Leveling

The materials used for Spot Leveling shall be Aggregate Base Class C, Penetration Macadam, Cold Mix Asphalt or Hot Mix Asphalt as instructed.

8.1.2.6 Pavement Edge Correction

Pavement Edge Correction works shall be constructed of Aggregate Base Class A and Sub-surface layer, together with Prime Coats and/or Tack Coats as required, as called for on the Drawings or as directed by the Engineer. The materials shall comply with the requirements specified in Sections 5.1, 6.1 and 6.3 of these Specifications as applicable to the material involved.

**8.1.3 EXECUTION**

8.1.3.1 Pavement Patching of Sealed and Unsealed Pavements (Excavation and Reconstruction)

The Engineer shall determine the areas to be reinstated, and the limits of these areas, and the Contractor shall mark out the areas accordingly. Paint Markings shall be used for sealed pavements and offset marker pegs shall be used for unsealed areas.

The perimeter of the defective area shall be cut away by hand. The excavation shall in general be rectangular in plan, with sides parallel and square to the road center line. The sides of the excavation shall be vertical or steeply sloped outward and must not be overhanging.

The excavated area shall be inspected by the Engineer and no material shall be placed before the excavation has been approved. Following this approval the bottom of the excavation shall be compacted and each layer of material accepted by the Engineer shall be compacted by approved mechanical compacting equipment. Hand methods of compaction may be used for the lower layers of repairs which are too small to accommodate

mechanical equipment. The compacted densities of each layer shall be equivalent to those for the equivalent materials specified in the major works section of these Specifications.

The finished levels of the reinstatement shall be the same as the adjacent sound areas of existing pavement or shoulder. Surface tolerances shall be those specified in the major works section of these Specifications for the particular material forming the top layer of the reinstatement.

#### 8.1.3.2 Pothole Repair of Sealed and Unsealed Pavements

The Engineer shall designate which potholes are to be repaired under this Section. All potholes in sealed pavements shall be filled as specified in this Article. Potholes in unsealed pavements that are deeper than the pavement depth shall also be filled as specified in this Article. The Engineer may require potholes in unsealed pavement that do not penetrate the pavement layers to be repaired by routine maintenance grading as specified in Article 10.1.2 of these Specifications, by filling in accordance with this Article.

The Contractor shall mark out rectangular sections on the pavement surface denoting the extent of each patch. Each layer of the road pavement shall be cut back to sound material to the depth of the pothole.

Only damaged layers shall be cut back. The prepared surfaces shall be clean and free of standing water before patching commences.

Each layer shall be filled and compacted in one operation commencing with the lowest layer. Filling and compaction shall be generally in accordance with the relevant specification for the material being used except that hand methods of placing and compaction may be used on the lower layers of the pavement where space is too restricted for the use of mechanical equipment.

After completion of the patch by filling the top layer, mechanical equipment shall be used to compact the top layer according to the specification for the material used in that layer.

#### 8.1.3.3 Sealing of Cracks in Sealed Pavements

All cracks shall be filled by one of the following methods

(a) Seal Coating

Isolated areas of permeable or cracked bituminous pavement shall be restored by seal coating (BURAS) using the treatments given in Section 6.7 of these Specifications. The application rate to be used shall be determined by the Engineer.

(b) Spot Sealing Individual Cracks

Isolated wide cracks in the pavement which can not be sealed satisfactorily by BURAS shall be sealed individually. Before sealing, wide cracks must be raked out to remove dirt and debris. Bitumen or bitumen emulsion shall then be poured into the crack from a container with a spout until refusal. Sand shall be applied to the surface as a blotter for excess bitumen immediately after filling.

#### 8.1.3.4 Spot leveling of Sealed Pavements

The Engineer shall determine the areas to be leveled and the Contractor shall mark out the areas accordingly using paint markings on the existing road surface.

Each layer of leveling material shall be placed and compacted using approved mechanical equipment. The final compacted densities of each layer shall be equivalent to those specified in the relevant sections of the Major Works Section of these Specifications.

The finished levels of the reinstatement shall be the same as the adjacent sound areas of existing pavement or shoulder. Surface tolerances shall be those specified in the relevant sections of the Major Works Section of these Specifications for the particular material forming the top layer of the reinstatement.

#### 8.1.3.5 Spot Overlay of Unsealed Pavements

The Engineer shall determine the areas to be overlaid and the required depth and camber of the resultant surface. Minor soft spots shall be patched in accordance with Articles 8.1.3.1 and 2 above before application of the overlay. Construction of the overlay shall be in accordance with Section 5.2 of the Specifications.

#### 8.1.3.6 Mechanical Stabilization of Unsealed Road Base

The Engineer shall determine the areas of excessively fine or coarse road base to be blended in situ with added coarse or fine materials to rectify the grading deficiencies. Construction shall comply with Section 5.2 of these Specifications.

#### 8.1.3.7 Heavy Grading of Unsealed Roads

For severely potholed and corrugated localized sections of unsealed roads, heavy grading shall be carried out using a motor grader of at least 135 horsepower. When possible, heavy grading is to be carried out during or immediately following the wet season when the moisture content of the gravel is still high enough to help re-compaction and prevent loss of fines.

If heavy grading must be carried out in the dry season, water must be added and the surface re-compacted by rolling immediately following the grading to prevent rapid deformation of the surface and the scattering of fines.

Localized heavy grading shall be carried out when necessary to ensure that the pavement cross-fall is in the range of 4 % to 6 % and to eliminate deep corrugations and potholes. This shall be achieved by cutting with the grader blade to a depth equal to or greater than the depth of the surface defects. If the road surface is hard, the grader's tines shall be used to loosen the material before blending is carried out.

For localized heavy grading, the grader shall start from the edge of the road and work towards the center. Cutting to the bottom of the surface irregularities shall be achieved in one or two passes of the motor grader, the cut material being deposited as a windrow just beyond the road center line. A water tanker shall then be used to spray the road if moisture needs to be added. The windrow shall then be spread back across the road with the grader blade at a height and angle which shall ensure that all the gravel is deposited uniformly over the carriageway and at the required cross-fall camber. Additional water shall be added during this spreading operation if necessary.

The procedure of cutting and spreading shall be repeated, if necessary, until the correct camber is achieved. Then the procedure is repeated on the other half of the road to

complete the work and leave a smooth even surface. Rolling of the gravel shall be carried out immediately following the cutting and spreading operation to achieve a tight well compacted surface to the satisfaction of the Engineer.

Care shall be taken by the Contractor to prevent the grader from passing down the center of the road with the blade lowered, as this may result in a flattening of the road camber. Care must also be taken during the cutting operation to avoid depositing soft clayey soil from the side drains on to the carriageway.

Heavy grading of an unsealed road shall not be carried out if the total existing thickness of gravel is less than 7.5 cm. In such a case, heavy grading must be accompanied by re-graveling, to build up the gravel road thickness.

#### 8.1.3.8 Edge Correction of Sealed Pavements

- (a) Pavement Edge Correction shall be required in all areas to be resurfaced and at other locations instructed by the Engineer. In these areas the exposed edge of the existing carriageway shall be trimmed back to sound material which is not loose or cracked or otherwise unstable, to form a clean vertical face.
- (b) Except where carriageway widening is to be carried out in accordance with the provisions of Section 4.1 of these Specifications, the width of Pavement Edge Correction work shall be sufficient to extend the existing carriageway to the design width, as indicated on the Drawings, or as directed by the Engineer, plus sufficient additional width to allow for the edge of each overlay course laid to be marginally indented from the edge of the underlying course or existing pavement.
- (c) The excavated grade of the Pavement Edge Correction areas shall be prepared compacted and tested as specified for Grade Preparation in Section 3.3 of these Specifications.

The prepared grade shall be inspected by the Engineer immediately prior to placement of the overlying material and no materials shall be placed until the grade preparation works have been approved by the Engineer.

- (d) Placing and Compacting Aggregate Base
  - (i) The provisions specified in Article 5.1.3 or Article 5.2.5 of these Specifications, for Aggregate Base or Unsealed Road Base respectively, shall apply except that the frequency of quality control testing shall be increased so that no less than five plasticity index tests, five particle grading tests, and one maximum dry density test shall be carried out for every 500 cubic metres of material brought on to the job.
  - (ii) In cases where Aggregate Base has been blended in situ with existing materials, the minimum frequency of testing specified in (a) above shall again be applied to any new material brought on to the site but in addition shall be applied also to the blended material in place. For the additional testing, the Contractor shall sample the blended material to the full design depth at locations indicated by the Engineer.
  - (iii) The frequency of density and moisture control testing shall be at least one test (SNI 03-2828-1992) in every 50 m of edge correction works on each side of the road (if applicable), measured along the road center line.

(e) Producing, Placing, Compacting and Testing Sub-surface layer

The provisions specified in Section 6.3 of these Specifications relating to the production, placing, compacting and testing of Sub-surface layer shall apply with the following exceptions:

- (i) Before the material is placed, a suitable prime coat shall be applied to the already placed Aggregate Base and also to the exposed vertical face of the edge of the existing carriageway pavement.
- (ii) Placing shall be by hand methods, but within the same temperature limits as for machine placing.

The Engineer shall approve the methods and equipment for compaction so that the compaction standards specified in Article 6.3.7.2 are met. Hand compaction, using approved hand hammers shall only be approved for small areas generally of less than 10 metres in length. For mix layers whose finished surface is below the surface of the existing pavement, the, compaction equipment used must be small enough to ensure that the equipment can be operated at all times on the newly laid material only.

- (iii) When required by the Engineer, density testing of the placed material, determined from core samples, shall be carried out at a frequency of no less than one test in every 100 m of pavement edge corrections works on each side of the road (if applicable), measured along the read center line.

8.1.3.9 Tack Coat for Reinstatement, Pothole Patching or Edge Correction

Surfaces against which any Asphaltic Mixture, is to be placed shall be thoroughly cleaned then fully and uniformly coated with bituminous tack coat which shall be allowed to break before the Asphaltic Mixture is placed.

**8.1.4 MEASUREMENT AND PAYMENT**

8.1.4.1 Measurement for Payment

- (a) Pavement patching, pothole repair, spot sealing, spot leveling, pavement edge correction and re-gravelling designated for reinstatement by the Engineer shall be measured for payment as the volume of granular and asphaltic materials actually placed and accepted by the reinstatement works.
- (b) Measurement of the volume of materials used for unsealed road pavements shall be in cubic metres, truck measure (loose measure). Bitumen for crack sealing shall be measured in Litres. All other materials shall be measured as the volume in cubic metres compacted in place.
- (c) Measurement for any of the material Pay Items listed in Article 8.1.4.2 below for which there is an equivalent material specification included in Sections 5.1 and 5.2 of these Specifications, shall include for such reinstatement operations as the supplying, mixing, placing, compacting and where necessary, finishing of the replacement granular materials.

- (d) Heavy grading of Unsealed Roads shall not be measured for payment under this Section. Compensation for this work is included in the measurement and payment of Grade Preparation in accordance with Section 3.3 of these Specifications.
- (e) Measurement for the asphaltic reinstatement Pay Items listed in Article 8.1.4.2 below shall include for such reinstatement operations as the supplying, mixing placing, compacting and finishing of any of the asphaltic materials specified in Section 6.3, for Hot Asphaltic Mixtures, and Section 6.5, for Cold Asphaltic Mixtures, as directed by the Engineer. It shall also include for the supply, mixing and application of Prime Coat and/or Tack Coat when so directed by the Engineer.
- (f) The Binder used for spot sealing, seal coating (BURAS) and other minor works shall be measured for payment under Pay Item 8.1.9 Residual Bitumen for Minor Works. The measured volume shall be the residual bitumen volume. Residual bitumen shall be defined as the bituminous residue remaining after the removal of all cutters and water. The residual bitumen content shall be determined at the Engineer's discretion, by one of the following methods: by a distillation test; from the product recipe; from the minimum bitumen residue value required by the appropriate material specification. The measurement for Residual Bitumen for Minor Works shall include all associated works and materials including cleaning and the supply, delivery and placing of any cover aggregate or blotting material.
- (g) Pay Item No. 8.1.6, shall apply to all types of Lasbutag and shall include full compensation for all constituent materials including Asbuton, Modifier Bitumen, and Additive and/or Anti Stripping Agent, if required.
- (h) For any other type of reinstatement treatment for which, in the opinion of the Engineer, relevant Pay Items are not listed in Article 8.1.4.2 below, the work shall be measured and paid for on a Daywork basis as provided for in Section 9.1 of these Specifications.
- (i) The cutting out and disposal of all defective existing material, trimming and cleaning of the edges of the excavated area, and compacting and preparing the bottom of the excavation shall not be separately measured and paid. These works shall be deemed entirely paid for under various Pay Items listed in Article 8.1.4.2 below.

8.1.4.2 Basis of Payment

The certified quantities of aggregate and asphalt materials used in the reinstatement work performed, measured as 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 the furnishing of all labor, tools, equipment, materials, and all other works or costs required to complete satisfactorily the various types of reinstatement works described in this Section.

Pay Item No.	Description	Unit of Measurement
8.1.1	Aggregate Base Class A for Minor Works	Cubic Metre
8.1.2	Aggregate Base Class B for Minor Works	Cubic Metre

8.1.3	Aggregate for Unsealed Roads for Minor Works (loose volume)	Cubic Metre
8.1.4	Water-bound Macadam for Minor Works	Cubic Metre
8.1.5	Hot Asphaltic Mixture for Minor Works	Cubic Metre
8.1.6	Lasbutag or Latasbusir for Minor Works	Cubic Metre
8.1.7	Penetration Macadam for Minor Works	Cubic Metre
8.1.8	Cold Asphaltic Mixture for Minor Works	Cubic Metre
8.1.9	Residual Bitumen for Minor Works	Litre

## SECTION 8.2

### REINSTATEMENT OF EXISTING SHOULDERS ON SEALED ROADS

#### 8.2.1 GENERAL

##### 8.2.1.1 Description

The work covered by this Section shall comprise the reconstruction, re-graveling or shape correction of isolated sections of existing shoulder not exceeding 50 metres in length (one side) in any one kilometre and the filling of large potholes at any location.

Reconstruction or reshaping of sections of shoulder exceeding 50 metres in length for any one section shall be performed in accordance with Section 4.2 of these Specifications.

The work shall consist of the excavation and preparation of the existing shoulder to be reinstated, the supplying, hauling, placing, compacting, and sealing if so required, of shoulder material in accordance with the lines and grades and dimensions shown on the Drawings or as instructed by the Engineer.

##### 8.2.1.2 Location of areas Requiring Reinstatement

Areas of shoulder requiring reinstatement will be designated by the Engineer based on visual observations made during the Contractor's initial field survey carried out at the beginning of the Mobilization Period, under the requirements of Section 1.9 of these Specifications. Actual details of the method and extent of the reinstatement work for each designated area will be furnished by the Engineer in writing after the field survey has produced sufficient detail of the existing shoulder condition. The Engineer's written instructions will also specify a reasonable time for completion.

##### 8.2.1.3 Classification of Shoulder Reinstatement Work

Shoulders which are unable to support normal wheel loads shall be reconstructed. Shoulders which are more than 5 cm lower than the adjacent sealed pavement or which are heavily potholed shall be re-graveled.

Isolated potholes, each exceeding 40 cm x 40 cm shall be filled. Shoulders which are higher than the pavement level or which inhibit the free drainage of water from the pavement shall be reshaped.

The Engineer may instruct the removal of trees which obstruct sight distance or are a safety hazard.

##### 8.2.1.4 Related Work Specified Elsewhere

- |     |                               |                |
|-----|-------------------------------|----------------|
| (a) | Traffic Management and Safety | : Section 1.8  |
| (b) | Field Engineering             | : Section 1.9  |
| (c) | Materials and Storage         | : Section 1.11 |
| (d) | Environmental Safeguards      | : Section 1.17 |
| (e) | Grade Preparation             | : Section 3.3  |
| (f) | Ctearing and Grubbing         | : Section 3.4  |
| (g) | Shoulders                     | : Section 4.2  |
| (h) | Aggregate Base                | : Section 5.1  |
| (i) | Prime Coat and Tack Coat      | : Section 6.1  |

- (j) Single and Double Surface Dressing : Section 6.2
- (k) Routine Maintenance of Sealed Pavement, Shoulders,  
Drainage, Road Furniture and Bridges : Section 10.1
- (l) Maintenance of Adjacent Roads and Bridges : Section 10.2

## **8.2.2 MATERIAL AND EXECUTION**

### **8.2.2.1. Materials, Production, Tolerances, Maintenance, Control of Traffic, Placing and Testing of Shoulder Reinstatement Work**

All of the provisions of Section 4.2 of these Specifications shall apply except as follows:

#### **8.2.2.2. Potholes**

Fill material to potholes, which are too small for compaction by mechanical, means may be compacted by hand operated equipment.

#### **8.2.2.3. Reshaping**

All Shoulders shall be reshaped to conform to the following requirements:

- (a) Shoulders shall not be higher than, or more than 1 cm lower than, the adjacent carriageway.
- (b) Shoulders shall not inhibit the flow of water from the carriageway.
- (c) The shoulder cross-fall shall not vary by more than 2 % from the design cross-fall.

Shoulders which do not require reconstruction shall be trimmed and re-compacted after reshaping.

#### **8.2.2.4. Excavated materials**

All excavated materials shall be disposed of tidily and to the Engineers approval, in locations which shall not:

- (a) Inhibit sight distance.
- (b) Interfere with any drainage.
- (c) Contribute to silting of drains.

## **8.2.3 MEASUREMENT AND PAYMENT**

### **8.2.3.1 Measurement for Payment**

- (a) Shoulder reconstruction or re-gravelling in areas of the existing shoulder designated for reinstatement by the Engineer shall be measured for payment as the volume of excavation work and/or of compacted granular material actually placed and accepted in the reinstatement works.

8.2.3.2 Basis of Payment

- (a) The certified quantities of materials used in the reconstruction or re-gravelling of existing shoulders shall be paid for in accordance with Section 8.1 of these Specifications for the particular materials used.
- (b) The certified quantities of excavation work performed, measured as above, shall be paid for at the Contract Price per unit of measurement for the Pay Item listed below and shown in the Bill of Quantities, which price and payment shall be full compensation for the furnishing of all labor, tools, equipment and all other works or costs required to complete satisfactorily the excavation, subgrade preparation or trimming and re-compaction of the formation when no fresh materials are placed, for the reinstatement of existing shoulders described in this Section.

Pay Item No.	Description	Unit of Measurement
8.2.1	Excavation for Shoulders and Other Minor Works.	Cubic Metre

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## SECTION 8.3 LANDSCAPING

### 8.3.1 GENERAL

#### 8.3.1.1 Description

(a) Ditches and Drains

The drainage system throughout the contract area shall be reinstated and improved in accordance with the Drawings and the Engineer's instructions. The principal objective shall be to eliminate all sites at which subsurface or surface water has a significant influence on pavement strength.

The work to be undertaken may include, but shall not be limited to the widening and/or deepening of existing ditches, construction of new ditches, replacement of existing drains or construction of new drains and the construction of subsoil drains. Particular attention shall be paid to the provision of table and cut-off drains at cuttings and subsoil drains between the road shoulder and cuttings or elevated wet paddy. The work shall be undertaken entirely in accordance with the provision of Division 2 of these Specifications.

(b) Cuttings and Embankments

This work shall consist of the restoration of unstable cutting or embankment slopes and the furnishing, planting and maintenance of sods or bamboo to prevent erosion.

(c) Replanting

This work shall consist of the provision of material, execution, wetting, protection, maintenance of new plantings for replacement of tree cutting or for replanting in locations which are directed by Engineer.

#### 8.3.1.2 Related Work Specified Elsewhere

- |                                                         |                |
|---------------------------------------------------------|----------------|
| (a) Environmental Safeguards                            | : Section 1.17 |
| (b) Mortared Stonework                                  | : Section 2.2  |
| (c) Excavation                                          | : Section 3.1  |
| (d) Embankment                                          | : Section 3.2  |
| (e) Pavement Widening                                   | : Section 4.1  |
| (f) Reinstatement of Existing Shoulders on Sealed Roads | : Section 8.2  |

### 8.3.2 MATERIALS

#### 8.3.2.1 Stabilization by Vegetation

- (a) The term "Vegetation" embraces sods and bamboo plants and, if the Engineer permits may include plants of other types capable of giving effective stabilization of the slope requiring stabilization.
- (b) Grass in sods shall be of a species native to the particular province in Indonesia, harmless and inoffensive to people and animals and not of a kind recognized as a

nuisance to agriculture. It shall be free of disease, noxious weeds and be deep rooting

- (c) Fertilizer shall be approved mixtures of plant nutrients.
- (d) Fill used in the restoration of unstable slopes shall be Selected Embankment.

#### 8.3.2.2 Replanting

##### (a) Plants

The type of vegetations shall conform to the Drawings or as directed by the Engineer.

##### (b) Fertilizer

Fertilizer shall be standard commercial fertilizer supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid and water soluble potash. It shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable state of fertilizer laws.

##### (c) Lime Stone

Calcareous lime stone shall contain not less than 50 % calcium oxide.

##### (d) Mulch

Mulch material shall be hay, straw or local nontoxic material.

##### (e) Top Soil

Top soil consists of a natural friable surface soil, characteristic representative soil in the vicinity that produces a heavy growth of crops, grass or other vegetation. It shall be free from roots, hard clay and other stone larger than 5 cm in diameter and other foreign material.

### 8.3.3 EXECUTION OF CUTTING AND EMBANKMENT REHABILITATION

#### 8.3.3.1 Unstable Cutting and Embankment Slopes

The restoration shall be undertaken in accordance with the Engineer's instructions. The work may be limited to drainage improvements which shall be performed entirely in accordance with Division 2 of these Specifications or may include excavation of unstable material, placing of selected fill to form a stable slope, stone pitching or the construction of mortared stonework toe or retaining walls.

Mortared stonework shall be undertaken entirely in accordance with the provisions of Section 2.2 of these Specifications.

If excavation and replacement of unstable material is instructed by the Engineer, all unstable material shall be removed. The exposed slope of round material shall be benched. Particular care shall be taken to ensure that the embankment toe area is stable and well drained. The refilling of the slope shall commence at the toe and shall be built up in horizontal layers each of which shall be compacted to the standard specified in Article

3.2.3. of these Specifications. Subsurface drains shall be provided at locations to be instructed by the Engineer. The finished embankment or cutting slope shall be protected by vegetation in accordance with Article 8.3.3.2 of these Specifications or in cases where the slope is only marginally stable or where severe erosion is anticipated, stone pitching or other forms of slope protection may be instructed.

8.3.3.2 Stabilization by Vegetation

(a) Preparation

- (i) Fine grade all areas to be sodded to a uniform surface and loosen the surface materials.
- (ii) Make up the surface with top soil so that the sod and top soil form a finished thickness of 15 cm.
- (iii) After surface preparation, spread fertilizer uniformly over all surfaces which are to be sodded, at a rate of 4 kg per 100 square metres. Incorporate fertilizer into such surfaces by raking, dishing or harrowing. Apply fertilizer not more than 48 hours before the grass is to be placed.
- (iv) Sods shall be cut with their root system substantially intact and taken when the earth is moist or has been artificially watered. Sods should be stacked on pallets in layers together with as much moisture as possible, protected from sun and wind and watered every 4 hours. They should be laid within 2 days of cutting.

(b) Application

- (i) The sodding operation is not permitted during heavy rain, periods of hot weather or hot dry winds and only when the soil is in a tillable condition.
- (ii) Sodding shall be done by planting sods along the contours to give continuous cover over the whole area.
- (iii) Bamboos shall be planted in slopes requiring stabilization by the Engineer at 1 Metre intervals.

(c) Watering

For at least 1 month after completion of sodding, sodded areas shall be watered at regular intervals as guided by the prevailing weather or as directed by the Engineer. The water shall be applied in such a manner that the newly sodded surface is not eroded, washed or damaged in any way.

(d) Protection

Provide protection barricades, fences, ropes on stakes, signs and other measures as needed to ensure that vegetation is not disturbed or damaged by animals, birds or people.

(e) Maintenance

The Contractor shall maintain the completed sodding or bamboo until the issue of the Final Hand Over This work shall include cutting, trimming, repairing erosion

channels, applying protective facilities and repairing areas where sodding or bamboos are not maintaining a healthy growth.

### **8.3.4 REPLANTING**

#### **8.3.4.1 Area Preparation and Clean Up**

After the areas have been graded, they shall be raked or cleared of stone larger than 5 cm in diameter, sticks, stumps and other debris which might interfere with the growth of grasses or subsequent maintenance of grass covered areas.

#### **8.3.4.2 Top Soils**

If top soil is shown on the Drawings or otherwise directed by the Engineer, placement shall be carried out in accordance with the requirements specified.

The top soil shall be spread evenly on the designated areas to the depth shown on the Drawings or not less than 8 cm. Spreading of top soil shall not be carried out when the ground or top soil is excessively wet or otherwise in a condition detrimental to the work.

#### **8.3.4.3 Applying Fertilizer and Ground Limestone**

Fertilizer and/or ground limestone, if required, shall be uniformly spread at no less than 5 kg per 100 square metres for fertilizer and 20 kg per 100 square metres for ground limestone or as directed by the Engineer. These materials shall, if so directed, be incorporated into the soil to a depth of not less than 5 cm by dishing, raking or other methods acceptable to the Engineer. On steep slopes where mechanical equipment can not be utilized effectively, they may be applied with power sprayer, blower equipment or other methods approved by the Engineer.

#### **8.3.4.4 Planting**

Planting shall take place during a period when satisfactory results may be expected. When drought, high wind, excessive moisture or other unsatisfactory condition prevail, the work shall be halted as directed by Engineer.

##### **(a) Shrubs**

Shrubs shall be planted in a pit of minimum size 60 cm X 60 cm X 60 cm depth and the spacing shall be as shown on the Drawings or as directed by the Engineer. Selected soil shall be placed around root-ball and firmly but not over compacted. The finished level of the backfill soil to be 5 cm above the general level to allow for settlement.

##### **(b) Trees**

Trees shall be planted in a pit of minimum size 2 m x 2 m x 1 m depth. Trees size shall be within the range of 8 to 20 cm girth. Provision should be made for correctly staking, guying and tying the newly planted trees.

#### **8.3.4.5 Mulching and Compacting**

After planting has been completed, and prior to compacting, the surface shall be cleared of stones larger than 5 cm in diameter, larger clods, roots and other litter brought to the

surface during planting operations. If mulching is indicated on the Drawings, the planted areas shall be covered with mulch within 24 hours from the time planting has been completed, weather and soil conditions permitting, otherwise at the earliest time possible thereafter.

Compaction (if mulching is not required) shall be done within 24 hours from the time of sprigging and/or sodding by multi packers, or rollers or other satisfactory equipment operated at right angles to the slopes.

8.3.4.6 Maintenance of Planted Areas

The Contractor shall protect planted areas against traffic, strong winds and other abuses by warning signs and/or barricades and other adequate means of protection approved by the Engineer. Surface gullies or other damage following planting shall be repaired by regrading and resprigging or resodding as directed. The Contractor shall mow and water as required and otherwise maintain planted areas in satisfactory and acceptable condition.

**8.3.5 MEASUREMENT AND PAYMENT**

8.3.5.1. Method of Measurement

Only stabilization by Vegetation and Replanting shall be measured and paid for under this Section of the Specifications. All drainage and mortared stonework shall be measured and paid for in accordance with Section 2.2 and stone masonry in accordance with Section 7.9 of these Specifications. All excavation work shall be measured and paid for under Section 3.1 while embankment material shall be measured and paid as Selected Embankment under Section 3.2 of these Specifications.

The quantities of Stabilization by Vegetation to be measured for payment shall be the actual planted surface area, measured in square metres on the slope, of established sodding or bamboo vegetation accepted by the Engineer. Fertilizer shall not be measured. Where both sodding and bamboo are required for stabilization then the area shall be doubled to obtain the quantity measured for payment.

The quantities of Replanting to be measured for payment shall be the actual number of shrubs and trees planted within the specified planting areas in a living and healthy condition. The using of mulch, fertilizer, ground limestone and top soil shall not be separately measured.

8.3.5.2. Basis of Payment

The work measured as provided above shall be paid for at the Contract Price per unit of measurement for the Pay Item listed below and in the Bill of Quantities, which payment shall be full compensation for furnishing all materials, labour, equipment and tools, for preparation of the surface, handling, placing and maintaining all vegetation and for all other costs necessary for proper completion of the work as prescribed in this Section.

Pay Item No.	Description	Unit of Measurement
8.3.1	Stabilization by Vegetation	Square Metre
8.3.2	Shrubs	Square Metre
8.3.3	Trees	Each

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## SECTION 8.4

### ROAD FURNITURE AND TRAFFIC CONTROL DEVICES

#### 8.4.1. GENERAL

##### 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, kilometre posts, guard rails, road studs, cat eyes, curbs, sidewalk, traffic light, road illumination 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.

##### 8.4.1.2. Issue of Arrangement Drawings and Construction Details

Arrangement drawings showing the location of road furniture and traffic control devices and construction details of all road furniture items not included in the Contract Documents at the time of tender will be furnished by the Engineer after the initial design review or design revision has been completed in accordance with Section 1.9 of These Specifications.

##### 8.4.1.3. Related Work Described Elsewhere

- |     |                                                                                     |                |
|-----|-------------------------------------------------------------------------------------|----------------|
| (a) | Traffic Management and Safety                                                       | : Section 1.8  |
| (b) | Field Engineering                                                                   | : Section 1.9  |
| (c) | Materials and Storage                                                               | : Section 1.11 |
| (d) | Environmental Safeguards                                                            | : Section 1.17 |
| (e) | Concrete                                                                            | : Section 7.1  |
| (f) | Routine Maintenance of Pavement, Shoulders,<br>Drainage, Road Furniture and Bridges | : Section 10.1 |
| (g) | Maintenance of Adjacent Roads and Bridges                                           | : Section 10.2 |

##### 8.4.1.4. Reference Standard

- |     |                                                                                                                                                                                                                                                                                                                   |                                                                       |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| (a) | SNI 15-4839-1998<br>(AASHTO M247 - 07)                                                                                                                                                                                                                                                                            | : Glass Beads Used in Traffic Paint (type 2).                         |
| (b) | SNI 06-4825-1998<br>(AASHTO M248 - 91 (2003))                                                                                                                                                                                                                                                                     | : Ready Mixed White and Yellow Traffic Paints.                        |
| (c) | SNI 06-4826-1998<br>(AASHTO M249 - 98 (2003))                                                                                                                                                                                                                                                                     | : White and Yellow Thermoplastic Stripping Material.<br>(Solid Form). |
| (d) | The configurations, dimensions, and colour of pavement markings shall conform to the Indonesian Government Road Sign Safety Codes and Regulations.                                                                                                                                                                |                                                                       |
| (e) | Road signs shall be of the sizes, colour, types and reflective areas prescribed by the Indonesian Traffic Control Authority, Direktorat Lalu Lintas dan Angkutan Jalan Raya (DLLAJR). Any discrepancy between these signs and those shown on the Drawings shall be checked with the Engineer before construction. |                                                                       |

8.4.1.5. Submittals

- (a) Submit a one Litre sample container of each color and type of for approval together with the following particulars of each type of paint.
  - (i) composition (analyses by weight)
  - (ii) application type (hot or cold-applied)
  - (iii) type and maximum amount of reducer
  - (iv) setting time (to re-coat)
  - (v) recommended coverage
  - (vi) heat resistance
  - (vii) details of any undercoat/primer or tack coat required
  - (viii) pot life (life cycle of product)
  - (ix) last date for utilization
- (b) Submit one galvanized steel tubular post for the road signs
- (c) Submit one sign plate with painting already completed
- (d) Submit 0.20 m section of galvanized guard rail.
- (e) Submit one road studs and/or cat eyes.
- (f) Submit two unit of precast curb if the precast curb is manufactured outside of project together with manufacturer's certificate which shall confirm the quality of materials.
- (g) Submit two unit of paving block, together with the manufacturer's certificate.

8.4.1.6. Work Scheduling

In order to maintain the existing road in as safe a condition as possible throughout the Time for Completion, new or replacement road signs, guide posts, kilometre posts and guard rails shall be installed and pavement markings shall be painted on the road surface within the first six months or as early as possible within the Time for Completion.

In the case of pavement markings, this will require that the painting of all markings on the existing pavement surface, for which the Engineer has issued details and locations in accordance with Article 8.4.1.2 above, be carried out within this initial six month period or, where pavement reinstatement works are also required, after the reinstatement operations have been completed.

For areas of the pavement that are designated to receive an overlay treatment that have already received pavement markings to the existing pavement surface, the markings shall be repainted after the completion of the overlay works in accordance with the time restriction specified in Article 8.4.3.4.(b). In this case the Contractor shall receive payment for the area involved in the second application of the road markings.

8.4.1.7. Rectification of Unsatisfactory Work

Any items of road furniture or areas of pavement markings that do not meet the requirements of this Specification or, in the opinion of the Engineer are unsatisfactory in any way, shall be rectified by the Contractor at his own expense as directed by the Engineer.

8.4.1.8. Maintenance of Accepted Work

Notwithstanding the Contractor's obligation to carry out rectification of unsatisfactory or failed work as specified in Article 8.4.1.7 above, the Contractor shall also be responsible for routine maintenance of all completed and accepted road furniture, pavement markings and traffic control devices throughout the remaining Time for Completion. Such routine maintenance work is to be carried out in accordance with Section 10.1 of these Specifications and shall be paid for separately under Article 10.1.7.

8.4.1.9. Control of Traffic

Traffic Control shall conform to the provisions of Section 1.8, Traffic Management and Safety.

**8.4.2. MATERIALS**

8.4.2.1. Storage of Paint

- (a) All paint shall be stored in compliance with the manufacturer's instructions and the provisions of Section 1.11 Materials and Storage of these Specifications.
- (b) All paint shall be utilized in order of pot life dates to ensure that only fresh products are used within the time limits specified by the manufacturer.

8.4.2.2. Traffic Sign 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 traffic sign plates.

8.4.2.3. Traffic Sign 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.

8.4.2.4. Traffic Sign Posts

Steel pipe, hot dip galvanized, to comply with ASTM A120. This includes pipe fittings and post caps. All open ends shall be capped to prevent water entry.

8.4.2.5. Hardware, Screws, Nuts, Bolts and Washers

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

8.4.2.6. Concrete and Cement Mortar

- (a) Concrete to be used for road sign foundation shall be Class K175 as specified in Section 7.1.
- (b) Concrete to be used for curb shall be Class K300 and shall conform to the requirements of Section 7.1 of these Specifications. If shown on the Drawings or directed by the Engineer, carbon black shall be mixed with the concrete.
- (c) Cement Mortar to be used for curb shall conform with the requirements of Section 7.8 of these Specifications or shall have a cement sand ratio of 1:3 if not tested.

8.4.2.7. Paint for Road Furniture

All coatings, paints and enamels used in the preparation of the signs, posts and fittings shall be of the best quality, specially made for the purpose they serve, and of types and brands acceptable to the Engineer.

Paint for steel parts shall be of high zinc oxide content containing a minimum of 7 kg of zinc oxide (acicular type) per 100 Litres of paint.

To ensure compatibility, primers, undercoats and finishing coats shall wherever possible be from the same manufacturer, all materials shall be used within the time limits specified by the manufacturer.

8.4.2.8. 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.

8.4.2.9. Guard Rail

Materials to be used for guard rail shall be galvanized steel, processed in manufacture from steel sheet conforming the AASHTO M180 with minimum thickness of 2.67 mm and shall have the following properties:

- (a) Elongation shall be not less than 12% in a 5 cm gauge length under tensile test.
- (b) Have an ultimate tensile strength of 4,900 kg/cm<sup>2</sup> (70,000 psi).
- (c) The zinc coated of galvanized steel sheet shall have a minimum weight of 550 gram/sq.m (one point test) and 610 gram/sq.m (three point test) or have a minimum thickness of 0.08 mm.
- (d) The element of guard rail which made from steel shall have nominal width of 483 mm with nominal width tolerance of 3.2 mm.

8.4.2.10. Road Studs and Cat Eyes

Shall be an approved design as per the sample submitted and shall have the following characteristics:

Type : Non Reflecting for Road Studs and Reflecting for Cat Eyes.

Head : 10 cm square

Shank : Length, cross-section and shape such as to ensure firm keying to the road pavement. Material to be rough cast or forged unprocessed metal. The head and shank shall be made as an integrated unit.

Finish : Upper face of head, Satin - 100.

#### 8.4.2.11. Road Paint

The word "paint" in this section often connoted thermoplastic type of road marking material. Road Paint shall be white and yellow as shown at the Drawings and in accordance with AASHTO Specifications as follows :

- (a) "Non" Thermoplastic Road Marking : SNI 06-4825-1998  
(AASHTO M248 - 91 (2003))
- (b) Thermoplastic Road Marking : SNI 06-4826-1998  
(solid form) (AASHTO M249 - 98 (2003))

#### 8.4.2.12. Glass Beads

Glass beads shall conform to SNI 15-4839-1998 (AASHTO M247 - 07) (Type 2).

#### 8.4.2.13. Concrete Blocks

Precast concrete blocks for sidewalks and medians shall be 60 mm thick interlocking paving grade as shown on the Drawings and shall be the best quality locally available, to a pattern acceptable to the Engineer. They shall be made from Class K175 concrete unless otherwise approved by the Engineer.

#### 8.4.2.14. Sand Bedding

Sand used to level to surface to be paved and to from bedding layers shall conform to the material requirements in Article 2.4.2.2 of these Specifications.

### 8.4.3. EXECUTION

#### 8.4.3.1. 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 shown on the drawings or 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.

Guard rail posts shall be set in concrete when the verge width behind the post is less than the standard 50 cm as shown on the drawings or when instructed by the Engineer.

#### 8.4.3.2. Painting of Pavement Marking Paint

All concrete kilometre and guide posts shall have one coat of primer, one undercoat and one gloss finish top coat as directed on the Drawings. Other markings and reflectors shall be applied as directed by the Engineer.

8.4.3.3. Painting

All paint shall be applied with a pressure spray on a prepared and dry surface to form a smooth and even film.

8.4.3.4. Painting of Pavement Markings

(a) Preparation of Road Surface

Before markings are set out or paint coatings applied, road surfaces which are to receive markings shall be clean, dry, and free from greasy and dust. Old painted marking or thermoplastic markings that would prohibit proper bonding of the new coating shall be removed by grit blasting.

(b) Application of Pavement Marking Paint

- (i) All cold applied paint shall be field mixed in accordance with the manufacturer's instruction just prior to application in order to keep the pigments in uniform suspension.
- (ii) Paint shall not be placed on a sealed surface less than three (3) months after application of resurfacing, unless otherwise directed by the Engineer. Upon the completion of the period defined above, the application of pre-marking on the sealed surface should be carried out immediately after surfacing.
- (iii) The precise dimensions and position of all road markings shall be set out and marked on the pavement before the paint is applied.
- (iv) Road paint shall be applied to center lines, lane lines, edge lines and zebra crossing lines by means of an approved mechanical machine, self-propelled, atomizing type with mechanical agitator, which has a satisfactory cut off valve capable of applying broken lines automatically. The machine shall produce an even and uniform coat of 0.38 mm wet thickness of "non-thermoplastic" road paint and 1.5 mm thickness of "thermoplastic" road paint, exclusive of the glass beads, and correct uniform width with clear cut edges. If there is no manufacture's guide, "thermoplastic" paint shall be applied at temperature of 204 - 218 °C.
- (v) Where machine laying is impossible, the Engineer may allow the road marking to be applied by hand brushing, spraying, or screening according to the marking configuration and the type of paint approved for use.
- (vi) Glass beads shall be applied to the surface of the road paint immediately after it has been laid. All glass beads shall be applied by pressure or spray application at a rate of 450 gm/m<sup>2</sup> for both type of the road paints
- (vii) All road marking shall be protected from traffic until the markings have dried sufficiently so that there is no pick up or imprint or tyre marks.
- (viii) All markings which do not have a uniform satisfactory appearance by day and night shall be corrected by the Contractor at his own expense.
- (ix) The requirements of Section 1.8, Traffic Management and Safety, shall be adhered to so as to ensure the safety of the motoring public while pavement marking operations are carried out.

- (x) All cold application of road paint shall be mixed on site in accordance with manufacturer's guidelines prior to be sprayed to ensure that all pigments in mix shall be uniform in the suspension.

8.4.3.5. Installation of Road Studs and/or Cat Eyes

- (a) Excavation of the road pavement to form a cavity for each road stud or cat's eye shall be carried out in accordance with the manufacturer's instructions. Care shall be taken to ensure a reasonably level floor and vertical side walls without projection into the cavity and that all loose material produced in excavating the cavity is cleaned out.
- (b) A layer of approved stone (6 mm to dust chippings) shall be laid and compacted level on the cavity floor. The road stud or cat's eye shall be prepared in accordance with the manufacturer's instructions and firmly bedded on the leveling layer such that the correct projection of the stud above the road surface is achieved. A template shall be used to check the line and level of the bedded road stud or cat's eye.
- (c) The cavity wall shall be brushed with asphaltic tack coat and the whole of the remaining cavity grouted with hot filled asphalt in accordance with the recommendations of the manufacturer until level with the road surface. Care shall be taken to ensure that no asphalt is spilled on the projecting portion of the stud. Any asphalt inadvertently spilled shall be carefully removed so that a clean workmanlike job is presented.
- (d) Traffic shall not be permitted to pass over the road stud or cat's eye until the grout has firmly set.

8.4.3.6. Curbing

(a) Site Preparation

The area required for the work shall be cleared and excavated to the required shape and depth, and the foundation upon which the curb is to be placed shall be compacted to an even surface. All soft and unsuitable material shall be removed and replaced with suitable material which shall be thoroughly compacted. The work shall conform in all respects with provisions of Sections 3.1 and 3.2 of these Specifications.

(b) Installation

Curbs shall be constructed strictly in accordance with the details, lines and grades as shown on the Drawings or as directed by the Engineer. All curbing to be constructed on a curve to a radius of less than 5 metres shall be constructed using curved forms or curved precast units.

Curbs shall be constructed to smooth lines and to levels having a standard deviation not exceeding 6 mm from the design line or level.

(c) Joints

Curbing blocks and other prefabricated items shall be laid with the joints as tight as possible.

(d) Back filling

After any in-situ concrete work has set, and prefabricated curb blocks have been laid to the satisfaction of the Engineer, any remaining excavated areas shall be filled with approved material. This material shall be placed and thoroughly compacted in layers not exceeding 15 cm in depth. All spaces between new curbs and the edge of existing pavement shall be filled with bituminous mixes of a type approved by the Engineer, unless the Drawings clearly indicate that this not required.

(e) Property Accesses, Crossing and Vehicle Entrances

When vehicle entrances, driveways, and crossings, are required a depressed or shaped section of curb, shall be installed as indicated on the Drawings or as directed by the Engineer. The Contractor shall furnish materials and carry out the construction in accordance with the Drawings or the directions of the Engineer.

8.4.3.7. Concrete Block

(a) New Works

New sidewalks and medians, as well as areas of existing sidewalks and medians with damaged or no paving, shall be finished with blocks of the type or types shown on the Drawings, or as directed by the Engineer.

(b) Existing Sidewalks

Areas of existing sidewalk or median which are to be finished shall have any damaged existing blocks chipped away. New blocks shall be chosen to match the type and colour of any remaining old blocks. The foundation shall be thoroughly moistened immediately prior to the placing of the sand bedding which shall be laid to the thickness shown on the Drawings or as directed by the Engineer.

(c) Block Paving

Block paving shall be laid in accordance with the manufacturer's instructions. Generally blocks shall be laid on an un-compacted sand bed about 60 - 70 mm thick and vibrated down to level using a plate compactor, causing sand to enter spaces between blocks thus assisting interlocking and compaction. Trials shall be carried out on various loose thicknesses of sand, prior to commencement of the work, to establish the correct laying thickness required to achieve the compacted thickness of 50 mm. Block paving shall not be grouted with cement mortar.

(d) Finishing

The finished paving surface shall present a uniform smooth appearance with no blocks protruding above or below the average surface position by more than 6 mm, as measured on a 3 m straight edge, applied any where on the paving. All joints shall be neat and tight, with no mortar or other material staining or smearing the finished surfaces. Paving shall be laid with a minimum fall of 4 %.

(e) Vehicle Crossings

When driveways or crossing occur a depressed or modified section of sidewalk shall be installed as indicated on the Drawings or as ordered by the Engineer.

(f) Cutting Blocks

Blocks shall be saw cut to fit round obstructions such and poles or trees, and between curbs and edgings etc.

**8.4.4. MEASUREMENT AND PAYMENT**

8.4.4.1. Method of Measurement

- (a) The quantities to be measured for Warning, Regulation and Guide signs other than Information Guide signs, guide posts and kilometre posts, road studs and cat's eyes shall be the actual number of road signs (including posts), guide posts, kilometre posts, road studs and cat's eyes furnished and installed in accordance with the Drawings and accepted by the Engineer.
- (b) The quantity to be measured for Information Guide Signs shall the sign face area in square metres and shall be inclusive of all posts of whatever type, framing, footings, installation and other items necessary for installation. Information Guide Signs shall be defined as Guide Sign types 1 to 7a of Standard Drawings.
- (c) The quantity to be measured for guard rail shall be the actual linear metres of guard rail furnished and installed in accordance with the Drawings and accepted by the Engineer excluding any lengths represented by end terminals of the following types furnished and installed:
  - (i) Bridge Terminal (BT)
  - (ii) Tangential End Terminal (TET)
  - (iii) Breakaway Cable Terminal (A) (BCTA)
  - (iv) Breakaway Cable Terminal (B) (BCTB)

The quantity to be measured for Guard Rail End Terminals shall be the number of each type furnished and installed.

The quantity of concrete guard rail pos footings shall be the number of furnished and installed. The post footings designed as concrete in the BCT terminal section drawings shall be excluded from this measurement. The cost of these footings shall be included the respective unit price for terminal section.

- (d) The quantity of paint or thermoplastic pavement marking to be paid for shall be the number of square metres of road or thermoplastic applied to the surface in accordance with the Drawings and accepted by the Engineer.
- (e) Cast In-situ Concrete Curbing
  - (i) No separate measurement for payment shall be made for cast in-situ concrete curbing under this Section of these Specifications.
  - (ii) Curbing constructed in accordance with this Section shall be measured for payment as the various materials used as provided for in the relevant sections of these Specifications.

(f) Precast Concrete Curbing

- (i) Precast curb, barrier curb and delineation strip, both new and reset, shall be measured in linear metres along the front face of the section at the top of the curb. No reduction in this length shall be made for drainage structures installed in the curbing.
- (ii) No additional measurement for payment shall be made for sloping or dropping curbs at entrances, crossings, driveways etc, for the inclusion of curb and barrier curb with ungrated drainage openings, for using curved curb units, cutting blocks or laying curbs end sections.

- (g) The quantity to be measured for concrete paving block shall be the actual number of square metres of new paving complete in place and accepted, and also in term of the amount of sand bedding actually used, calculated using the method specified in Article 2.4.4.1. No separate measurement shall be made for removing defective blocks or vibrating blocking

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 the furnishing 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
8.4.1	Pavement Markings Thermoplastic Type	Square Metre
8.4.2	Pavement Markings Non Thermoplastic Type	Square Metre
8.4.3a	Road Signs with Reflector of Engineering Grade Single (Size 600)	Each
8.4.3b	Road Signs with Reflector of Engineering Grade Single (Size 750)	Each
8.4.3c	Road Signs with Reflector of Engineering Grade Single (Size 900)	Each
8.4.3d	Road Signs with Reflector of Engineering Grade Double (Size 600)	Each
8.4.3e	Road Signs with Reflector of Engineering Grade Double (Size 750)	Each
8.4.3f	Road Signs with Reflector of Engineering Grade Double (Size 900)	Each
8.4.3g	Information Guide Signs with Reflector of Engineering Grade	Square Metre

8.4.4	Road Signs with Reflector of High Intensity Grade	Each
8.4.4a	Guide Sign With High Intensity Grade Tipe 1a	Each
8.4.5a	Guide Posts concrete type	Each
8.4.5b	Guide Posts plastic type with metal anchor	Each
8.4.6a	Kilometre Posts	Each
8.4.6b	Right of Way Posts	Each
8.4.7a	Guard Rail (excluding terminal lengths)	Linear Metre
8.4.7b	Guard Rail bridge terminal (10m)	Each
8.4.7c	Guard Rail BCTA terminal (5.1m)	Each
8.4.7d	Guard Rail BCTB terminal (5.1m)	Each
8.4.7e	Guard Rail TET terminal (7.62m)	Each
8.4.7f	Concrete Footing for Guard Rail	Each
8.4.8	Road Studs	Each
8.4.9	Cat's eye	Each
8.4.10a	Precast Portland Cement Concrete Curb Type (A, C, E and transitions)	Linear Metre
8.4.10b	Precast Portland Cement Concrete Curb Type B	Linear Metre
8.4.10c	Precast Portland Cement Concrete Curb Type L1	Linear Metre
8.4.10d	Precast Portland Cement Concrete Curb Type L2	Linear Metre
8.4.10e	Precast Portland Cement Concrete Curb Type P1	Linear Metre
8.4.10f	Precast Portland Cement Concrete Curb Type F	Linear Metre
8.4.11	Re-used Existing Precast Portland Cement Concrete Curb	Linear Metre
8.4.12	Block Paving on Side Walk or Medians 60 mm	Square Metre

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## **SECTION 8.5 REINSTATEMENT OF EXISTING BRIDGE STRUCTURES**

### **8.5.1 GENERAL**

#### **8.5.1.1 Description**

The work covered by this Section of the Specifications shall comprise the reinstatement of existing bridge structures located within the physical boundaries of the Contract.

Such reinstatement works being primarily aimed at extending the service life of the existing structures where no improvement of the capacity or structural strength of the structure is required, and where previous detailed inspection has identified areas of distress within component parts of the structure.

Works designated as part of the improvement scope of the Contract, aimed at improving the capacity or structural strength of a bridge structure, such as bridge widening, replacement or new construction, shall not be considered as part of reinstatement works and shall be measured and paid for under applicable major works sections of these Specifications for the materials used or such other additional special specifications as issued by the Engineer

Reinstatement works will be identified by the Engineer during the Time for Completion and may involve remedial works of varying complexity and detail. The exact nature of the works being dependant upon the type, size, age and general condition of the bridge structure as a whole and the type of materials used in the original construction of the various components of the structure.

#### **8.5.1.2 Identification of Reinstatement Works**

Identification of reinstatement works for existing bridge structures to be included within the scope of the Contract shall be made by the Engineer based on the results of survey and inspection work furnished by the Contractor. Such survey and inspection activities by the Contractor being carried out at various times throughout the Time for Completion in accordance with the requirements of other Sections of these Specifications.

##### **(a) Field Survey for Minor Design Revision**

Bridge structures shall be inspected during the first thirty days of the Mobilization Period as part of the Contractor's field survey of the whole works carried out in accordance with Section 1.9 of these Specifications. This initial inspection will identify minor areas of reinstatement works, not detailed on the Drawings, that the Engineer may accommodate when refining the detailed scope of work, estimated quantities and budget required for the works.

##### **(b) Routine Maintenance Inspection**

Bridge structures will also be inspected at regular intervals throughout the Time for Completion as part of the Routine Maintenance activities carried out in accordance with Article 10.1.6 of these Specifications

Such regular inspection activities will principally concentrate on the identification of cleaning and clearing operations to be carried out on a routine basis but will also include the identification of any additional areas of the structure showing signs of

distress as a result of the further passage of time or flood action occurring with in the Time for Completion.

8.5.1.3 Issue of Construction Details

Construction details of bridge reinstatement works identified in accordance with Article 8.5.1.2 above will be developed by the Engineer and furnished to the Contractor after the initial design review or design revision has been completed in accordance with Section 1.9 of these Specifications and when necessitated by the subsequent identification of additional reinstatement work during routine maintenance inspections.

8.5.1.4 Related Work Specified Elsewhere

- |     |                                                                                    |   |              |
|-----|------------------------------------------------------------------------------------|---|--------------|
| (a) | Mobilization                                                                       | : | Section 1.2  |
| (b) | Traffic Management and Safety                                                      | : | Section 1.8  |
| (c) | Field Engineering                                                                  | : | Section 1.9  |
| (d) | Construction Schedules                                                             | : | Section 1.12 |
| (e) | Environmental Safeguards                                                           | : | Section 1.17 |
| (f) | Concrete Work                                                                      | : | Section 7.1  |
| (g) | Reinforcing Steel for Concrete                                                     | : | Section 7.3  |
| (h) | Cement Mortar                                                                      | : | Section 7.8  |
| (i) | Stone Masonry                                                                      | : | Section 7.9  |
| (j) | Demolition of Existing Structures                                                  | : | Section 7.15 |
| (k) | Daywork                                                                            | : | Section 9.1  |
| (l) | Routine Maintenance of Pavement, Shoulder,<br>Drainage, Road Furniture and Bridges | : | Section 10.1 |

8.5.1.5 Submittals

- (a) The Contractor shall submit samples of all the materials he intends to use together with test data confirming that all the material properties specified in the relevant sections of these Specifications, or supplementary specifications issued by the Engineer, are met.
- (b) For reinstatement using concrete, submittals of mix design details and quality control testing shall be in accordance with Article 7.1.1.7 of these Specifications.
- (c) The Contractor shall submit detailed drawings of all false work to be used and shall obtain the Engineer's approval before setting up any false work.
- (d) The Contractor shall submit details of work schedules and traffic control provisions for all bridge reinstatement works involving the closure of part or all of the bridge to traffic, and shall obtain the Engineer's approval prior to the commencement of reinstatement operations.

8.5.1.6 Rectification of Unsatisfactory Reinstatement

Areas of the bridge structure that, in the opinion of the Engineer, have been unsatisfactorily reinstated in accordance with the provisions of this Specification, or are considered unsatisfactory in any other respect shall be rectified as directed by the Engineer. Rectification may include the total reconstruction of the area of unsatisfactory reinstatement or any other measure which the Engineer deems necessary.

#### 8.5.1.7 Maintenance of Satisfactory Reinstatement

Notwithstanding the Contractor's obligation to carry out rectification of unsatisfactory or failed work as specified in Article 8.5.1.6 above, the Contractor shall also be responsible for routine maintenance of all completed and accepted reinstated areas throughout the remaining Time for Completion. Such routine maintenance work is to be carried out in accordance with Section 10.1 of these Specifications and shall be paid for separately under Article 10.1.7.

#### 8.5.1.8 Control of Traffic

Traffic Control shall conform to the provisions of Section 1.8, Traffic Management and Safety and the additional provisions detailed hereunder:

- (a) Where bridge reinstatement work involves the replacement of sections of a bridge deck, the Contractor shall schedule his work to afford the least interference or interruption of traffic.
- (b) For two lane bridges the Contractor shall, when the extent of reinstatement work will allow, schedule his work to maintain one lane open to traffic at all times.
- (c) For all bridges where the extent of reinstatement work will dictate that the bridge must be completely closed to all traffic, the Contractor shall schedule his work to ensure that the closure of the bridge is for the shortest possible period of time.

#### 8.5.1.9 Work Scheduling

Following the issue of construction details for bridge reinstatement works, the Contractor shall schedule his work program as early as possible within the Time for Completion. Full details of the sequence and timing of the construction operations for each bridge shall be incorporated into the Contractor's construction schedules, the revision of which shall be submitted to the Engineer for his formal approval in accordance with the provisions of Section 1.12 of these Specifications.

Where the reinstatement works requires the full closure of a bridge the provisions of Article 8.5.1.8 above shall apply and the programmed closure shall be fully coordinated with the Engineer in order that a detour or other alternative provisions can be made to minimize disruption to traffic.

### **8.5.2 SCOPE OF REINSTATEMENT WORKS**

8.5.2.1 Bridge reinstatement works identified for inclusion in the scope of the Contract may involve remedial works to any or all of the major functional components of the bridge substructure, including such items as foundations, piers, abutments and river training works, and the bridge superstructure, including such items as bridge decks, bearings, expansion joints, curbs, handrails, sidewalks and drainage system.

8.5.2.2 Generally the construction details for reinstatement work may include, but shall not be limited to, any or all of the following :

- (a) Reinstatement of Concrete Components
  - (i) Sealing of cracks that have developed in any of the major structural components of the bridge structure. This shall particularly apply to reflective cracking in bridge deck slabs.

- (ii) Resurfacing of aggregate exposed scaled and weathered surfaces to improve their resistance against the effect of inclement weather.
  - (iii) Repair of sections of spalled concrete including where necessary the cleaning of exposed corroded reinforcement.
  - (iv) Local repair of parts of the concrete structure that are structurally damaged or severely cracked, including where necessary, the removal of the damaged area and reconstruction with new concrete.
  - (v) Removal and replacement of cracked or brittle expansion joint sealant.
- (b) Reinstatement of Timber Components
- (i) Cleaning and repainting of weather affected protective coatings.
  - (ii) Removal and replacement of worn, decayed, fractured or broken timber, including the application of a suitable prime and cover coat paint treatment.
  - (iii) Replacement of all damaged, worn or missing metal spikes in the bridge deck running surface.
  - (iv) Replacement of all corroded structural fasteners and connection hardware.
- (c) Reinstatement of Steel Components
- (i) Cleaning and repainting of weather affected protective coatings, including lightly corroded areas.
  - (ii) Cleaning of localized areas of corroded steel work, where the existing protective coating treatment has completely broken down, and the application of a suitable prime and cover coat paint treatment.
  - (iii) Local repair of damaged or cracked steel sections including the application of new protective paint coatings.
  - (iv) Removal and replacement of corroded structural fasteners.
  - (v) Repair, and where necessary, replacement of damaged metal expansion joints in the bridge deck.
  - (vi) Lubrication of dry lightly corroded metal expansion bearings.

8.5.2.3 The scope of reinstatement work for bridges shall not include reinstatement of operations ordered by the Engineer on asphaltic surfacing on the bridge deck or bridge approaches nor on ancillary items associated with the control and safety of traffic using the bridge such as, weight and speed restriction signs, bridge end markers, pavement markings or bridge approach guard rails. Such reinstatement works are to be executed and paid for under the relevant other Sections of Division 8 of these Specifications.

### 8.5.3 REINSTATEMENT OF CONCRETE COMPONENTS

#### 8.5.3.1 Description

The reinstatement work covered in this Article includes crack sealing, resurfacing of aggregate exposed surfaces, repair of spalled concrete, reconstruction with new concrete and replacement of expansion joint sealant.

#### 8.5.3.2 Sealing of Surface Cracks

Crack sealing may be instructed by the Engineer when the extent of surface cracking is not considered to have affected the structural integrity of the cracked area or the structure as a whole, and it is desired to protect the internal structural reinforcement from possible future corrosion attack or to reduce the risk of future structural damage in bridge decks from the repeated application of heavy wheel loads.

Crack sealing shall generally be restricted to narrow hairline cracks or individual wider shrinkage cracks of no structural consequence. Individual deep cracks of larger magnitude propagated by differential movement of the structure, either settlement or expansion, will generally require more substantial repairs in accordance with construction details by the Engineer.

Sealing of cracks may involve the application of a pourable cement grout to individual wide cracks or the erection of an epoxy resin grout to areas with hairline cracks. Where the Engineer has specified the use of epoxy resin by injection, the work shall be carried out by experienced operators in accordance with the general guidelines given in Article 8.5.3.3 below and shall be to the satisfaction of the Engineer.

#### 8.5.3.3 Injection of Epoxy Resin Grout

##### (a) Materials

Materials used for this work shall comprise a proprietary epoxy resin grout suitable for injection and a temporary sealing agent for use during the grouting operation. The material properties for both the grout and the seal shall comply with the requirements of Table 8.5.3.1 below or such other equivalent specification approved by the Engineer.

Table 8.5.3.1 Material Properties

Description	Units	Grout	Seal
Specific Gravity (JIS K711)	-	1.15 ± 0.05	1.70 ± 0.10
Viscosity (JIS K6838)	centi-poise	500 ± 200	-
Yield Stress (JIS K7208)	kg/cm <sup>2</sup>	≥ 500	≥ 400
Elastic Modulus (JIS K7208)	kg/cm <sup>2</sup>	≥ 1.0 x 10 <sup>4</sup>	≥ 2.00 x 10 <sup>4</sup>
Shear Strength (JIS K6850)	kg/cm <sup>2</sup>	≥ 100	≥ 100

##### (b) Execution

##### (i) Cleaning of Existing Surfaces

The surface to be worked on shall initially be cleaned with a mechanical grinder or wire brush until it is free from dirt and broken concrete, and shall then be cleaned again with compressed air. Any area of oil or grease shall be cleaned with solvent.

(ii) Location of Injection Valves

Injection valves shall be located approximately at the center of cracks and at a uniform spacing dependant on the length and depth of the cracks, as directed by the Engineer.

(iii) Sealing of Cracks

Sealing compounds shall be used to close all cracks of greater length than 5 cm and of greater width than 3 mm. Injection work shall not be allowed to proceed until after the seal has sufficiently hardened (1 - 2 days).

(iv) Mixing of Grout

The mixing of the base and hardening components of the epoxy grout shall be carried out strictly in accordance with the manufacturer's mixing specifications.

(v) Final Cleaning

Final cleaning of the concrete surface shall be carried out after the grout is 6 - 7 days old. Chisels and grinders shall be used, where necessary, to remove the injection valves and the hardened sealing compound.

8.5.3.4 Resurfacing of Aggregate Exposed Surfaces and Repair of Spalled Concrete

- (a) The resurfacing of aggregate exposed surfaces and the repair of spalled concrete shall be carried out in accordance with the instructions of the Engineer. Generally, repairs of this nature may be executed using a cement mortar mix composed of cement and fine sand of suitable proportions.
- (b) Existing spalled and scaled concrete surface shall be cut back where necessary to sound material, roughened to provide a key for the new finishing materials and thoroughly cleaned of all dust, oil, grease and loose material using compressed air or high pressure water sprays as required.
- (c) Where existing reinforcing steel is exposed in badly spalled areas the reinforcement shall also be thoroughly cleaned of all loose concrete, oil, grease and rust.
- (d) The materials used and the mixing, placing and finishing of the cement mortar shall comply in all respects with the requirements of Section 7.8 of these Specifications.

8.5.3.5 Repair of Damaged Concrete

Repairs to existing concrete components may be instructed by the Engineer for severely cracked sections or where damage is such that the structural integrity of the section has been, or is in danger of being lost. Repairs of this nature will include such operations as the removal or demolition of the damaged concrete and reconstruction with new concrete and where necessary new reinforcing steel.

(a) Removal or Demolition of Existing Concrete

Concrete removal and demolition shall be carried out to the requirements of Section 7.15 of these Specifications and to the following additional requirements:

- (i) The removal of concrete and the complete demolition of parts of a structure shall be carried out in a safe and controlled manner by workers with sufficient experience and training in demolition procedures to the complete satisfaction of the Engineer. The demolition procedure proposed by the Contractor, including all necessary safety provisions, methods of temporary support and the method of disposal of materials, shall be approved by the Engineer prior to the commencement of demolition operations.
- (ii) Where existing reinforcement exposed during concrete removal operations is to be retained, special care shall be exercised by the Contractor during removal operations to prevent damage, bending or displacement of the existing reinforcement.
- (iii) Where existing reinforcing is also removed as part of the demolition work the Engineer will provide construction drawings for the fabrication and placement of new reinforcing steel.

(b) Preparatory Works

No new concrete shall be placed until all preparatory work described below is properly completed and approved by the Engineer.

- (i) All formwork and falsework or other means of temporary support shall be of sufficiently rigid construction as to prevent distortion of the forms from all expected construction loads. All forms shall be securely fixed in place to the correct lines and levels and so constructed and maintained as to avoid grout loss due to opening of the joints. Internal surfaces of the form work shall be free of all loose material, dirt, wire and reinforcing off cuts and shall be treated with an approved form oil.
- (ii) The connecting face of the old concrete shall be roughened, cleaned from loose material, tidied and sprayed with water until the run off water is clear. The connecting face shall be given a coat of mortar prior to the placement of fresh concrete.
- (iii) Existing reinforcement that is to be retained in the new construction shall be cleaned of all old concrete, oil, grease and rust scale. New reinforcement where required, shall be fabricated, placed and secured according to the spacing and cover requirements detailed on the reinforcing drawings furnished by the Engineer. All other requirements with respect to new reinforcement, with the exception of the method of payment, shall be as detailed in Section 7.3 of these Specifications.

(c) Placement of New Concrete

Replacement concrete shall be of a minimum strength of K250 or as other-wise directed by the Engineer. Materials for concrete and the mixing, batching, placement, compaction, finishing, curing and testing of the new concrete construction shall comply with requirements of Section 7.1 of these Specifications and shall be to the satisfaction of the Engineer.

Placement of new concrete shall be carried out during daylight hours unless the approved construction schedule for bridge maintenance works referred to in Article 8.5.1.9 necessitates placement of concrete at night. In this case adequate lighting shall be provided to the satisfaction of the Engineer.

#### 8.5.3.6 Replacement of Expansion Joint Sealant

Replacement of expansion joint sealing materials may be instructed by the Engineer when the existing seal has cracked, has de-bonded from one face of the joint, has been damaged or ripped out by the continual effect of passing traffic, is in a brittle condition due to the passage of time and the effect of inclement weather conditions or passes surface water to the bearings or substructure. Replacement may also be necessary as a consequence of the repair of damaged or cracked concrete sections adjacent to the joint.

##### (a) Preparatory Works

Damaged or defective expansion joint sealant shall be raked out from the joint using appropriate hand tools. Care shall be taken during making operations to ensure that the concrete surfaces forming the joint are damaged to the least extent possible and that preformed filler material beneath the sealant is left intact and in place.

The raked joints shall be cleaned free of all loose old sealant, spalled concrete, dirt or other debris using compressed air or such other methods as the Engineer may allow to leave a clean joint suitable for the application of new sealant material.

##### (b) Joint Filling

The prepared joint shall be filled with a pourable joint filler material conforming to the requirements of AASHTO M173 (ASTM D1190). The selected material shall in every respect be suitable for the prevailing weather and traffic conditions, the dimensions of the joint to be filled, the expansion characteristic of the joint and any other requirements specified by the Engineer. Filling of the joint shall be carried out to the satisfaction of the Engineer using application guns or pourable containers strictly in accordance with the manufacturer's recommended procedures.

### **8.5.4 REINSTATEMENT OF TIMBER COMPONENTS**

#### 8.5.4.1 Description

The reinstatement work covered by this Article primarily includes for the removal and replacement of existing worn, decayed, fractured or broken bridge deck planking, bearers and other structural support timbers. It may also include the cleaning and repainting of the bridge timbers and the removal and replacement of corroded structural fasteners and other connection hardware.

#### 8.5.4.2 Dimensional Variations

Where the Engineer directs that a bridge deck shall be removed and replaced in total, the dimensions and road elevation of the replacement bridge deck shall be in line with the general dimensions and levels that existed before replacement, unless the use of larger cross section timbers is authorized by the Engineer. In this case the Engineer will issue appropriate details in accordance with Article 8.5.1.3 of these Specifications.

#### 8.5.4.3 Removal, Demolition and Disposal of Existing Timber

The removal and demolition of timber from existing bridge structures shall be carried out to the requirements of Section 7.15 of these Specifications and to the following additional requirements :

- (a) The removal of timber components and the demolition of a timber structure, either in part or in whole, shall be carried out in a safe and controlled manner by workers with sufficient experience and training in demolition procedures to the complete satisfaction of the Engineer. When requested by the Engineer the demolition procedure proposed by the Contractor, including all necessary safety provisions, methods of temporary support and the method of disposal of materials, shall be approved by the Engineer prior to the commencement of demolition operations.
- (b) All broken, worn and decayed material removed from the existing structure shall be burned or otherwise disposed of to the satisfaction of the Engineer.
- (c) Where complete demolition of a bridge structure has been authorized, any demolished materials found to be in a suitable condition for reuse in the replacement bridge decking, may, subject to the approval of the Engineer, be reused in non-structural locations.
- (d) Under no circumstances shall corroded, bent, broken or otherwise damaged metal fixings, nails, washers, etc, be allowed to be reused in the reinstatement works.

#### 8.5.4.4 Materials for Reinstatement Work

- (a) Lumber and Timber (Solid Sawn)

Sawn lumber and timber shall conform to the requirements for Structural Timber, Lumber and Piling, as specified in AASHTO M168, or shall be equivalent locally available timber or lumber acceptable to the Engineer. Structural lumber and timber, or solid sawn lumber, shall not be used in exposed permanent locations without adequate preservative treatment. Temporary structures of lumber and timber with adequate heartwood requirements (see AASHTO M168) need not require preservative treated lumber and timber.

- (b) Structural Shapes

Rods, plates and structural shapes for connections shall be of structural steel conforming to the requirements of AASHTO M162 and shall in all respects be acceptable to the Engineer.

- (c) Hardware

Machine bolts, drift bolts, and dowels may be either wrought iron or medium steel Washers may be cast iron ogee or malleable iron castings, or they may be cut from medium steel or wrought-iron plate, as directed by the Engineer.

Machine bolts shall have square heads and nuts, unless otherwise directed by the Engineer. Nails shall be cut or round wire of standard form.

Unless otherwise specified all hardware for treated timber bridges shall be either galvanized or cadmium plated.

Nails, bolts, dowels, washers and lag screws may be black or galvanized, as directed by the Engineer.

- (d) Paint

When paint treatment for timber bridge decking is called for on the Drawings, or is directed by the Engineer, the paint shall conform to the specification for white and Tinted Ready-Mixed Paint (Lead and Zinc Base), AASHTO M70. The paint as specified is intended for use in covering previously painted surfaces. When it is

applied to unpainted timber, turpentine and linseed oil shall be added as required by the character of the surface in an amount not to exceed 1/8 Litre per each Litre (one pint per each gallon) of the paint as specified. The paint shall be either white or tinted as directed by the Engineer.

(e) Timber Connectors

Connectors for timber bridge decking, when called for on the Drawings, shall be of any approved manufacture acceptable to the Engineer and may of the following types:

- (i) Split Ring Connectors manufactured from hot rolled, low carbon steel conforming to AASHTO M162.
- (ii) Tooth-Ring Connectors manufactured from hot rolled sheet steel conforming to AASHTO M162.
- (iii) Shear-Plate Connectors of the Pressed Steel Type manufactured from mild steel conforming to AASHTO M162 or the Malleable Iron Type manufactured according to AASHTO M106 for malleable iron castings.
- (iv) Spike-Grid Connectors manufactured according to AASHTO M106 for malleable iron castings.

Connectors for treated timber structures, except those of malleable iron, shall be galvanized in accordance with AASHTO M111 (ASTM A123).

8.5.4.5 Storage of Material

Lumber and timber stored on the site shall be kept in orderly piles or stacks. Untreated material shall be open stacked on supports at least 30 centimetres above the ground surface to avoid absorption of ground moisture and permit air circulation and it shall be so stacked and stripped as to permit free circulation of air between the tiers and courses. In some cases protection from the weather by a suitable covering may be directed by the Engineer.

8.5.4.6 Workmanship

(a) General

- (i) All lumber and construction timber shall be accurately cut and framed to a close fit so that all joints shall have an even bearing over their entire contact surface. No shimming shall be permitted in making joints, and all joints shall be closed.
- (ii) Unless otherwise directed by the Engineer, nails and spikes shall be driven with just sufficient force to set the heads flush with the surface of the wood.
- (iii) Holes for round drift bolts and dowels shall be bored with a bit 2 mm less in diameter than the bolt or dowel to be used. The diameter of holes for square drift bolts or dowels shall be equal to the least dimension of the bolt or dowel.

Holes for machine bolts shall be bored with a bit of the same diameter as that of the bolt to be used. The diameter of holes for rods shall be 2 mm greater than the body of the screw at the base of the thread.

When the use of galvanized hardware is specified, then all holes shall be drilled 1½ mm greater than the bolt size.

- (iv) Washers of the size and type shown on the Drawings shall be placed under all bolt heads and nuts. All nuts shall be fully tightened to provide proper bearing and excess bolt lengths of more than 2.3 cm shall be cut off. After tightening, all nuts shall be effectively checked or burred with a pointing tool to prevent loosening.

(b) Treated Timber

(i) Handling

Treated timber shall be carefully handled without chopping, breaking of outer fibers, bruising, or penetrating the surface with tools. It shall only be handled with rope slings, hooks shall not be used.

(ii) Framing and Boring

As far as practicable cutting, framing end boring of treated timbers shall be completed in accordance with the shop drawings or other approved construction details before treatment.

(iii) Cuts and Abrasions

All cuts and abrasions, after having been carefully trimmed, shall be covered with 2 applications of a mixture of 60 percent creosote oil and 40 percent roofing pitch or brush coated with at least two applications of hot creosote oil and covered with hot roofing pitch.

(iv) Bolt Holes

All bolt holes bored after treatment shall be treated with creosote oil by means of an approved pressure bolt hole treated. Any unfilled holes, after being treated with creosote oil, shall be plugged with creosote plugs.

(v) Countersinking

All recesses for countersinking in treated timber shall be painted with hot creosote oil. Recesses likely to collect injurious materials shall be filled with hot pitch,

(vi) Temporary Attachments

Whenever, with the approval of the Engineer, forms or temporary braces are attached to treated timber with nails or spikes, the holes shall be filled by driving galvanized nails or spikes flush with the surface or plugging the holes as specified in Article 8.5.4.6.(b).(iv).

(c) Untreated Timber

In structures of untreated timber the following surfaces shall be thoroughly coated with two coats of hot creosote oil before assembly ends, tops, and all contact surfaces of sills, caps, floor beams, and stringers. The back faces of bulkheads and all other

timber which is to be in contact with earth, metal, or other timber shall be similarly treated.

Bolts passing through non-resinous wood shall be galvanized.

#### 8.5.4.7 Painting

Rails and rail posts of untreated timber, shall be painted with three coats of paint of the type specified in Article 8.5.4.4.(d) of these Specifications.

Parts of the structure, other than rails and rail posts, which are to be painted, shall be as designated on the Drawings or as directed by the Engineer.

Metal parts, except hardware and any specified galvanized components, shall be given one coat of shop paint and, after erection, two coats of field paint of a type suitable for the protection of metal parts and acceptable to the Engineer.

All paint shall be applied by approved means in strict conformity to the paint manufacturer's recommended application procedure or as otherwise directed by the Engineer.

#### 8.5.4.8 Construction Details for Timber Bridge Decks

##### (a) Stringers

Stringers shall be placed in position so that knots near edges shall be in the top portion of the stringer.

Outside stringers may have butt joints with the ends cut on a taper, but interior stringers shall be lapped to take bearing over the full width of the floor beam or cap at each end. Where the use of untreated stringers has been approved by the Engineer, the lapped ends shall be separated at least 12 mm for the circulation of air and shall be securely fastened by drift-bolting where specified. When stringers are two panels in length the joints shall be staggered.

Cross bridging between stringers shall be neatly and accurately framed and securely toe nailed with at least two nails in each end. All cross bridging members shall have full bearing at each end against the sides of stringers. Unless otherwise specified in the Drawings, or directed by the Engineer, cross bridging shall be placed at the center of each span.

##### (b) Plank Floors

Planks shall be of the grade required as specified in Article 8.5.4.4.(a) of these Specifications.

Single plank floors shall consist of a single thickness of plank supported by stringers or joists. The planks shall be carefully graded as to thickness and so laid that no two adjacent planks shall vary in thickness by more than 2 mm. Each plank shall be laid heart side down, with 6 mm openings between planks for seasoned material and tight joints for unseasoned material, and shall be securely spiked to each joist.

Two ply plank floors shall consist of two layers of flooring supported on stringers or joists. The top course may be laid either diagonal or parallel to the center line of the roadway with each floor plank securely fastened to the lower course. End joints shall

be staggered at least one metre. If the top layer of flooring is placed parallel to the center line of the roadway, special care shall be taken to securely fasten the ends of each plank. At each end of the bridge the ends of the planks shall be beveled.

(c) Laminated or Strip Floor

The strips shall be of the grade required as specified in Article 8.5.4.4.(a) of these Specifications. The strips shall be placed on edge, at right angles to the center line of the roadway. Each strip shall be spiked to the preceding strip at each end and at approximately 0.5 metre intervals with the spikes driven alternately near the top and bottom edges. The spikes shall be of sufficient length to pass through two strips and at least half-way through the third strip.

If timber supports are used, every other strip shall be toe nailed to every other support. The size of the spikes shall be as shown on the Drawings or as directed by the Engineer. When specified on the Drawings, the strip shall be securely attached to steel supports by the use of approved galvanized metal clips. Care shall be taken to have each strip vertical and tight against the preceding one, and bearing evenly on all the supports.

(d) Wheel Guards and Railing

Wheel guards and railing shall be accurately framed in accordance with the Drawings or directions of the Engineer and shall be erected true to line and grade. Wheel guards shall be laid in sections not less than 3.7 metres long.

## **8.5.5 REINSTATEMENT OF STEEL COMPONENTS**

### 8.5.5.1 Description

The reinstatement work covered by this Article primarily includes the cleaning and surface preparation of damaged or weathered existing protective paint finishes and the application of new prime and finish paint treatments, and the repair of damaged galvanized surface coatings. It may also include miscellaneous local repairs to damaged, or cracked steel sections, the removal and replacement of corroded structural fasteners and other miscellaneous repairs. For all such miscellaneous local repairs the Engineer will issue appropriate instructions including, where necessary, supplementary specifications for the execution of the work.

### 8.5.5.2 Suitability of New Paint Treatments

Where reinstatement works to existing painted surfaces are specified, the Engineer will provide the Contractor with details of the technical specification for the existing paint treatment, where such information is available. In the event that this information is not available the Contractor shall carry out suitable trials to determine that the proposed new paint treatment to be applied is compatible in every respect with the existing treatment. The application of new paint coatings will not be permitted until after the Engineer has witnessed and approved the results of such trials.

### 8.5.5.3 Temporary Works

All cleaning, preparation, painting and other miscellaneous reinstatement works shall be carried out in a safe, efficient and orderly manner and with the minimum disruption to

traffic. Scaffolding or other temporary works shall be provided by the Contractor to afford convenient and safe access to all parts of the structure requiring reinstatement work. Such temporary works shall be erected by the Contractor according to all normal construction practices with respect to safety provisions for construction staff and the public using the bridge, and shall in every respect be to the satisfaction of the Engineer. In certain situations the Engineer may request that the Contractor prepare and submit drawings of the proposed temporary works for his approval. In this case the erection of such temporary works shall not be commenced until after the Contractor has received the Engineer's approval.

#### 8.5.5.4 Surface Preparation

Existing surfaces to be painted shall be thoroughly cleaned by removing all rust, dirt, oil, grease, and other foreign substances to the satisfaction of the Engineer. The amount of surface preparation work required in any given location will vary according to the severity of weathering and for corrosion that has taken place within the existing protective coating or steel surface, and must be suitable for the type of new paint treatment to be applied. Surface preparation works for local repairs to either painted or galvanized existing surfaces shall be carried out in such a manner as to ensure that the edge of the retained surface coating is suitably feathered so as to provide a smooth transition for the application of the reinstatement paint treatment.

Unless instructed otherwise by the Engineer, the Contractor may use any of the following methods for achieving an acceptable prepared surface :

##### (a) Solvent Cleaning

Solvent cleaning shall be used prior to and in conjunction with any of the other methods of surface cleaning specified in this Article.

Soil, cement spatter, salts, or other foreign matter (other than grease or oil) shall be removed by, cleaning with solutions of alkaline cleaners, provided such cleaning with stiff fiber or wire brushes is followed by a fresh water rinse.

Oil or grease shall be removed by wiping or scrubbing the surface with rags or brushes wetted with solvent or by spraying the surface with solvent. When spray applications are used the final spray operation shall be carried out using clean solvent.

##### (b) Hand Tool Cleaning

Hand tool cleaning may be carried out using ordinary hand tools or small power assisted mechanically operated hand held tools. Power assisted hand tools will generally be used for areas of deep corrosive pitting and large areas of heavy surface corrosion whereas ordinary hand tools will generally be used for areas of slight surface corrosion and areas inaccessible for cleaning with the help of power assisted hand tools.

##### (i) Ordinary Hand Tools

Loose rust, loose paint and other detrimental foreign matter may be removed by wire brushing, sanding, scraping, chipping, hammering, or other methods using hand impact tools, or by any combination of these methods.

(ii) Power Assisted Hand Tools

Loose rust scale and paint may be removed with the use of such power tools as wire brushes, impact tools, grinders, sanders, or any combination of these tools. Power wire brushes shall be of the rotary cup type of suitable size for entering all accessible openings, angles, joints, and corners.

Power impact tools may include power driven chipping or scaling hammers, rotary scalers, single or multiple piston scalers, or other similar impact cleaning tools. Sand or other abrasive materials used in power sanding shall be discarded when they become ineffective.

The steel wires of both ordinary and power assisted wire brushes shall have sufficient rigidity to clean the surface, shall be kept free of excess foreign matter, and shall be discarded when they are no longer effective. Hand scrapers and the cutting edge of all power impact tools shall be kept sharp enough to be effective. All hand tools shall be used in such a manner that no bores or sharp ridges are left on the surface and no sharp cuts are made into the steel.

Upon the completion of hand tool cleaning operations, dust and other loose matter shall be removed from the surface. If detrimental amounts of grease or oil are still present the effected areas shall be spot cleaned with solvent.

(c) Blast Cleaning

For extensive areas of the structure with severely weathered existing surface coatings, the Engineer may approve the use of blast cleaning using portable blasting equipment. However, areas of excessive rust scale, shall preferably be removed using power assisted impact tools. When blast cleaning operations are approved the following requirements shall be observed;

- (i) All blast cleaning equipment shall be approved by the Engineer prior to use. The air compressors shall be capable of supplying a continuous air volume of at least  $6 \text{ m}^3/\text{min}$  at a minimum pressure of  $7 \text{ kg/cm}^2$  and the compressed air supply shall be free of detrimental amounts of water and oil.
- (ii) The abrasive employed in blasting shall be either graded steel grit or quartz sand, or similar, and shall be dry, clean, and free from soluble contaminants. Sand shall be used once only in blasting work.
- (iii) Blast cleaning shall as far as possible be carried out, in dry conditions, on fully dry surfaces and when there is no risk of rain or condensation.
- (iv) Blast cleaning shall not be carried out:
  - On surfaces that are moist or greasy, or that may become moist or greasy before the application of a primer.
  - When metal surface temperatures are less than 3 degrees Celsius above the dew point, or when the relative humidity of the air is greater than 85 %.
  - In proximity of surface coating operations or near other surfaces susceptible to dust and particle contamination.

- (v) When blast cleaning operations using dry sand or grit are employed, the finished surface, shall be brushed with clean brushes made of hair, bristle, or fiber, or blown off with compressed air (from which detrimental oil and water have been removed) for the purpose of removing any traces of blast products from the surface and also for the removal of abrasive from pockets and comers.
- (vi) When wet or water vapor sand blasting methods are employed the finished surface, shall be cleaned by rinsing with fresh water to which sufficient corrosion inhibitor has been added to prevent rusting, or with fresh water followed immediately by an inhibitive treatment, This cleaning shall be supplemented by brushing, if necessary, to remove any residue.
- (vii) Blast cleaned surfaces shall be examined for any traces of oil, grease or smudges deposited in the cleaning operations. If present, they shall be removed with solvent or a detergent solution. All blast cleaned surfaces shall be of a finish acceptable to the Engineer and must be approved by the Engineer prior to painting.

#### 8.5.5.5 Paint Treatment

Unless directed otherwise by the Engineer or dictated by the compatibility recruitment of an existing paint treatment that is to be over painted, the paint treatment for reinstatement works shall be as follows:

##### (a) Existing Painted Surfaces

###### (i) Prime Coat

The prime coat shall consist of a solvent borne inorganic zinc silicate which is suitable for application by airless-spray to a minimum dry film thickness of 75 microns. The paint shall conform to a minimum product solids limit of 63 % when measured by volume according to ASTM D2697 - 73 and a metallic zinc content of a minimum of 85 % when measured by weight.

A proprietary product such as Hempel's GALVOSIL 1570, or equal is approved for use for prime coats.

###### (ii) Finish Coat

The finish coat shall consist of a 2 pack high build epoxy polyamide pigmented with aluminum in order to provide low permeability and to give the surface a grey aluminum finish. The paint shall conform to a minimum product solids limit of 70 % when measured by volume according to ASTM D2697 - 73 and shall be suitable for application by air less spray to a minimum dry film thickness of 125 microns.

A proprietary product such as HENPADUR 4511, or equal is approved for use for finish coats.

##### (b) Existing Galvanized Surfaces

The prepared surface shall receive two coats of a zinc rich primer to a combined minimum dry film thickness of 150 microns.

#### 8.5.5.6 Storage of Materials

All paint and thinner should preferably be stored under dry well ventilated conditions that are free from excessive heat, sparks, flame, or the direct rays of the sun.

All containers of paint should remain unopened until required for use and any containers which have been opened shall be used first. Paint which has livened, gelled, or has otherwise deteriorated during storage shall not be used.

#### 8.5.5.7 Mixing of Materials

All paint shall be mixed strictly in accordance with the manufacturer's recommendations and in general conformity to the following provisions:

- (a) All ingredients in any container of paint shall be thoroughly mixed before use and shall be agitated often enough during application to keep the pigment in suspension. Paint mixed in the original container shall not be transferred until all settled pigment is incorporated into the vehicle.
- (b) The paint shall be mixed in a runner which will ensure the breaking up of all lumps, complete dispersion of settled pigment, and will produce a uniform composition. If mixing is done by hand, most of the vehicle shall be poured off into a clean container. The pigment in the paint shall be lifted from the bottom of the container with a broad, flat paddle, lumps shall be broken up, and the pigment thoroughly mixed with the vehicle. The poured off vehicle shall then be returned to the paint with simultaneous stirring or repeated pouring from one container to another until the composition is uniform. The bottom of the container shall be inspected for unmixed pigment.
- (c) Where a skin has formed in the container, the skin shall be cut loose from the sides of the container, removed and discarded. If such skin is thick enough to have a detrimental effect on the composition and quality of the paint, the paint shall not be used.  
When the use of thinner is permissible, the thinner shall be added to the paint during the mixing process strictly in accordance with the manufacturer's recommendations. Additional thinner shall not be added to the paint after it has been thinned to the correct consistency.

#### 8.5.5.8 Equipment

All equipment used for the spray application of paint shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gauges. The air caps, nozzles, and needles shall be those recommended by the manufacturer of the equipment for the material being sprayed.

Traps or separators shall be provided to remove oil and water from the compressed air. Such traps or separators shall be of adequate size and shall be drained periodically during painting operations. The air from the spray gun impinging against the surface shall show no water or oil.

All equipment shall be maintained in a satisfactory condition to permit proper paint application and all spray guns, hoses and pumps shall be clear before new material is added.

#### 8.5.5.9 Application of Paint

(a) General

Paint shall be applied by brush or airless spray or a combination of these methods. For the products referenced in Article 8.5.5.5 above the use of airless spray application is strongly recommended. Daubers or sheepskins may be used when no other method is practicable for proper application in places of difficult access.

To the maximum extent practicable, each coat of paint shall be applied as a continuous film of uniform thickness over the entire surface. Skips, runs, sags and drips shall be avoided wherever possible and shall be removed and the surface re-coated when they do occur. On beams and irregular surfaces, edges shall be allowed to dry for the time period specified by the Manufacturer or as directed by the Engineer before the application of any succeeding coat.

Each coat of paint shall be in a proper state of cure and shall be free from all pin holes, pores, voids, bubbles and other surface defects before the application of the succeeding coat. Any such defects shall be repaired at the Contractor's expense.

(b) Timing of Application

The prime coat of the paint treatment shall be applied as soon as possible after the surface has been cleaned and before deterioration of the surface occurs. Any oil, grease, soil, dust, or foreign matter deposited on the surface after the surface preparation has been completed shall be removed prior to the application of a new coating. In the event that rusting occurs after completion of the surface preparation, the surfaces shall again be cleaned in accordance with Article 8.5.5.4. Any blast cleaned area not having received a prime coat within a time period of 4 (four) hours shall be blast cleaned again.

Particular care shall be taken to prevent the contamination of cleaned surfaces with salts, acids, alkali, or other corrosive chemicals. Should such contamination occur the contaminant shall be removed from the surface before the next coat is applied. In the event that such contamination occurs on the surface of the base metal, the prime coat of paint shall be applied immediately after the surface has been cleaned.

For optimum results the time interval between the application of coats must not exceed the recommended time interval specified by the Manufacturer.

(c) Climatic Restrictions

Painting shall be carried out only under such climatic conditions as approved by the Engineer. In all situations, the surface must be completely dry, and its temperature should be at least 3 degrees Celsius above the dew point. No coating shall be applied when the relative humidity is outside the limits specified by the Manufacturer and immediately prior to rain.

No coating shall be applied during fog, mist, rain or when there is a likelihood of a detrimental change in the weather conditions within 2 hours after the application. The Engineer will suspend the application of a coating when, in his opinion, damage to the coating may result from actual or impending weather condition

Any prime coat which is exposed to excess humidity, rain or other detrimental weather conditions before drying shall be allowed to dry, the damaged areas of primer shall be removed, and the surface again prepared and primed.

(d) Brush Application

Paint applied by brush shall be worked into all crevices and corners where possible and any surface not accessible to brushes shall be painted by spray, daubers, or sheepskins. During painting operations all runs or sags shall be brushed out leaving a finished surface containing a minimum of brush marks.

(e) Spray Application

Paint ingredients, particularly those containing heavy pigments that tend to settle, shall be kept properly mixed in the spray pots or containers during paint application either by continuous mechanical agitation or by intermittent agitation of a frequency as required by the Manufacturer's application instructions.

The pressure on the material in the spray pot shall be adjusted when necessary for changes in elevation of the gun above the pot. The atomizing air pressure at the gun shall be high enough to atomize the paint properly but not so high so as to cause excessive fogging of paint, excessive evaporation of solvent, or loss by over spray.

During application, the spray gun shall be held perpendicular to the surface and at a distance which will ensure that a wet layer of paint is evenly deposited on the surface. The spray pattern shall be adjusted so that overlapping occurs at the edge of each spray run and the trigger of the gun should be released at the end of each stroke.

8.5.5.10 Thickness of Coatings

The specified dry film thickness for the coating materials shall be strictly observed. Film thickness measurements shall be taken using appropriate film thickness gauges furnished by the Contractor that have been suitably calibrated for the specified thickness range to be checked.

For large areas of surface covering the thickness measurements shall be taken according to the following procedure:

- (a) 5 sets of readings (each set consisting of 3 spot readings) shall be taken on ten square Metre surface areas selected at random.
- (b) The number of 10 square Metre areas shall be such that they total at least 5% of the total area to be painted.
- (c) Abnormally high or low spot readings shall be discarded prior to determining the average Group Reading for the 5 sets.

The acceptable tolerance limits for the measured thickness shall be according to Table 8.5.5.1 below :

Table 8.5.5.1 Minimum Allowable Dry Film Thickness

<b>Specified Minimum Dry Film Thickness</b>	<b>Minimum Allowable Spot Reading</b>	<b>Minimum Allowable Group Reading</b>
25	20	25
50	40	50
75	60	75
100	80	100
125	100	125
150	120	150
175	140	175
200	160	200
250	200	250

The maximum dry film thickness shall be as close to the specified minimum as possible, Areas where total measured dry film thickness (Group Readings) is more than twice the specified minimum are unacceptable and must be redone completely unless specifically approved otherwise by the Manufacturer and accepted by the Engineer.

When the measured dry film thickness is less than that specified, additional coats shall be applied as required at no additional cost to the Contract. Particular attention shall be paid to obtaining the frill film thickness on all corners, edges and welding, etc.

## **8.5.6 MEASUREMENT AND PAYMENT**

### **8.5.6.1 Pricing and Payment Philosophy**

It is anticipated that the majority of work designated by the Engineer as reinstatement works, under this Section of the Specifications, will involve reinstatement operations to the bridge superstructure. In general such work shall be paid for from the Contract Unit prices bid for the Pay Items listed In Article 8.5.6.6 of these Specifications.

However, in certain circumstances, where in the opinion of the Engineer the established Unit Prices do not adequately cover a designated reinstatement operation, such as the supply and erection of replacement structural steel members, the provision of special craneage or temporary support works, or reinstatement operations required to the substructure, such works shall be priced and paid for in accordance with various Pay Items to be used in the Works, or if necessary with Section 9.1, Daywork.

When issuing construction details for bridge works in accordance with Article 8.5.1.3, the Engineer shall clearly define whether the work is categorized as improvement or reinstatement works and for work to be performed under this Section of the Specifications shall clearly nominate the applicable method of payment to be used.

Because the reinstatement works for bridge superstructures executed under this Section of the Specifications may be of a varied and localized nature, the Unit Prices bid for the Pay Items listed in Article 8.5.6.6 shall be deemed or the Engineer to include for all operations necessary to successfully complete such reinstatement work. The Engineer will not entertain any additional claim from the Contractor for additional compensation on account of the variable and localized nature of the work.

8.5.6.2 Measurement of Reinstatement Works for Concrete Bridge Decks

Reinstatement works to concrete bridge decks shall be measured for payment as the actual number of square metres of plan surface area of concrete bridge deck satisfactorily completed and accepted in writing by the Engineer.

Measurement for payment on the basis of square metres of concrete bridge deck shall be deemed to provide full compensation to the Contractor for all operations performed in the sealing of surface cracks with a pourable cement grout or by injection of epoxy resin grout, the resurfacing of aggregate exposed surfaces, the repair of spalled concrete, the removal or demolition of existing concrete, the placement of new concrete, and/or the removal and replacement of cracked or brittle expansion joint sealant, for all concrete components located above bearing level requiring reinstatement including the bridge deck slab, sidewalk, curbs and balustrade.

No additional measurement or allowance shall be made for the disposal of demolished materials, the cleaning and preparation of existing surfaces, the provision of formwork, the supply and placement of new reinforcement or any other ancillary operations incidental to the satisfactory completion of reinstatement works to concrete bridge decks, the cost of this work being deemed to be included in the Unit Price bid per square Metre of bridge deck.

8.5.6.3 Measurement of Reinstatement Works for Timber Bridge Decks

Reinstatement works to timber bridge decks shall be measured for payment as the actual number of square metres of plan surface area of timber bridge deck satisfactorily completed and accepted in writing by the Engineer.

Measurement for payment on the basis of square metres of timber bridge deck shall be deemed to provide full compensation to the Contractor for all operations performed in the removal and disposal of existing worn, decayed or damaged material and the furnishing fabricating, treating, erecting and finishing of all new components located above bearing level, including timber deck planking, curbs, sidewalk planking, hand railing and all associated structural fasteners and other connection hardware.

8.5.6.4 Measurement of Reinstatement Works for Structural Steel Surface Coatings

Reinstatement works to structural steel surface coatings shall be measured for payment as the actual number of square metres of surface area of structural steel satisfactorily completed and accepted in writing by the Engineer.

Measurement for payment on the basis of square metres of surface area of structural steel shall be deemed to provide full compensation to the Contractor for all operations performed in the cleaning and preparation of existing surfaces and the furnishing, storing, mixing applying, finishing, curing and testing of new surface coating materials as specified in this Section of the Specifications or such other surface coating materials approved by the Engineer.

No Additional measurement or allowance shall be made for the provision, erection, maintenance and dismantling upon completion of any scaffolding required for the satisfactory completion of reinstatement works to structural steel surface coatings, the cost of this work being deemed to be included in the Unit Price bid per square Metre of surface area.

#### 8.5.6.5 Measurement of other Miscellaneous Reinstatement Works

Reinstatement work to existing bridge structures designated by the Engineer as falling outside the scope of work included in Articles 8.5.6.2, 8.5.6.3 and 8.5.6.4 shall be measured for payment in accordance with various Pay Items to be used in the Works, or if necessary with Section 9.1 of these Specifications.

Such reinstatement work falling into this category may include, but shall not be limited to any or all of the following operations:

- (a) The supply and operation of craneage.
- (b) The supply, erection, maintenance and dismantling of special false work arrangements.
- (c) The supply and operation of other special temporary works such as hydraulic jacks.
- (d) The fabrication, supply, erection and finishing of replacement structural steel members.
- (e) The local in situ repair of damaged or cracked structural steel sections or welds.
- (f) The removal and replacement of corroded structural fasteners in structural steel bridges.
- (g) The repair and/or replacement and resetting of metal expansion joints in the bridge deck.
- (h) The unfreezing or replacement and lubrication of non functional metal expansion bearings.
- (i) The repair and/or removal and replacement of damaged elastomeric bearing pads.
- (j) The fabrication, supply, erection and finishing of replacement drainage piping.
- (k) All reinstatement works required to a bridge substructure.
- (l) River training works to prevent scour around piers and abutments.

#### 8.5.6.6 Basis of Payment

The quantities as determined 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 furnishing all material, equipment, tools and labor and for all other costs necessary or usual for the proper completion of the reinstatement works in accordance with the requirements of this Section of the Specifications or the directions of the Engineer.

Pay Item No.	Description	Unit of Measurement
8.5.1	Reinstatement of Concrete Bridge Decks	Square Metre
8.5.2	Reinstatement of Timber Bridge Decks	Square Metre
8.5.3	Reinstatement of Structural Steel Surface Coatings	Square Metre