

TECHNICAL SPECIFICATION

PROJECT TITLE : **REPAIR OF SETTLED BACK-UP AREA
PORT OF DEL CARMEN**

SCOPE OF WORK

The work includes the furnishing of labor, materials and equipment required to carry out the proposed Repair of Settled Back-up Area, Port of Del Carmen as shown in the plans and as provided in this specification.

GENERAL REQUIREMENT

During the execution of work, the contractor shall see to it that the site must be free of dirt and debris at all times.

REINFORCED CONCRETE

a) Cement :

Cement used shall be Type I Portland Cement throughout the work.

All cement shall be used within two months of the date of the manufacture.

b) Coarse Aggregates

Coarse Aggregates shall be 25mm uniform size washed, well graded, hard pieces of gravel, crushed gravel, or rock conforming with no decomposed stones.

c) Fine Aggregates

Fine Aggregates shall be washed sand, stone screenings or other inert materials of same characteristics, or any combination thereof composed of clean, hard, strong uncoated grains and free from injurious amount of dust, lumps of clay, shale, alkali, and organic matter. Beach sand shall not be used.

d) Admixtures

Unless otherwise required by field conditions admixtures may be used subject to the expressed approval of the Engineer. The cost thereof shall be considered as already included in the unit cost bid of the Contractor for the concrete.

e) Mixing of concrete

All concrete used shall be machine-mixed at the site. Each batch shall be mixed at the mixer's design speed, for at least 1 ½ minutes after all concrete materials are simultaneously placed in the mixer. The ideal rotation speed of the mixer shall be between 14 and 20 rpm.

All mix contents of the mixer shall be thoroughly removed before any succeeding batch is placed. The materials for the first batch shall contain sufficiently excess

cement, sand and water to coat the inside walls of the mixer without reducing the required mortar content of the mix. The mixer shall be provided with devices for accurately measuring and controlling the amount of water used in each batch and for automatically recording the number of revolutions of the mixer. Clean, fresh portable water is to be used for the mixing of concrete. Hand mixing of concrete will only be allowed in case of mixer breakdown, in which case it shall be stopped as soon as pouring for the particular section is completed, or at a construction joint as directed by the Engineer.

f) Designed Strengths of Concrete

Concrete shall develop a minimum 28-days cylinder strength of 3,500 psi, unless otherwise indicated in the drawing.

g) Reinforcement bars

All bars reinforcements shall have deformed surfaces. Deformed billet bars for concrete reinforcement shall have a minimum yield strength of 274 MPa. Tie wires to be plain, cold drawn annealed steel wire, 1.6mm diameter. Bent bars cold in a manner which will not injure the materials. Bending hot at cherry red heat will not be allowed. No form oil shall run to the reinforcement and other embedded steel rebars. Bar bending shall conform to standard bends. Splicing and or overlapping at construction joints and at points where steel stress has fallen to less than half the allowable stress shall be no less than 40 D.

FORMS AND SCAFFOLDINGS

All forms and scaffoldings to be used in the work must be designed, and constructed by the contractor for rigidity and adequacy for carrying the loads of the green concrete and / or additional superimposed construction loads. The Authority may from time to time verify the adequacy and safety of such temporary works and may require the contractor to submit detailed designed drawings of forms and scaffoldings/ false works proposed to be used. Approval of such drawings or design of forms however, shall not relieve the contractor of his liability on resulting imperfections or damages to the finished concrete, or other damages which may directly result there from.

Forms may be re-used but shall be scrapped by a wire brush of all clinging mortar. Bulges should be planed and realigned prior to its use.

Prior to placing concrete, form surfaces should be oiled for easy form removal. However, the oil coating should not be so thick as to stain and soften the concrete surface. Oil coatings should be applied before rebars are in place.

CURING AND WATERPROOFING

All concrete shall be cured for at least 14 days after the date of placing in accordance with approved and accepted methods.

PLACING OF REINFORCEMENT

Metal reinforcement shall be placed as accurately detailed on drawings and properly secured by approved means.

All bars shall be cold bent unless approved otherwise by the Engineer. Minimum distance between parallel bars shall be one and one-half (1 ½) times the diameter for round bars. The clear distance between bars shall not less than 2.54 cm. (1 in) nor less than one and one-third (1 1/3) times the maximum size of the coarse aggregates, whichever is bigger.

All reinforcing steel shall be cleaned of all rust or scale and deleterious materials which tend to destroy the bond between the concrete and the steel.

PAVEMENTS

SCOPE OF WORK

The works include the furnishing of all labor, materials and equipment required for the preparation of base course and concrete pavement together with concrete curb. The works shall be in accordance with the lines and grades shown on the Drawings or as directed by the Engineer and in conformity with these Specifications.

MATERIALS REQUIREMENTS

Aggregate Base Course

It shall consist of hard, durable particles or fragments of stone or gravel crushed to the size and of the quality requirements of this Clause. It shall be clean and free from vegetable matter lumps or balls of clay and other deleterious substances. The material shall be of such nature that it can be compacted readily to form a firm stable base.

The base material shall conform to the grading requirements of table 24.2 whichever is called for in the Bill of Quantities.

Table 24.2 Base Course Grading Requirements

<u>Sieve Designation</u> Standard MM	Alternative US Standard	<u>Mass Percent Passing</u>	
		Grading A	Grading B
37.5	1-1/2"	100	
25.0	1"	-	100
19.0	¾"	60-85	-
12.5	½"	-	60-90
4.75	No. 4	30-55	35-65
.425	No. 40	8-25	10-30
0.075	No. 200	2-14	5-15

The portion of the material passing the 0.75 mm (No. 200) sieve shall not be greater than 0.067 (two-thirds) of the fraction passing the 0.425 mm (No. 40) sieve.

The portion of the material passing the 0.425 mm (No. 40) sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 6 as determined by AASHTO and 90, respectively.

The coarse aggregate retained on a 2.00 mm (No. 10) sieve shall have a mass percent of wear not exceeding 45 by the Los Angeles Abrasion Test as determined by AASHTO T 96, and not less than 50 mass percent shall have at least one (1) fractured face.

The material shall have a loss of less than 12 percent when subject to five cycles of the Sodium Sulfate Soundness Test according to AASHTO T 104.

The material passing the 19 mm (3/4 inch) sieve shall have a minimum soaked CBR-value of 80% tested according to AASHTO T 193. The CBR- value shall be obtained at the maximum dry density determined according to AASHTO T 180, Method D.

If filler, in addition to that naturally present, is necessary to meet the grading requirements or for satisfactory bonding, it shall be uniformly blended with the crushed base course material on the road or in a pugmill unless otherwise specified or approved. Filler shall be obtained from sources approved by the Engineer, free from hard lumps and shall not contain more than 15 percent of material retained on the 4.75 mm (No. 4) sieve.

Portland Cement Concrete Pavement

1. Cement

Portland cement shall conform to the requirements of Section 3 "Reinforced Concrete".

2. Fine Aggregate

The fine aggregate shall be well-graded from coarse to fine and shall conform to the requirements of Section 3.

3. Coarse Aggregate

Coarse aggregate shall conform to the requirements of Section 3.

4. Water

Clean, fresh, potable water shall be used for the mixing of all concrete and mortar and shall be from a source approved by the Engineer. Sea water or brackish water shall not be used.

5. Admixture

Admixture shall only be used with the written permission of the Engineer. If air-entraining agents, water reducing agents, set retarders or strength accelerators are permitted to be used, they shall not be used in greater dosages than those recommended by the manufacturer, or as permitted by the Engineer. The cost shall be considered as already in the Contractor's unit cost bid for concrete.

6. Tie Bars and Dowels

Tie bars for joints shall be deformed steel bars conforming to the requirements specified in AASHTO M 31 or equivalent, sizes as indicated on the Drawings or

as approved by the Engineer. The deformed steel bars shall be Grade 40 and shall be shipped in standard bundles, tagged and marked in accordance with the Code of Standard practice of the Concrete Reinforcement Steel Institute.

Dowel bars shall be plain steel bars conforming to the requirements specified in AASHTO M 31 or equivalent.

7. Joint Filler

Poured filler for joint shall conform to the requirements of AASHTO M173.

Preformed fillers for joints shall conform to the requirements of AASHTO M 33, AASHTO M 153, AASHTO M 213 or AASHTO M 220 whichever is specified in the Drawings or ordered by the Engineer. The filler for each joint shall be furnished in single piece for the depth and width required for the joint unless otherwise authorized by the Engineer.

Curb

1. Class of Concrete

Concrete material shall conform with the requirements of Section 21 "Reinforced Concrete".

Minimum 28 days comprehensive strength :	24 MPA
Maximum Aggregate size :	25 mm.
Maximum Water – Cement Ratio :	0.52

Mortar Base

Cement mortar shall be composed of one (1) part Portland cement and three (3) parts fine aggregate by volume and sufficient water to make the mortar of such consistency that can be handled easily and spread with a trowel.

Form

Form shall be wood or metals as approved by the Engineer and shall be straight, free from warp and of adequate strength to resist distortion.

METHOD OF CONSTRUCTION

Subgrade on Fill

After the fill has been completed, the full width shall be conditioned by removing any soft or other unstable material that will not be compacted properly. The resulting areas and all other low sections, holes or depressions shall be brought to grade with suitable materials. The entire roadbed shall be then shaped and compacted, scarifying, blading, dragging, rolling or other methods of works shall be performed or used as necessary to provide a thoroughly compacted roadbed shaped to the cross section shown on the Drawings.

Proof Rolling

Unless otherwise ordered by the Engineer, a variable-load pneumatic tired roller shall be used to proof roll the subgrade. The roller shall have a load variable within the range of (at least) from 10 to 45 tonnes, on an overall width not greater than 3.2 m and shall have tires whose pressures are variable up to not less than 620 KN per square meter. The wheels shall be in one row and shall be capable of considerable vertical movement relative to each other without appreciable variation in loading either by each supporting a separate ballast unit, or by virtue of an efficient interconnecting suspension system. The ballast shall be in a form which permits rapid adjustment of load.

The total loaded weight and tire pressure used at any time shall be as directed by the Engineer. The pneumatic tired roller shall not be towed over completed subbase or surfacing without prior approval of the Engineer on each occasion. The proof rolling shall consist of one pass of the roller along the center of each lane of the traveled way.

Protection of Completed Works

Any part of the subgrade that has been completed shall be protected and any damage resulting from negligence on the part of the Contractor shall be repaired by him as directed by the Engineer without additional payment.

The Contractor shall be responsible for all the consequence of traffic being admitted to the subgrade. He shall repair any ruts or ridges occasioned by his own traffic or that of others by reshaping and recompacting. He shall limit the amount of subgrade preparation to an area that can be maintained with the equipment available. He shall arrange for subgrade preparation and subbase placing to follow each other closely.

The subgrade when prepared too soon in relation to the laying of the subbase, is liable to deteriorate, and in such case, the Contractor shall, without additional payment, repair, reroll or re-compact the subgrade as may be necessary to restore it to the state specified herein.

Placing

The aggregate subbase material shall be placed as a uniform mixture on a prepared subgrade in a quantity which will provide the required compacted thickness. When more than one layer is required, each layer shall be shaped and compacted before the succeeding layer is placed.

Placing material shall begin at the point designated by the Engineer. Placing shall be from vehicles especially equipped to distribute the material in a continuous uniform layer or windrow. The layer or windrow shall be such size that when spread and compacted the finished layer shall be reasonably in close conformity to the nominal thickness shown on the Drawings.

When hauling is done over previously placed material, hauling equipment shall be dispersed uniformly over the entire surface of the previously constructed layer to minimize rutting or uneven compaction.

Spreading and Compacting

When uniformly mixed, the mixture shall be spread to the plan thickness for compaction. When the required thickness is 150mm or less, the material may be spread and compacted in one layer. Where the required thickness is more than 150mm, the aggregate subbase shall be spread and compacted in two or more layers of approximately equal thickness and the maximum compacted thickness of any one layer shall not exceed 150mm. All subsequent layers shall be spread and compacted in similar manner.

The moisture content of subbase material shall be adjusted prior to compaction by watering with approved sprinklers mounted on trucks or by drying out, as required in order to obtain the required density.

Immediately following final spreading and leveling, each layer shall be compacted to the full width by means of approved compacted equipment. Rolling shall progress gradually from the sides to the center, parallel to the centerline of the road and shall continue until the whole surface has been rolled. Any irregularities or depressions that develop shall be corrected by loosening the material at these places and adding or removing material until the surface is smooth and uniform. Along curbs, headers and walls and at all places not accessible to the roller, the subbase material shall be compacted thoroughly with approved mechanical tampers or compactors.

If the layer of subbase material or part thereof, does not conform to the required finish, in the opinion of the Engineer, the Contractor shall, at his own expense, make the necessary corrections.

Compaction of each layer shall continue until field density of at least 100 percent of the maximum dry density determined in accordance with AASHTO 180, Method D has been achieved. In-place density determination shall be made in accordance with AASHTO T 191 for every 300 square meters.

Trial Sections

Before subbase construction is started, the Contractor shall spread and compact trial section directed by the Engineer. The purpose of the trial section is to check the suitability of the material and efficiency of the equipment and construction method which is proposed to be used by the Contractor. Therefore, the Contractor must use the same for the same material, equipment and procedures that he proposed to use for the main work. One trial section of about 500 sq.m. shall be made for every type of material and/or construction equipment/procedure proposed for use.

After final compaction of each trial section, the Contractor shall carry out such density tests and other tests required as directed by the Engineer.

If a trial section that the proposed materials, equipment or procedures, in the Engineer's opinion, are not suitable for subbase, the material shall be removed at the Contractor's expense, and a new section shall be constructed.

If the basic conditions regarding the type of material or procedure change during the execution of the work, new trial section shall be constructed.

Opening to Traffic

The pavement shall be closed to traffic, including the vehicles of the Contractor, for a period of 10 days after the concrete is placed or longer if in the opinion of the Engineer, the weather conditions make it necessary to extend this time. The Contractor shall furnish, place and maintain satisfactory barricades and lights as directed, to exclude all traffic from the pavement.

Any damage to the pavement due to traffic shall be repaired or replaced at the expense of the Contractor. Paving mixers, mechanical concrete spreaders and finishers and other heavy paving equipment shall not be operated on completed concrete lanes in order to construct alternate lanes until after the regular curing period is completed. Even then, planks shall be laid on the finished pavement or other precautions taken to prevent damage to the concrete pavement.

Pavement Smoothness, Thickness and Tolerance


Portland cement concrete pavement shall be constructed to the designed level and transverse slope shown on the Drawing. The allowable tolerance shall be as listed hereunder:

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|---|----------|
| a) Permitted variation from design thickness of layer | + - 5 mm |
| b) Permitted variation from design level of surface | + - 5 mm |
| c) Permitted surface irregularity measured by 3m straightedge | + - 6 mm |
| d) Permitted variation from design crossfall or camber | + - 0.2% |

GALVANIZING

Hot-Dipped galvanizing of steel gratings shall conform to the requirements of ASTM A 123. The required weight of the zinc coating for each type of material category with corresponding range of thickness shall comply with STM A 123.

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