



RFQ-PAL-0000166164: Paving Agricultural Roads Using Recycled Crushed Concrete In Different Locations Of Gaza Strip



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Package # 10: Paving of Agricultural roads using recycled crushed concrete in Gaza Strip.

1 -SUB BASE AND BASE COURSE

1.1 General

Locating sources and manufacturers of materials are the responsibility of the contractor.

Prior to starting quarry or borrow pit operations, the contractor shall obtain written permission from the Authorities or Owner concerned.

The contractor shall submit to the Engineer, 10 days prior to the scheduled beginning of crushing and screening, a statement of origin of all stone and/or gravel aggregates and granular materials.

The contractor shall submit for testing and approval, representative samples of all materials needed. Samples shall be taken by the contractor in the presence of the Engineer. Approval of specific sources of materials shall not be considered as final approval.

The contractor may conduct necessary tests in the Field Laboratory in the presence of the Engineer and the contractor's Materials Engineer.

Samples shall satisfy all specified test requirements. The contractor shall furnish all necessary labor, transport, tools and equipment required by the Engineer.

1.2 Granular Material for Sub-Base

Granular material for use in sub-base courses shall be naturally occurring gravel, blended as necessary with fine or coarse material and screened to produce the specified gradation. Crushing of natural granular material shall not normally be required, unless for the purpose of meeting the gradation requirements, or when shown on the Drawings (to produce a higher quality sub-base with improved mechanical stability).

Gravel shall consist of hard, durable and sound stones, free from deleterious substances not mentioned below.

Other requirements are:

Crystalline gypsum (expressed as SO ₃)	5% max.
Clay lumps and friable particles	10% max.

Flakey and elongated particles

Crushed rock	40% max. Each
Crushed gravel	45% max. Each
Natural gravel	50% max. Each

Determined in accordance with BS812 Section 105.1: 1985 and BS812 Part 1 1975)

Maximum dry density

Maximum dry density is 2.05gm/cm³ as min.

Chart content (determined by percentage by weight insoluble in hydrochloric acid) should be specified in special technical specification.

Granular materials delivered to the road site shall meet the requirement of class A or B as shown in Table 3.1, when tested in accordance with AASHTO T-27 after dry mixing and just before spreading and compacting. The Class of granular material to be used shall be as shown on the Drawings or otherwise as selected by the Engineer. The actual gradation shall, in all cases, be continuous and smooth within the specified limits for each Class. If gradation is tested after compaction, a tolerance of 3% is allowed in the upper limit for the percentage of material passing sieve no. 200.

Gradation of Granular Material by Class, shown table 13-1

Table 13-1: Gradation of Granular Material by class

Sieve Designation (Square openings)	Percent by weight passing	
	Class A	Class B
63 mm (2-1/2 in.)	100	
50 mm (2 in.)	80-100	100
37.5 mm (1-1/2 in.)	70-95	80-100
25 mm (1 in.)	55-90	60-95
12.5 mm (1/2 in.)	45-75	47-80
4.75 mm (No.4)	30-60	30-60
2.00 mm (No. 10)	22-48	22-45
0.425 mm (No.40)	10-30	10-30
0.075 mm (No. 200)	5-12	5-12

Sand equivalent

The material shall contain a minimum of 25% sand equivalent at any stage of construction.

Loss weight of granular material

The loss weight of granular material shall not exceed 45% after 500 revolution, when tested in accordance with AASHTO T 96 (Los Angeles Abrasion Test).

$$\text{The ratio of wear loss} = \frac{\text{Abrasion after 100 Rev.}}{\text{Abrasion after 500 Rev.}}$$

Should not be more than twenty percent of the maximum allowed abrasion after 500 revelations.

Soaked CBR

The granular material shall have a 4-day soaked CBR of not less than 30 when compacted at 100% of modified proctor AASHTO (T 180-D) and tested in accordance with AASHTO T 193.

Soundness

When tested for soundness in accordance with AASHTO T 104, the material shall not show signs of disintegration and the percentage loss in weight after 5 cycles shall not exceed 12% in the case of the sodium sulphate test and 18% in the case of the magnesium sulphate test.

Portion of granular material

The portion of granular material, including any blended material, passing the 0.425 mm (No. 40) mesh sieve shall have a liquid limit (L.L) of not more than 27 and a plasticity index (P.I.) not greater than 6 when tested in accordance with AASHTO T 89 and T 90. Non-Plastic condition might be accepted if crushed limestone is used provided that angularity test (R) value shall not be less than 8.

Additional fine material

If additional fine material is required to correct the gradation of the granular material, or for adjusting the L.L. or P.I. of the fraction passing 0.425 mm (No. 40) sieve, it shall be uniformly blended and mixed with the granular material. Additional fine material for these purposes shall be obtained from the crushing of stone, gravel, or slag, if naturally occurring fine materials not available.

1.3 Aggregate for Base Courses:

Aggregate for use in base course construction shall be crushed stone, and may be washed, if directed, to remove excessive quantities of clay, silty clay or salts.

It shall consist of hard durable and sound particles or fragments of stone, free from other substance. Other requirements are gypsum, or flaky particles.

Other requirements

Gypsum content (expressed as SO₃) 2 % max.

Clay lumps and friable particles 8 % max.

Elongated and flakey particles for crushed rock (Determined in accordance with BS 812 Part 1: 1975)

Granit and Basalt 40 % max each.

Lime stone 35 % max

Minimum dry density (g/cm³) 2.15 % min

Linear shrinkage not exceed 3%

Gradation of Base course Aggregate by class, shown in table 13-2.

Table 13-2: Gradation of Base course Aggregate by class

Sieve Designation	Percent by weight passing	
	Class A	Class B
50 mm (2 in)		100
37.5 mm (1.5 in)	100	70-100
25 mm (1 in)	75-100	55-85
19 mm (3/4 in)	60-90	50-80
12.5 mm (1/2 in)	45-80	
9.5 mm (3/8 in)	40-70	40-70
4.75 mm (No 4)	30-65	30-60
2 mm (No 10)	20-40	20-50
0.425 mm (No 40)	8-20	10-30
0.075 mm (No 200)	5-10	5-15

The material shall contain a minimum of 40% sand equivalent at any stage of construction.

The loss weight shall not exceed 40 % after 500 revolutions, when tested in accordance with AASHTO T96 (Los Angeles Abrasion Test).

The ratio of wear loss should not be more than twenty percent of maximum allowed abrasion after 500 revolutions.

The crushed aggregate base course material shall have a 4-day soaked CBR of not less than 80 when compacted at 100 % of modified proctor AASHTO (T 180-D) and tested in accordance with AASHTO T 193.

When tested for soundness in accordance with AASHTO -104, the material shall not show signs of disintegration and the loss by weight shall not exceed 12 % in case of the sodium sulphate test, and 18 % in the case of the magnesium sulphate test.

The portion of aggregate, including any blended material passing the 0.425 mm (No. 40) sieve shall have a liquid limit (L.L.) of not more than 25 and plasticity index (P.I.) of not more than 6, and not less than 3 when tested in accordance with AASHTO T 89 and T 90.

If additional fine material is required to correct the aggregate gradation or for adjusting the L.L or P.I. of fraction passing the 0.425 mm (No 40) sieve, it shall be uniformly blended and mixed with the aggregate material.

Elongated and flakiness not to exceed 35% for each.

1.4 GRANULAR SUB-BASE COURSES

1.4.1 Scope

These Works shall consist of furnishing granular sub-base material of the required Class, mixing, spreading on prepared sub-grade, compacting and finishing, all as and where shown on the Drawings.

1.4.2 Materials

All materials shall conform to the relevant requirements of Section "Materials", in respect of granular material Class A or Class B for sub-base construction.

1.4.3 Sub-grade Surface Preparation

The sub-grade shall have previously been constructed in accordance with the requirements of Section "Sub-grade Construction and Topping" and properly maintained and kept well drained thereafter.

At all special grade control points, such as at bridge structures, existing pavements, etc. The sub-grade shall be lowered to a depth sufficient to permit construction of the sub-base course to the specified elevations and thickness.

Transitions shall be of sufficient length to avoid abrupt change of grade and shall be within plus or minus 3% of the final design grade unless otherwise directed. Surplus material shall be removed and disposed of.

The sub grade shall be inspected and approved immediately prior to commencement of sub-base construction. Any soft, yielding material shall be removed and replaced by approved topping material. Holes, depression and other irregularities shall be made good as directed and the sub-grade re-compacted as necessary and finished ready to receive the sub-base course.

1.4.4 Equipment

Equipment used to handle, place, spread, water, compact and finish sub-base shall conform to the requirements of Section "Contractor's Plant and Equipment" and with the Contractor's approved Work Program.

1.4.5 Construction

1.4.5.1 Stockpiling of Granular Material

Stockpiling procedures shall conform to the relevant requirements of Section "Materials".

Methods used for stockpiling granular material and removing it from stockpiles shall not result

in significant degradation or segregation nor the introduction of significant amounts of foreign materials or extraneous matter.

Granular material adversely affected, in the opinion of the Engineer, by stockpiling or handling procedures shall be incorporated in the Works regardless of previous approval of such material, until the deficiencies have been rectified in an acceptable manner.

1.4.5.2 Mixing and Spreading

All components of sub-base course material shall be mixed thoroughly and uniformly with water in situ. The amount of water added, as approved by the Engineer, shall be such that the material will be uniform and within the specified moisture content range at the time of compaction. Wetting of granular material in stockpiles or in trucks before or during delivery to the Site will not be permitted. However, water shall be added to the material, if necessary, during placing and compaction of sub-base material.

The sub-base material shall be placed on the subgrade in a uniform two layers each 150 mm thickness (after compaction).

If approved, heavy duty vibratory compaction equipment is used, the sub base may be in one 300 mm layer (after compaction) provided compaction tests with appropriate testing equipment indicate that the specified compaction standard will be attained and uniform throughout the thickness.

The sub-base material shall be placed to the required width using a self-propelled spreader or motor grade equipped with blade extensions. Water shall be applied by approved spraying equipment and thoroughly mixed with the sub-base material.

The material shall not be bundled in such a way as to cause segregation. If the spreading equipment causes segregation in the material, or leaves ridges, or other objectionable marks on the surface which cannot be readily eliminated or prevented by adjustment of the equipment, the use of such equipment shall forthwith be discontinued and it shall be replaced by a spreader or grader capable of spreading the material in proper manner.

All segregated material shall be removed and replaced with well-graded material. "Skin" patching will not be permitted. Only minor surface manipulation and watering to achieve the required surface tolerances will be permitted during the compaction process.

Neither hauling nor placement of material will be permitted when, in the judgment of the Engineer, the weather or surface conditions are such that hauling operations will cause cutting of the subgrade or cause contamination of the sub-base material.

1.4.5.3 Compaction

The Contractor shall plan the sequence of operations so that the least amount of water will be

lost by evaporation from uncompleted surfaces, If the Contractor delays placing of succeeding layers of material to the extent that additional water is required to prevent raveling or excessive drying, the application of such water shall be carried out as directed and at the Contractor's expense.

The sub-base material shall be compacted by means of approved compaction equipment, progressing gradually from the outside towards the center, with each succeeding pass uniformly overlapping the previous pass.

Rolling shall continue until the entire thickness of each sub-base layer so thoroughly and uniformly to 100% AASHTO T 180 (Method D) maximum density. Final rolling of the completed course shall be by means of an approved self-propelled roller. Rolling shall be accompanied by sufficient blading, to insure a smooth surface, free from ruts or ridges and having the proper shape. When additional water is required, it shall be applied in an approved manner.

Any areas inaccessible to normal compaction shall be compacted by use of portable mechanical tampers until the required standard of compaction is achieved.

Each layer shall be completely compacted and approved prior to delivery of materials for the subsequent layer.

Prior to placing a subsequent layer, the existing surface shall be made sufficiently moist as directed, to ensure proper bond between the layers.

The edges and slopes of the sub-base course shall be bladed or otherwise dressed to conform to the lines and dimensions shown on the Drawings and to present straight, neat lines and slopes as free of loose material as practicable.

Material which has dried out prior to final compaction, or which has dried and compacted subsequent to final compaction, shall be watered and recompactd using approved equipment and procedure. If the Contractor is unable to return the material to its original or specified condition with respect to compaction, thickness and surface tolerances, the Contractor shall remove the material and reconstruct the sub-base course on a re-approved sub grade.

1.4.5.4 Tolerances

The fully compacted and completed sub-base course shall conform to the lines, grades and cross sections as shown on the Drawings.

The elevations of the finished sub-base course shall be checked by the Contractor in the presence of the Engineer at maximum intervals of 10 m and at intermediate points as directed.

The tolerance on elevations of finished surface shall be plus 10 mm to minus 20 mm, minus

tolerance shall be compensating by the proceeding layer.

When the finished surface is tested with a 3 m long straightedge, placed parallel to, or at right angles to the centerline, the maximum deviation of the surface from the testing edge between any 2 contact points shall not exceed 10 mm.

All areas which exceed the specified tolerances shall be corrected by removing the defective sections of sub-base and reconstructing them or, if approved, by adding new material mixing and re-compacting and finishing to the specified standard.

1.4.5.5 Maintenance of Completed Sub-base

Following completion and acceptance of the sub-base course, it shall be maintained by the Contractor at his own expense. The sub-base shall be bladed, broomed and otherwise maintained, keeping it free from raveling and other defects until such time as the base course is placed. Water shall be applied at such times and in such directed by the Engineer.

1.4.6 Testing

Every 500 linear meter of sub-base material or whenever there is a change in the material source shall be subject to a full set of tests after mixing in situ and, if found satisfactory, shall be approved for compaction. This approval shall not deem to constitute acceptance of the sub-base course.

Sampling and testing shall conform to the relevant requirements of Section 1.05- "Control of Materials and Standards for Sampling and Testing".

Compaction shall be tested in accordance with AASHTO T 191 or AASHTO T 205. If there is a delay between the construction of any layer and the following layer, if necessary and required by the Engineer the compaction of the lower layer may be recertified to ensure that it has not loosened due to traffic, passage of construction equipment, adverse weather conditions or otherwise.

1.5 AGGREGATE BASE COURSES

1.5.1 Scope

These works shall consist of furnishing crushed aggregate base course material of class a, mixing, spreading, compacting and finishing, all as and where shown in the Drawings.

1.5.2 Surface Preparation

The sub-grade surface shall be inspected and approved prior to commencement of base construction, Holes, depressions and other irregularities shall be made good as directed an the sub-grade re-compacted as necessary and finished ready to receive the base course layer.

1.5.3 Equipment

Equipment used to handle, place, spread, water, compact and finish base course in accordance with contractor's Work program approved by the Engineer.

1.5.4 Construction

1.5.4.1 Stockpiling of Base Course Material

Stockpiling method of aggregates and moving them from stockpiles shall not result in significant degradation or the introduction of significant amounts of foreign materials. Aggregate materials adversely affected, in the opinion of the Engineer, by stockpiling or handling procedures shall not be incorporated in the works regardless of previous approval of such material until the deficiencies have been rectified in an acceptable manner.

1.5.4.2 Mixing and Spreading

Base course material shall be mixed with water to reach the specified moisture content range at the time of compaction. The mixed material shall be handled and placed on subgrade in a uniform layer as to not cause segregation. All segregating material shall be removed and replaced with well-graded material, "Skin" patching will not be permitted and spread to the required width and shall be delivered such that it is ready for compaction without farther shaping.

1.5.4.3 Compaction

The contractor shall plan the sequence of operations so that the least amount of water will be lost by evaporation from uncompleted surfaces.

The base course material shall be compacted by means of approved compaction equipment, progressing gradually from the outside towards the center, with each succeeding pass uniformly overlapping the previous pass. Rolling shall continue until the entire thickness of each base layer is thoroughly and uniformly compacted to 100% AASHTO T 180 (Method D) maximum density:

The edges and edge slopes of the base course shall be bladed or otherwise dressed to conform to the lines and dimension shown on the Drawings.

Materials which have dried out prior to final compaction, or which has dried and decompact subsequent to final compaction, shall be watered and recompact. If the contractor failed to return the material to its original or specified condition with respect to compaction, thickness and surface tolerance the contractor shall scarify the material and reconstruct the base course on a re-approved subgrade surface or to the satisfaction of the Engineer.

1.5.4.4 Tolerances

The dully-compacted base course shall conform to the lines, grades and cross sections as shown in the drawings.

The elevations of base course shall be checked at intervals of 20 m on straight and 10 m on curves, the tolerance on elevations of surface shall not exceed +10 mm or -05 mm, and not exceed 12 mm between any two contact points tested with a 4 m long straight edge placed parallel to, or at right angles to center line.

All areas which exceed the specified tolerances shall be scarified and corrected to specified standard.

1.5.4.5 Maintenance of Completed Base Course

Following completion and acceptance of base course, it shall be maintained by contractor at his own expense. The surface shall be broomed and rolled keeping it free from defects until such time as the following course is placed. Water shall be applied at such times and in such quantities as directed.

1.5.5 Testing

Sub base and base Course material shall be tested in accordance with the table shown below at stock pile and at the mixing plant for control on site tests, and if satisfactory shall be approved for use. This approval shall not be deemed to constitute acceptance of base course for full payment purposes.

Required Tests and Minimum Repetition for Base course material, shown in table 13-3.

Table 13-3: Required Tests and Minimum Repetition for Base course

Source of Materials		Control on Site (The Road)	
Required Test	Repetition Required for all Test	Required Tests	Repetition Required for all Test
1-Gradation of materials	* Test for each source	1. Proctor	* test for every 500 Lm for each layer * when materials changed
2- Plasticity Index	* for every 1000 m ³	2. Gradation of materials	
3- Abrasion	* When materials changed or every 1000 m ³	3. Plasticity Index	

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4- C.B.R.		4. C.B.R.	
5- Sand equivalent		5. Abrasion	
6-Percentage of Fractured Grains		6. Sand equivalent 7. Clay Lumps & Friable particles 8. Field Density 9. Thickness	

Compaction test: for every layer at least 3 samples taken for one street or 1000 m² from layer area, or 200 linear meter of road which is smaller.

1.5.6 Measurement

1. The net area executed must be measured (without the area under the curb stone).
2. The area of manholes and gullies is to be deducted from measurement.