



Delhi Integrated Multi Modal Transit System Ltd.

(A Joint Venture of Govt. of Delhi & IDFC Ltd.)

Construction of Cement Concrete Approach Road at Kanjhawala Depot of DTC, New Delhi

BID DOCUMENTS

VOLUME 2

TECHNICAL SPECIFICATIONS

**1st Floor, Maharana Pratap Inter State Bus Terminus,
Kashmere Gate, Delhi-110006**

TECHNICAL SPECIFICATIONS

GENERAL

- 1.00 Unless otherwise specified in the nomenclature of individual item or in these specifications, the entire work shall be carried out as per CPWD specifications 2009 Volume I & II. The measurements of component of work shall be in metric units.
- 1.01 For the item not covered in the CPWD Specifications, the work shall be executed as per latest relevant standard codes published by BIS(formerly ISI) inclusive of all amendments issued thereto or revision, if any, upto the date of opening of tenders.
- 1.02 In case of BIS codes specifications are not available the decision of the Engineer based on acceptable sound engineering practice and local usage shall be final and binding on the contractor.
- 1.03 The rates of different items of works shall be for all height, lifts, leads and depths of the building except where otherwise specified in the item of work or in special conditions appended with the Tender.
- 1.04 All materials to be used in the works shall bear I.S. Certification marks unless otherwise the make specified in the item or special conditions appended with tender document. In case IS marked materials mentioned in the tender document are not used due to non availability, the materials used shall confirm to IS code applicable in this contract.
- In such cases the Engineer shall satisfy himself about the quality of such materials and give his approval in writing. Only articles classified as First Quality by the manufacturer shall be used unless otherwise specified.
- All materials not having IS marking shall be tested as per provision of the mandatory Tests in relevant IS specifications. The Engineer may relax the condition regarding testing if the quantity of materials required is small. For the products bearing ISI certification mark, no further testing is required at site. In all such cases of use IS certified materials proper proof of procurement of materials from authentic manufacturers shall be provided by the Contractor to the satisfaction of Engineer.
- 1.05 Unless otherwise specified in the bill of quantities the rates for all items of work shall be considered as inclusive of all operations required for which no extra payment will be made.
- 1.06 The contractor shall clear the site thoroughly of all the scaffolding materials and rubbish etc left out of his work and dress the site around the building to the satisfaction of the Engineer before the work is considered as complete.
- 1.07 The rates quoted for all the brick/concrete work shall be deemed to include making openings, shall cut, leave or form holes, recesses, chases etc and making good these with cement sand mortar (1:3)/PCC (1:2:4) or with the same specifications as directed by the Engineer. No extra payment shall be made to the Contractor on this account.

1.08 Where ever IS/BIS codes are mentioned in the CPWD Specifications or in these specifications the latest codes with up to date amendments shall be used.

1.09 MATERIALS

1.09.1 Water:

Clean, fresh, potable water confirming to Clause 4.3 of IS 456 shall be used for mixing all concrete, grout, mortar, curing, etc. This shall be free from all deleterious matter in solution or in suspension and obtained from an approved source.

1.09.2 CEMENT :

Cement used shall be ordinary Portland (43/53 grade) confirming to specification IS 8119 unless otherwise specified elsewhere. Contractor shall procure all the cement required for the project as the work proceeds at site.

1.09.3 COARSE AGGREGATE :

Shall consist of crushed or broken stone 95% of which shall be retained on 4.75 mm Sieve. It shall be obtained by crushing Granite, Quartzite, Trap, Basalt or similar approved stones from approved quarry and shall conform to IS : 381 and IS :515. Coarse aggregate shall be chemically inert when mixed with cement and shall be cubical in shape and free from soft, friable, thin, porous, laminated or flaky pieces. It shall be free from dust and any other foreign materials.

1.09.4 SAND :

Sand shall confirm to IS : 383 and relevant portion of IS 515. It shall be from natural source or crushed stone screening(if allowed), chemically inert, clean, sharp, hard, durable, well graded and free from dust, clay, shale, large pebbles, salt, organic matter, loam, mica or other deleterious matter.

1.09.5 BRICKS:

Bricks for general masonry works shall be first class well burnt, of uniform size and colour, free from cracks, flaws or nodules or free lime and emit clear ringing sound when struck. Fractured surface shall show uniform texture free from grit, lumps holes, etc. Compressive strength of brick shall be 75 kg/cm.sq., water absorption after 24 hrs immersion shall not exceed 15% by weight for common bricks and 12% for face bricks. Dimension tolerance shall not exceed 8% for of the size shown for common bricks and 3 % for face bricks. All bricks shall have rectangular face and sharp edges. The bricks shall show no efflorescence after soaking in water and drying.

Each brick shall have the manufacturers identification mark clearly on the frog.

1.09.6 SCAFFOLDING:

All the scaffolding before installation shall be checked by the Contractor's Engineer for their strength and fitness and tied up properly. Steel/Aluminum scaffolding is to be used. Where scaffolding is necessary, it shall be erected on double support, independent of the work having two sets of vertical supports. Holes shall not be made in the wall for support. Planks shall be fixed and tied together. In case of

finishing work such as plastering, painting, distempering, etc no part of the scaffolding shall touch the structure. Where ladders are used, gunny bags shall be tied up at the ends to protect any damage to work by sliding or tipping. In case of ceiling plaster stage scaffolding shall be provided and it shall be independent of walls.

1.09.7 PAINTS AND PRIMERS.

These shall be ready mixed of approved brands conforming to latest IS standard and in sealed tins.

1.09.8 C.I. RAIN WATER PIPES

These shall be of approved brand. If embedded in concrete or brick wall, these shall be C.I. Pipes with lead caulked joints.

1.09.9 Concrete Work/RCC Work.

All plain Concrete and RCC work shall be machine batched, machine mixed and machine vibrated. For all type of RCC work M 25 Design Mix concrete including admixture in recommended proportions (as per IS 9103) to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer. Cost of admixtures as required shall be deemed to be included in the quoted rates. Minimum cement content in Design mix shall be as per IS- 456-2000. Nothing extra shall be payable on this account.

Design mix shall be as specified in Para 5.8 including sub para's of CPWD specifications and relevant IS codes.

All concrete surfaces either cast in situ or precast shall have even, clean finish, free from honey combs, air bubbles, fins, or other blemishes. The form work joint marks for concrete work exposed to view should be rubbed out with corborundum stone and defects patched up with paste of 1 part sand and 1 part cement and cured. The finish shall be made to the satisfaction of the Engineer. Concrete surface to be subsequently plastered or where brick work shall be against it shall be adequately hacked as soon as the form is stripped off so that proper bond can be developed.

Curing and Protection of Concrete : All fresh concrete shall be covered with hessian or similar absorbent material and kept constantly wet for a period of 7 days or more from the date of placement of concrete as per direction of Engineer. Curing may also be done by ponding. Steps shall be taken to protect immature concrete from any type of damage that may impair the strength of concrete.

1.09.10 Reinforcement:

Steel reinforcement shall be of mild steel of tested quality confirming to IS- 432-1966, Grade I and hot Rolled High Yield Deformed bars as per IS 1139-1966 or cold worked steel high strength deformed bars as per IS 1786 -1979 (Grade Fe 415) as specified in bill of quantities/drawings. Contractors can use TMT bars of approved make on prior approval of Engineer.

If type of steel is not specified Contractor shall use High Strength deformed bars Gde 415 for reinforcement.

1.9.11 Bar Bending Schedule.

Contractor shall prepare bar bending schedules for prior approval of the Engineer. However, the approval does not relieve the contractor from his liability for bending, placing and binding reinforcements as per the approved drawings.

All bars shall be bent by machine or other approved means. Bends, hooks and shapes shall conform strictly to the dimension shown on drawings and unless otherwise mentioned, the binding dimensions shall conform to IS: 2502. All binding shall be done with 18 gauge annealed soft iron galvanised wire. When shown on drawing or instructed by Engineer, reinforcement shall be welded. The cover as shown on drawing shall be maintained by use of plastic spacers at approved spacing. Sufficient number of chairs and hangers shall be used to keep the reinforcement in position. No placing of concrete shall be done before the inspection and approval of reinforcement by Engineer.

The Contractor shall ensure that the reinforcement steel does not get rusted and shall properly store it. The contractor shall apply cement slurry to the bars as soon as it reaches site.

1.9.12 Formwork:

Formwork shall be substantially and rigidly constructed of steel. The formwork required shall be with proper bracings, prop, etc furnished by the contractor to ensure safety against bulging, deformation, sagging, joints shall be tight enough to prevent any leakage of water. Provision shall be kept for fixing of anchor bolts, sleeves or any inserts as per drawing or as directed by Engineer. The minimum period of stripping of the formwork may be extended by the Engineer, in which case Contractor would not get any extra payment.

1.9.13 Brick Work:

Bricks shall be well burnt, uniform in size and shape, red cherry or copper colour and should give clear ringing sound and of class designation 75 or as specified in BOQ. Bricks shall be laid in English Bond unless otherwise specified.

Joints should be raked to minimum depth of 15 mm with raking tool during progress of work. The thickness joint in brickwork shall not exceed 1 cm for all class of brickwork.

Top course of plinth, parapet, steps, window sills should be provided with header course.

Joints below ground level should be finished during progress of work.

The dates of execution of work should be painted / marked as the progress.

Partition walls not to be raised beyond lintel level before casting of roof.

1.9.14 Cement Plaster:

Portland Cement shall be thoroughly mixed with dry sand in the prescribed proportion as per BOQ/specifications. Water shall then be added gradually to make mixture homogeneous. The cement mortar shall be prepared in mechanical mixer.

The joints between the bricks will be raked out to depth of 20 mm and the surface shall be thoroughly watered and the cement mortar applied evenly on the surfaces to be plastered. The plastered surface shall be kept for a period of 7 days. The thickness of plaster shall be as specified in the BOQ item. The dates of plastering shall be marked/painted on the surface.

The rate shall include preparation of jamb carrier at the junction of walls, ceiling and beams and all corners. Rates also include providing of chicken mesh at junction of RCC and brick work and making of grooves at the junction of RCC and brickwork or in ceiling at the junction of walls and ceiling or as directed by Engineer.

2 **Testing of Materials.**

All materials used in the works shall be subject to inspection and tests. The contractor shall carry out sampling of such materials and making of concrete test cubes as and when ordered by the Engineer as per the appropriate Indian Standards and as directed by the Engineer. The contractor shall deliver the samples of materials and concrete test cubes in a manner as directed by the Engineer who will inspect the same and then order for testing of the materials and concrete cubes.

The contractor shall arrange for testing of materials normally at Station but samples may be sent to outside testing laboratories, if necessary. The delivery of the samples shall be undertaken by the contractor. The cost and charges for sampling of materials and concrete cubes and delivering the same to the office of the Engineer and / or other places including all incidentals in connection with the same as directed by the Engineer and the testing charges thereof shall be borne by the contractor and shall be deemed to be included in the rates and prices quoted in the Bill Of Quantities. The results of the tests carried out shall be binding on the contractor who shall comply with any rectification measures that the Engineer may deem fit and order to be executed by the contractor as a result of testing. The frequency and number of test of materials shall be as decided by the Engineer-in charge.

Frequency of tests:

At least one test consists of three sample specimen at random from each lot.

The samples shall be got tested from the test house as mentioned here

under:-

- a) Delhi Test House, 62/3 GT Karnal Road, Indl. Area, Delhi.
 - b) Recognised Engineering Colleges & institutes.
 - c) NCCBM, Ballabgarh, Haryana.
 - d) Shriram Laboratories New delhi.
 - e) Any other laboratories as decided by the Engineer.
- 3.0 Utilization, application mix proportion etc. of materials in waterproofing, repair & rehabilitation and carbon fibre wrapping works shall be as per manufacturer specification.
- 4.0 Old/ expiry date materials shall not be allowed to be used in the work.
- 5.0 Contractor shall be depute technically competent person for execute the job in the work.

6.0 CEMENT CONCRETE PAVEMENT UNDER CONTROLLED CONDITIONS

6.1 Materials

6.1.1 Cement

(a) Cement used on work shall be as per sub head cement concrete of CPWD specifications-2009 (Vol. – I).

6.1.2 Water : Water used on work shall conform to SH: cement concrete of CPWD, Specification 2009- Vol. I.

6.1.3 Coarse Aggregate : These shall be crushed or broken from hard stones obtained from approved quarry. These shall be clean strong, durable of fairly cubical shape and free from soft, friable, thin elongated and laminated disintegrated pieces. These shall also be free from dirt, organic deleterious and any other foreign matter and adherent coatings and shall satisfy the physical requirements laid down in para 16.37.19 under quality control.

6.1.4 Fine Aggregate : This shall be coarse sand conforming to CPWD Specification 2009 Vol- I.

6.1.5 Grading of Mixed Aggregates : The grading of all aggregates (coarse and fine aggregates) to be used in the work shall be determined in the laboratory. The coarse and fine aggregates shall be mixed in suitable proportions so that the grading of the mixed aggregates shall be in the range indicated in Table mentioned below.

TABLE

<i>I.S. Sieve Size (IS 460)</i>	<i>%age passing by weight</i>
45 mm	100
22.4 mm	55 - 60
11.2 mm	45 - 50
5.6 mm	35 - 40
2.8 mm	30 - 35
1.4 mm	20 - 25
710 microns	15 - 20
355 microns	10 - 14
180 microns	2 - 5

6.2 Mix Design

6.2.1 The mix shall be approved by Engineer-in-Charge so as to obtain the following mean strength that exceeds the minimum specified flexural strength by 1.64 times the designed standard deviation.

Minimum works beam flexural strength at 28 days = 300 kg/sqm. for M-30 or specified in item

Designed standard deviation = 60 kg/sqm. for M-30 or for specified grade(s)

Design flexural strength at 28 days = $300 + 60 \times 1.64 = 398.4$ kg/sqm. (f + 1.64 s) says 400 kg.

Water cement ratio by weight = 0.5

Minimum slump not more than 25 mm

6.2.2 For the purpose of tendering the contractor shall base his rate on the assumption that the Quantity of cement used for one cum. of finished concrete shall be 340 kg. or M - 30. If the actual quantity of cement required to be used as a result of the laboratory test is different from that assumed above, necessary adjustment in the cost due to short cement used shall be made on the basis of issue rate of cement including storage charges plus 2.5% for handling charges. However, under no circumstances the quantity of cement to be used shall either exceed 350 kg./cum or fall below 330 kg.per cum of finished concrete.

6.3 Statistical Field Check

6.3.1 Samples of concrete shall be taken at the mixer and works beams, made, cured and tested in accordance with IS 1199 and IS 516.

6.3.2 When a mix is used for the first time, it is important to get a large number of results, as soon as possible, in order to establish the level of control and then suitability of the mix proportions. A sample of concrete shall be taken at random on eight separate occasions during each of the first five days of using that mix. From each sample two beams shall be made one for test at 7 days and the other for test at 28 days.

6.3.3 The work beam results shall be examined both individually and in consecutive (but not overlapping) sets of four, for which the average and the range of each set is calculated. The mix proportions shall be modified to increase the strength, if in the first ten consecutive (but not overlapping)sets any of the following conditions are not satisfied.

(I) Each sample has a test strength not less than the minimum specified strength i.e. 30 kg/sq. cm. (or otherwise specified in item).

OR

(II) (a) Not more than two individual results (Not more than one of first twenty) of the 40 beams tests shall fall below the minimum work beam strength but they shall not be less than 80% of the Specified beam strength of 30 kg./sq. cm (or otherwise specified in item) or the minimum

Specified strength minus 1.35 times the standard deviation whichever is greater.

(b) No value of the range in any set shall exceed 3 times the designed standard deviation.

(c) The average for all samples (10 sets) shall not be less than the minimum specified strength i.e. 30 kg/sq. cm (or otherwise specified in item) plus 1.64 times the designed standard deviation 60 kg/sq.cm M-30.

6.3.4 If either of these conditions (16.37.3.3 I or 16.37.3.3 II) are not satisfied, the mix shall be modified and the procedure described above shall be repeated till results satisfying the above criteria's are obtained.

6.3.5 Subsequently samples shall be taken at the rate of one for every 30 cubic metre of concrete laid. Eight beam specimen shall constitute one sample. A set of 4 specimen shall be tested after 7 days and another set of 4 specimen shall be tested after 28 days. These test results shall be checked individually and in sets of four as the work progresses. If at any stage it is found that either of conditions 16.43.4.3,I or 16.4.3,II of CPWD Specification 2009 part-II, are not satisfied, the overall average and the standard deviation of the previous consecutive 40 beam test results including the non-complying set shall be calculated. If the overall average strength minus 1.64 times the standard deviation is more than the specified beam strength (30 kgm/sq.cm) (or otherwise specified in item) the concrete shall be accepted. But if it is less than the concrete work corresponding to these 40 beams tests shall be rejected and the mix proportion shall be modified forth with for further work. The rejected work shall be replaced by the contractor immediately at his own cost and expense.

6.3.6 The statistical field checks described in 6.3.1 to 6.3.2 are meant to control the quality of concrete. The standard of acceptance of concrete shall be governed by the provision of para 6.3.3 to 6.3.5.

6.4 Slump Test

The test shall be carried out as per IS 1199. A slump test shall be carried out at each mixer at least one in fifty batches mixed or more frequently if directed by the Engineer-in-Charge. Any batch from which slump test is being made shall not be transferred to the place of laying till the slump test has been completed. Not only the batch which gives a slumps in excess of that specified shall be rejected but the concrete already laid immediately preceding the batch tested upto the nearest last transverse joint may be rejected by the Engineer-in-Charge or his subordinate, if he is satisfied that such preceding batches were substandard in this respect. The decision of the Engineer-in-Charge in this respect shall be final and binding on the contractor. Such rejected concrete shall be removed by the contractor immediately and replaced with proper slump concrete at his cost and expense.

6.5 Steel Forms

6.5.1 All side forms shall be of mild steel. The steel forms shall be of M.S. Channel sections and their depth shall be equal to the thickness of the pavement.

6.5.2 The side forms shall have a length of at least 3.0 metres except on curves of less than 4.5 metres radius where shorter lengths may be used. When set to grade and stacked in place the maximum deviation of the top surface of any section from a straight line shall not exceed 3 mm. The method of connection between sections shall be such that the joint formed shall be free from play or movement in any direction. The use of bent, twisted or worn out forms shall not be permitted. At least three stake pockets for bracing pins or stakes shall be provided for each 3.0 M length of forms.

Bracing and supports must be ample to prevent the springing of forms under pressure of concrete or weight or thrust of the machinery (like screed vibrator) operating on the forms. Support to the forms shall be sufficiently rigid to hold them in position during the entire operation of laying and compacting and finishing and that they shall not at any time deviate more than 3 mm from straight edge 3 metres in length. Forms which show a variation from the required rigidity of the alignment and levels shown on the plans shall be reset or removed as directed. The length and number of pins or stakes shall be such as to maintain the forms at the correct line and grade.

6.5.3 The supply of forms shall be sufficient to permit their remaining in place for at least 12 hrs. after the concrete has been placed or longer, if in the opinion of the Engineer-in-Charge, it is necessary.

6.5.4 The top line of the forms is not to vary from the correct level or alignment and the levels and alignment of the forms are to be checked and corrected as necessary immediately prior to the placing of concrete. The top edges and faces of the forms are to be carefully cleaned and maintained in clean condition.

6.5.5 While removing the steel forms, care shall be taken to withdraw them gradually, any damage to the bull nosed edges shall be made good while the concrete is still green.

6.5.6 Setting of Forms

- (a) Setting of forms shall be according to the slab plan subject to the approval of Engineer-in-Charge and concreting shall not commence until the setting of forms is approved.
- (b) Forms shall be set for at least 50 metres in advance of the point where the concrete is being laid and shall not be removed until at least 12 hrs. of placing of the concrete or longer if in the opinion of Engineer-in-Charge is necessary.
- (c) After setting, the working faces shall be thoroughly oiled by using approved oil before concrete is placed against them.
- (d) The pavement joints of overlay layer would overlap with the joints of underlay cement concrete.

6.6 Batching and Mixing

As detailed in SH: 5 of reinforced cement concrete work of CPWD specifications 2009.

6.7 Placing of Concrete

As detailed in SH: 5 of reinforced cement concrete work of CPWD specifications 2009.

6.8 Compaction of Concrete

6.8.1 Compaction shall be carried out by electrically (or) diesel operated needle and screed vibrators as stipulated hereafter. Needle vibrator should be used all over the area for obtaining initial compaction of concrete. These should be of diameter not less than 4.5 cm. If the vibrator is pneumatic the pressure must not be below 4 kg/sq.cm. If electrically operated, they should have a minimum frequency of 3500 impulses per minute.

6.8.2 There should be at least three needle vibrators working in any bay. A vibrating screed consisting of a steel or timber section weighing not less than 15 kg. per metre with a tamping edge of not less than 7 cm width and having a vibrator mounted thereon shall follow needle vibrators to obtain full compaction. The face of the wooden tamping edge of the screed shall be lined with M.S.

Plate rigidly fixed by means of counter sunk screw. Where screed vibrators are used for compaction, a standby unit shall always be maintained ready for use, should the other one go out of order. Where electrically driven vibrators are employed, a standby diesel pneumatic unit shall be kept ready for use in case of power failure. At the discretion of the Engineer-in-Charge, for compaction at edges and joints, vibrators may be supplemented by hand tamping and rodding for securing satisfactory results. Under no circumstances, honey combing of concrete at joints or elsewhere shall be permitted.

6.8.3 When using screed vibrator for compaction it should not be dragged over the concrete. During the initial passes it shall be lifted to the adjacent forward position in short steps, subsequently, it shall be slowly slid over the surface with its axis slightly tilted away from the direction of sliding and the operation repeated until a close, dense surface is obtained.

6.8.4 Concreting shall be carried out in one operation between the expansion joints and construction joints without any break at the dummy joints.

6.8.5 Concrete shall be deposited on the base as near the joints as possible without touching them. It shall then be shoveled against the sides, maintaining equal pressure and deposited approx. 50 mm higher than the depth of the joints, care being taken that it is worked well around the joints. The concrete shall not be dumped from the bucket directly upon or against the joints.

6.8.6 Workmen shall not be allowed to walk on freshly laid concrete and proper cat walk shall be provided with independent supports beyond concreting bays.

6.9 Finishing of Concrete

6.9.1 During compaction, any low or high spots shall be made up by adding or removing concrete. After longitudinal floating has been completed but while concrete is still plastic, the slab surface shall be tested for trueness with a 3 m straight edge. Any depressions or high spots showing departure from the true surface shall be immediately rectified. High spots shall be cut down and refinished. Depressions shall be enlarged to about 8-10 cm and filled up with fresh concrete, compacted and finished.

6.9.2 The straight edge testing the refloating is to continue until the entire surface:

- (a) is free from observable departure from the straight edge,
- (b) conforms to the required levels and across section, and
- (c) shall conform to the specified surface when the concrete has hardened.

6.10 Brooming

6.10.1 After belting and as soon as the surplus water, if any, has risen to the surface, the pavement shall be given a broom finish with an approved steel or fiber broom not less than 45 cm wide. The broom shall be pulled gently over the surface of the pavement from edge to edge. Adjacent strokes shall be slightly overlapped. Brooming shall be perpendicular to the centre line of the pavement and so executed that the corrugations formed shall be uniform in character and width and not more than 1.5 mm deep.

6.10.2 Brooming shall be completed before the concrete reaches such a stage that the surface is likely to be torn or unduly roughened by the operation. The broomed surface shall be free from porous or rough spots, irregularities, depressions, and small pockets such as may be caused by accidental disturbing of particles of coarse aggregates embodied near the surface. The brooming shall be of uniform pattern all through.

6.10.3 Edging : After belting/brooming has been completed but before the initial setting of concrete, the edges of the slab shall be carefully finished with an edger of 6 mm radius, and the pavement edges shall be left smooth and true to line.

6.11 Honey Combing

6.11.1 The side forms shall not be removed until 12 hours or such longer period as the Engineer-in-Charge may decide after the laying of concrete.

6.11.2 As soon as the side forms are removed, any minor honey combed area shall be filled with mortar composed of one part of cement and two parts of fine aggregate. Major honey combing areas or segregated concrete or other defective work or areas damaged by removal of the forms or concrete damaged by rain or due to any other reason whatsoever shall be considered as defective work and shall be removed and replaced by the contractor at his own expense. The total area of honey combed surface shall not exceed 4 per cent of the area of the slab side. However, no individual honeycomb patch shall exceed 0.1 sqm. Engineer-in-Charge's decision as to whether the concrete is defective or not shall be final and binding.

6.12 Initial Curing

6.12.1 Immediately after completion of the finishing operations, the surface of the pavement shall be entirely covered with wetted burlap, cotton or jute mats. The mats used shall be of such length (or width) that as laid they shall extend at least 45 cm beyond the edges of the slab. The mats shall be placed so that the entire surface and both edges of the slab are completely covered. This covering shall be placed as soon as, in the judgment of the Engineer-in-Charge the concrete has set sufficiently to prevent damage to the surface prior to being placed, the mats shall be thoroughly saturated with water and shall be placed with the wettest side down. The mats shall be so placed and weighed down as to cause them to remain in intimate contact with the surface covered, and the covering shall be maintained full wetted and in position for 24 hours after the concrete has been placed or until the concrete is sufficiently hard to be walked on without suffering damage. Water shall be gently sprayed so as to avoid damage to the fresh concrete. If it becomes necessary to remove a mat for any reason, the concrete slab shall not be exposed for a period of more than half an hour.

6.12.2 Worn burlap or burlap with holes shall not be permitted. Burlap reclaimed from previous use other than curing concrete shall be thoroughly washed prior to use for curing purposes. If burlap is obtained in strips, shall be laid to overlap by at least 150 mm.

6.12.3 Burlap shall be placed from suitable bridges. Walking on freshly laid concrete to facilitate placing burlap shall not be permitted.

6.13 Final Curing

6.13.1 Upon the removal of the burlaps, the slab shall be thoroughly wetted and then cured as follows:-

All joints shall be filled with filler in order to prevent the edges of joints from getting damaged and entry of clay materials into the joints during final curing. Exposed edges of the slab shall be banked with a substantial berm of earth. Upon the slab shall then be laid a system of transverse and longitudinal dykes of clay about 50 mm high immediately covered with a blanket of sandy soil free from stones to prevent the drying up and cracking of clay. The rest of slab shall then be covered with sufficient sandy soil so as to produce a blanket of earth not less than 40 mm deep after wetting. The

earth covering shall be thoroughly wetted while it is being placed on the surface and against the sides of the slab and kept thoroughly saturated with water for 21 days and thoroughly wetted down during the morning of the 22nd day and shall thereafter remain in place until the concrete has attained the required strength and permission is given by the Engineer-in-Charge. Thereafter the covering shall be removed and the pavement cleaned and swept. If the earth covering becomes displaced during the curing period, it shall be replaced to the original depth and resaturated.

6.13.2 Contractor shall appoint chowkidars at his expense to prevent workmen, cattle, etc., straying on the pavement concrete.

6.13.3 Concrete shall not be subjected to any load or weight of any plant until at least 28 days after laying.

6.14 Construction Joints

6.14.1 Construction joints shall be provided as shown in the drawing and also at places where concreting is stopped due to unforeseen circumstances. The joints shall be straight and vertical through the full thickness of the slab. While concrete in adjacent bay is still green, flats of suitable size shall be drawn along the edge and a groove of size 10 mm x 25 mm deep shall be neatly formed and finished. The edges of the groove shall be full nosed. After curing of concrete is complete, this groove shall be thoroughly cleaned of all sand dust and shall be perfectly dried and filled with hot poured sealing compound conforming to grade B of IS 1834. Before filling with sealing compound the faces of concrete of the joint shall be coated with primer of approved brand to a depth of 25 mm at the rate of 2.6 liters per 10 square meters. Bitumen emulsion shall not be used as primer.

6.15 Dummy Joints

6.15.1 The joints shall be 10 mm wide and shall extend vertically from the surface of the slab to a depth equal to 1/3rd of the thickness of the slab but not less than 4 cm in any case. The joint may be formed by depressing into the soft but compacted concrete a high tensile M.S. or other approved Tee of flat bar of depth not less than required depth of the joint plus 25 mm. The bar used for forming the groove shall be coated with soft soap or other suitable lubricant to facilitate its removal when the steel Tee or flat is removed joints shall be neatly formed with proper tools and mortar/fine material from the slab itself. No additional cement mortar (rich or otherwise) shall be used.

6.16 Concreting during Rains

6.16.1 To prevent damage to freshly laid concrete during monsoon, or sudden rains, the contractor shall provide an adequate supply of tarpulines or other water proof covering material. Any concrete damaged by rain shall be removed and replaced by the contractor at his own cost as directed by the Engineer-in-Charge.

6.17 Defects Liability Period

6.17.1 This period shall be reckoned in the case of this work as one year from the date of completion of work and it shall be the liability of the contractor to repair, strengthen or reconstruct any portion of the work which has shown damage or any defect, arising out of any bad workmanship or defective material used in the work during this period. In the case of this rectification not being commenced by the contractor within 7 days from the date of notice from the Engineer-in-Charge and

completed expeditiously the Engineer-in-Charge reserves the right to get the repair work executed at the risk and cost of the contractor.

6.18 EXPANSION JOINT

6.18.0 Materials

Premoulded Joint Filler in Expansion Joint : It shall conform to IS 1838 (Pt. I). The thickness shall be 25 mm with tolerance 1.5 mm. and shall be of the maximum available standard length not less than one lane width. The filler board shall be positioned vertically with the prefabricated joint assemblies along the line of the joint within tolerance of + 10 mm from the intended line of the joint. The depth of board shall be 25 mm less than thickness of slab within a tolerance of ± 3 mm so that the top of the board shall be below the surface or will not impend the passage of the finishing straight edge or oscillating beam of the paving machine.

Bitumine Hot Sealing Compound : The joint sealing compound shall be fuel and heat resistant type complying to grade B of IS 1834. It shall be capable of adhering to the concrete without cracking, spalling and disintegration.

6.19 CONSTRUCTION PROCEDURE

6.19.1 Expansion joints shall be provided as shown in the drawing and as per directions of Engineer-in-Charge. All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement. The joint shall be 20 mm wide. The depth of the non-extruding filler pad shall be 25 mm less than the depth of the concrete slab.

6.19.2 Before the provision of expansion joint, the face of the already laid concrete slab shall be painted with primer at the rate of 2.6 liters per 10 square metres. The expansion pad shall be properly cut to shape and shall then be placed in position abutting the painted face of the already laid concrete slab. The adjacent slab shall then be concreted. The face of the pad against which the new concrete slab is to be laid shall also be painted with primer before laying the concrete, while concreting a neat groove of size 20 mm x 25 mm as per drawing shall be formed on top of the pad taking care that the edges are absolutely straight and that the groove so made does not get filled with any material like concrete, mortar and other rubbish.

6.19.3 Before the curing process is started, the top of expansion joint shall be filled with bitumen sand mixture in order to ensure that no foreign material used in curing enters into the joint. This filling shall be removed before filling the joints with sealing compound.

6.19.3.1 For sealing the joints following operations shall be carried out :—

(a) The joints are cleared of any foreign matter to the full depth upto the top of expansion pad with steel spatula.

(b) The joints are blown with compressed air.

(c) Cleaning is done with Kerosene oil.

(d) Priming is done with spray gun @ 2.6 liters per 10 sqm of the surface to be primed.

(e) The primer is allowed to dry completely before pouring the sealing compound.

(f) The sealing compound grade 'A' is heated to the required temperature ranging between 155 deg. C to 165 deg. C or to the temperature range specified by the manufacturer. Over heating shall be

avoided. Pouring shall be done from vessel with spout in such a manner that the material will not get spilled on the exposed surface of the concrete, any excess filler on the surface of the pavement shall be removed immediately and the pavement surface cleaned.

(g) The filling shall be worked into the joints with hot flats to ensure escape of trapped air.

(h) The filling is then ironed with hot iron. It is recommended that while in summer the joints may be sealed flush with the adjacent pavement surface, in winter the sealing compound may be filled to a depth 3-4 mm below the surface.

(i) The edges of the joints are then cut and trimmed to ensure neat and straight line finish.

(j) To prevent tackiness or pick up under traffic, the exposed surfaces of the sealing compound shall be dusted with hydrated lime, if directed by Engineer-in-Charge (Nothing extra shall be paid for the same).

LIST OF APPROVED MAKES

CIVIL WORKS

S. No.	Materials	Approved make
1	POLY-SULPHIDE SEALANT	PIDILITE, TUFFSEAL, CHOKSEY, CHEMICLA
2	DAMP PROOF MATERIAL	IMPERMO BY M/S SNOWCEM, DURA-1, ACC-PROOF, AT –CRETE LATEX
3	STUCTURAL STEEL SECTIONS	TATA, SAIL, RINL, JINDAL
4	ADMIXTURE	FOSROC, MC MBT, SIKA, CICO, ASIAN, DURA BUILD CARE, ROFFE, VAM ORGANICS, DURA-SPRED, AT-PLAST
5	WHITE CEMENT	J.K. WHITE, BIRLA WHITE
6	WATER PROOFING COMPOUND	TAP CRETE, CICO, ACCOPROOF, IMPERMO BY M/S SNOWCEM SIKA, DURA-CRETE, AT-CRETE
7	BITUMEN	INDIAN OIL, HINDUSTAN PETROLEUM
8	BRICK-COBA WATERPROOFING AND ACRYLIC IMPREGNATION TREATMENT	OVERSEAS W.P.CO / ROOFRS COMBINE / DEVICON INTERNAZIONALE / HINDUSTAN WATERPROOFING
9	WATER PROOFING MEMBRANE	CARLILES OR EQUIVALENT
10	NONMETELIC SURFACE HARDNER	MC DERITOP F.H.
11	LOCKS/ LATCH	D-LINE, DORMA, REYENRS
12	LAMINATES	GREEN, MERINO, CENTURY, FORMICA,
13	WIRE MESH	STERLING ENTERPRISES, TRIMURTY WELDED MESH
14	PRELAMINATED PARTICLE BOARD	GREENPLY, DURO, CENTURY, KITLAM, JOYTI PLY, ALPRO, CENTURY
15	ADHESIVE	PIDILITE, DUNLOP, VAMORGANIC, DURA-XY-BOND, AT-BOND COAT
16	EPOXY MORTAR	FOSROC, SIKA, DURA-XY-RM, AT-BOND (EX)
17	DASH FASTNERS/ ANCHORING FASTNERS.	HILTI, FISHER

S. No.	Materials	Approved make
18	FLUSH DOOR SHUTTERS (DECORATIVE,/NON DECORATIVE.)	GREEN PLY ,CENTURY,, KITLAM, ALPRO, JOYTI
19	HYDRAULIC DOOR CLOSER/FLOOR SPRING	D-LINE,DORMA, GEZE
20	WOODEN DOOR FITTINGS OF BRUSHED STEEL	DORMA , DLine, ARKAY
21	S.S. STAIRCASE RAILING	D-LINE, DORMA,CONNECT ARCHITECTURAL PRODUCTS PVT. LTD, JINDAL STAINLESS STEEL LTD, ICICH INDUSTRIES, ESSAL
22	FIRE CHECK DOOR	PROMAT, NAVAIR,SURKHI,SHAKTI MET-DOR
23	FIRE CHECK ASSESSORIES CALCIUM SILICON BOARD	FROMTECT
24	SMOKE SEAL STRIP	IMPORTED PROMAT/ASTRO FLAME
25	DOOR CLOSER LOCK	GEZE,DORMA, DLINE
26	PANIC EXIT DEVICE	INGERROLL RAND /MONARCH
27	DOOR COORDINATOR	UL LISTED /MONARCH
28	ANDODISED ALUMINIUM HARDWARE (HEAVY DUTY)	HARDIMA, EVERITE, SIGMA (ISI MARKED)
29	TOUGHENED/NON TOUGHENED GLASS	PILKINGTON, SAINT GOBAIN, ASAHI, GLAVERBEL
30	POLYSTER POWDER COATING SHADES	NEROLAC, BERGER, J&N
31	ALUMINIUM SECTIONS	JINDAL, HINDALCO, BHORUKA, INDO ALUSYS
32	FRICTION STAY HINGES	EARL-BIHARI
33	NUTS, BOLTS AND SCREWS, STEEL	KUNDAN, PRIYA, ATUL
34	EPDM GASKET	HANU/ ANAND
35	STUCTURAL SILICONE	DOW CORNING/WACKER
36	WEATHER SILICONE	DOW CORNING/ WACKER
37	ADHESIVE TAPE	NORTON
38	TERROZZO TILES (PRECAST)	NITCO, BHARAT, KK
39	GLAZED CERAMIC TILES	SOMANY, NITCO, ASIAN, ORIENT, JOHNSON

S. No.	Materials	Approved make
40	CEMENT CONCRETE TILES/ HARDONITE TILES	NITCO, NTC, HINDUSTAN
41	VITRIFIED TILES	MARBITO, ORIENT, GRANITO, ASIAN,KAJARIA
42	VITRIFIED PAVING TILE	PAVIT,SUPER TILES,ULTRA
43	INTERLOCKING PAVERS	PAVER'S INDIA LTD, PAVIT,SUPER TILES,ULTRA
44	TILE ADHESIVE	CICO, PIDILITE,FOSROC
45	PREMIUM ACRYLIC SMOOTH EXTERIOR PAINT WITH SILICONE ADDITIVES	SNOWCEM, ICI DULUX, ASIAN,
46	SYNTHETIC ENAMEL PAINT	ICI DULUX ,BERGER, NEROLAC, ASIAN,
47	PLASTIC EMULSION PAINT	ICI DULUX ,ASIAN, BERGER, NEROLAC,JOTUN
48	VITREOUS CHINA SANITARYWARE	HINDWARE,KHOLER, PARRYWARE
49	STAINLESS STEEL SINKS	NILKANTH, AMC, CORBA, JAYNA, HINDWARE
50	C.P. BRASS FITINGS	JAGUAR, KHOLER,, HINDWARE PARKO, MARC
51	MS PIPES	KESORAM, ELECTRO STEEL, TATA, JINDAL
52	ORDINARY PORTLAND CEMENT (Grey)	BIRLA VIKRAM, ACC, L&T, JP REVA, SHREE, AMBUJA.
53	STEEL PRIMER	ICI, NAROLAC, BURGER, ASIAN PAINTS
54	WOOD PRIMER	ICI, NAROLAC, BURGER, ASIAN PAINTS
55	MIRROR GLASS	ATUL, MODI, GUARD, GOLDEN
56	REINFORCEMENT STEEL	SAIL,TATA,RINL,RATHI
57	READY MIX CEMENT CONCRETE (RMC)	ACC, AHLCON, UNITECH, L&T, BIRLA ULTRA
58	VACUUM DEWATERED FLOOR	WALIA / FIBRECON CF/ VACMAX ENGINEERS / IRONITE

Construction of Cement Concrete Approach Road at Khanjawala Depot of DTC, New Delhi

S. No.	Materials	Approved make
59	NON-SHRINK GROUT	FOSROC CHEMICALS, SIKA, DURA-EV, AT-GROUT (GP)
60	RELEASE AGENT	FOSROC, MBT, DURA-MOL, AT-MOREL
61	TILE ADHESIVE	CICO, PIDILITE,SIKA, DURA – FIX, AT-TILE FIX (P)
62	MASONITE SKIN DOOR	GODREJ,ALPRO, KUTTY, GREEN PLY
63	Expansion joint	SAINFIELD /VEXCOLT/ C.S