SECTION-G

TECHNICAL SPECIFICATION

Name of Work: - Construction of Approach Road for 75 MW Solar Plant (for North &South Side) along with cross drainage work.

Detailed scope of work, technical specifications & mode of measurements

ITEM NO. 1: Earthwork in excavation below ground level for box cutting of road to proper slope and camber for making base of Road in all type of soil as the case may be and including site cleaning, the disposal of debris/excavated stuff at designated location, stacking of useful materials as required, levelling and dressing, watering, rolling of earthwork in layers with power roller, filling in depression which occur during the process and compacting the surface, including disposal of soil/debris from 50 Mtr to 0.5 KM lead etc. complete as per detailed given in technical specification and as directed by Engineer in charge

Clearing the Site :

The site on which the Road is to be constructed shall be cleared, and all obstructions, loose stone, materials and rubbish of all kind, bush, wood and trees shall be removed as directed. The land width required for the roadway shall be cleared of all trees, vegetation bushes, stumps and all other objectionable materials. The roots of trees and stumps shall be removed to a depth of 30cm. below the grade formation and slopes. Useful materials shall be arranged in convenient stacks along the roads boundary or as directed at places within 50 meters lead. Unsuitable materials disposed off by the contractor at his own cost as per the location shown within lead of 01 KM. Contractor shall carry out site cleaning/ preparation by using grader at their own cost.

After cleaning the site, contractor shall carry out survey work for finalization requirement of excavation/ filling work by taking initial level records and also the alignment of the road shall be properly set out true to line, curves, slopes, grade and sections as directed by the Engineer. The Contractor shall finalized the profile/alignment by arranging dumpy level machine and also should provide all labour and materials such as lime, strings, pegs, nails, bamboos, stones, mortar, concrete etc. required for setting out establishing bench marks and giving profiles. The Contractor shall be responsible for maintaining the B.M. profiles, alignments and other marks as long as they are required for the work in the opinion of the Engineer. Before starting excavation, Contractor shall take levels and section of the ground and recorded in the presence of the GIPCL engineer so as to serve as the basis of measurement.

Excavation :

Earthwork in excavation in all kinds of soil including soft rock for road in required shape and size for pipe culver, box cutting for road, area grading, etc including excavation below existing ground level at any depth for road of correct size, shape and correct side slope and gradient and in proper line, level and gradient at the site as directed by

Engineer in charge. The site shall be left clean of all debris on completion. The excavation shall be carried out in correct line, level & profile of the Road. After completion of excavation up to required level, contractor have to compact excavated surface using water sprinkling and vibro roller before starting sub-base road. Rate for excavation is included all such operations**.**

The excavation shall be finished neatly, smoothly and evenly to the correct lines, curves, grades, section and side slopes as shown on the plans or directed by the Engineer. If it is necessary in the execution of the work to interrupt existing surface drainage or under drainage, temporary arrangements shall be provided till such time as is necessary. The Contractor at his own cost shall make good the interrupted drainage. Road shall be excavated to the specified section and shall be measured in cubic meters. Signalers shall be stationed at each end to regulate traffic where it is heavy, If necessary. No handling or conveyance charges shall be paid if the materials are temporarily deposited elsewhere and subsequently conveyed to site of deposition.

All above specified preparatory works, site cleaning, grading, survey works etc, shall be in the scope of contractor without any additional cost to GIPCL and quote the rate of excavation accordingly.

Disposal of Excavated Materials :

The excavated earth shall be disposal / stacking of surplus excavated soil within radius of 50 Mtr to 0.5 KM lead including loading, un loading transporting, dozing, leveling and making suitable approach road as required etc complete. No materials excavated from the road or drain edge, of whatever kind they may be, are to be placed even temporarily up to 1.5 Mts. or at the distance prescribed by the Engineer, from the outer edge of excavation. All materials excavated shall remain the property of the GIPCL. Rate of excavation shall include sorting out of useful materials and stacking them separately as directed within the specified lead. Materials suitable and useful for back filling or other use shall be stacked in convenient places but not in such a way as to obstruct free movement of men, animals and vehicles or encroach upon the area required for constructional purposes.

Measurements for payment

Excavation for roadway shall be measured by taking cross-sections at suitable intervals in the original position before the excavation work starts and after its completion and computing the volumes in cu. m. by the method of average end areas for all class of material encountered. At the option of the Engineer, the Contractor shall leave depth indicators during excavations of such shape and size and in such positions as directed so as to indicate the original ground level as accurately as possible. The contractor shall see that these remain intact till the final measurements are taken.

No over-excavation below required level given in road profile chart or drawing will be permitted. In such cases over-excavation shall be made good by the Contractor with fly ash or of the same class as for road and side drain and no payment shall be made for the same. Depth of excavation is to be measured from existing ground level. No additional payment shall be made for excavation thickness more than specified.

No extra payment shall be made for temporary pumping of water/sewage due to abnormal adverse conditions/climate. Sub soil water may encounter during execution of work. Same shall deem to be included in rates.

The Plan area of road, drain & culver shall be measured for its length, breadth and depth as per level sheet or jointly measured with Engineer In charge, limiting dimensions to those specified on plan or as directed. The rate shall be for a unit of one cubic meter.

Rates

The contract unit rates for the items of roadway and culver/drain excavation shall be payment in full for carrying out the operations required for the individual items including full compensation for:

i. Site cleaning & preparation
ii. Setting out, marking, layout & survey works
iii. Transporting and disposal of the excavated materials and depositing the same on shown location.
iv. Grading of excavated bottom by grader in true line and level.
v. Watering where necessary and compacting to requirements by vibro roller.
vi. Dewatering.
vii. Disposal of surplus excavated stuff and clearing of site after completion of work.
viii. Erecting all safety provisions and making necessary diversions as directed by Engineer.

ITEM NO. 2: Stabilization of existing ground soil of road base by excavation, pulverizing the soil using equipments like disc harrows, rotavators or any other suitable machineries to make soil boulders if any, pieces of rocks, removal of vegetation or any other deleterious matter, spreading of lime - Fly ash/ bed ash admixture with excavated sub base soil. The rate shall be including loading, unloading transportation spreading fly/bed ash in a layer of maximum 200mm thick dressing, watering & compacting, levelling in a required line, level etc. completed as per detailed specification and as directed by OWNER/Engineer. (Fly ash of required quantity shall be given from silo of GIPCL on specific request as available. The rate is including necessary transportation of fly ash up to work site is in the scope of contractor), all as per detailed given in technical specification and as directed by Engineer in charge.

2.1 Material requirements

The Fly ash to be used for the roadwork shall be free issue by GIPCL from plant silo. Necessary transportation shall be in the scope of Contractor by arranging top covered trucks. The carting of material from plant to site shall be done in closed trucks.

The lime shall be commercial dry lime confirming latest revision of IS 1514, slaked at site or pre-slaked with CaO content not less than 70 per cent. The supply of GIPCL approved quality lime shall be in the scope of contractor.

The contractor shall ensure that excavated soil shall be vegetation or any other deleterious matter.

2.2 Construction Operations

2.2.1 Preparation before filling

Immediately prior to the filling, the area shall be prepared by removing all vegetation, deleterious matter and other extraneous matter such as stone, clots etc. Contractor shall arrange pulverizing the soil using equipment like disc harrows, rotavators or any other suitable machineries to make soil boulders if any, pieces of rocks.

The contractor shall arrange required quantities lime & fly ash as site at various locations of road.

2.2.2 Mixing, Spreading and Compacting

Contractor shall arrange mixing of Lime, Fly ash & Soil approximately 3:(20 to 25) : (70 to 75) or both of proportions as per design mix using suitable equipment. After proper mixing, arrange for spreading & levelling of mixture in layers of not more than 200mm using grader machine. Suitable watering arrangement shall be made for flooding the fly ash with water to achieve desired compaction using water tanker. After watering over the Mixture levelling of the filled material shall be carried out using JCB of grader and compacting using vibratory roller. All loose, segregated or otherwise defective areas shall be made good to the full thickness of layer and re-compacted.

2.3 Measurements for Payment

Mixture of Lime, Fly ash & Soil filling shall be measured as **compacted** finished work in position in cubic meters considering average 200mm thickness as per requirement of site. Contractor shall maintain joint record of initial level (before starting filling) and final level (after compacting as per scope of work & specifications) of work done duly signed by contractor & GIPCL site in charge for measurement of thickness. The required average thickness of filling shall be verified based on joint level record. The payment shall be done considering the average thickness of filling calculated based on level records or jointly measured on site. No additional payment shall be made for filling thickness/width more than required laid on site.

2.4 Rate

The Contract unit rate for fly ash filling shall be payment in full for carrying out the required operations including full compensation for:

i. Making arrangement for traffic.
ii. Supply of approved quality Lime
iii. Carting in closed truck including all leads and lifts.
iv. All labour, tools, equipment and incidentals to complete the work to the Specifications.
v. Removing of unused fly ash to the location as shown

ITEM NO. 3: Providing & laying Hard Murrum of approved quality including spreading & filling in two layers not more than 150mm thick of each layer, watering, consolidation with vibratory roller for total compacted Avg 300 mm thickness to required level of road including transportation, loading, unloading, dressing in a required line, level and gradient etc. complete as per detailed given in technical specification and as directed by Engineer in charge

The Murrum shall be approved quality as approved by the GIPCL Engineer in charge.

1. The Murrum shall be cohesive non-swelling materials. The Murrum shall be hard, tough, solid durable. The flacky material shall be rejected.
2. Any collection which does not fully satisfy the GIPCL requirement is liable to be rejected all together.
3. Supply of materials shall as per actual requirement and any materials in excess shall be have to be transported by the contractor back at the risk and cost of the contractor
4. The permission for spreading the Murrum shall be given by the Engineer In charge after the initial levels are recorded in the Field book.
5. The surface shall than be levelled by means of templates and strings as well as with camber boards and spirit level.
6. At the time of spreading Murrum, a small quantity (about 4 to 5 percent) of metal as directed shall be retained at the first instance. It shall be spread later on after partial consolidation as required to rectify the camber and fill up the hollows if any. No extra amount shall be paid for this.
7. Before rolling is allowed on Murrum, the side berms shall be filled up to the top of the soling and at least 3'-00" (1 m) on either side so as to prevent Murrum layer getting disturbed at times during rolling
8. Immediately following the spreading of the Murrum rolling shall be started with vibratory roller. The capacity of the vibrating roller shall depend upon the type of the aggregate and shall be indicated by Engineer in Charge
9. Except on super elevated portions where the rolling shall proceed from inner edge to outer, rolling shall begin from the edges gradually progressing towards the centre. First the edge/edges shall be compacted with roller running forward an backward. The roller shall then move inward parallel to centre line of the road in successive passes uniformly lapping proceeding trackes by at least one half the width.
10. During rolling slight sprinkling of water may be done, if necessary. Rolling shall be done when the subgrade is soft of yielding of when it causes like wave like motion in the sub grade of sub base course.
11. The rolled surface shall be checked transversely and longitudinal with templates and rolling until the entire surface conforms to desired camber and grade. In no case shall the use of screening be permitted to make up depression.

12. After each application, the surface shall be continuously sprinkled with water, the resulting swept in with hand broom of mechanical broom to fill the voids properly and rolled during which water shall be applied to the wheel of the roller if necessary to wash down the binding materials sticking to them. These operations shall continue until the resulting slurry after filling of voids, form a wave ahead f the moving roller.
13. After final compaction the road shall be allowed to dry overnight. Next morning spots shall be filled with screenings of binding materials as directed, lightly sprinkled with water if necessary and rolled. No traffic shall ne allowed on the road until the surface has set.

3.1 Measurements for Payment

Murrum filling shall be measured as **compacted** finished work in position in cubic meters considering average 300mm thickness of Murrum filling as per requirement of site. Contractor shall maintain joint record of initial level (before starting Murrum filling) and final level (after compacting as per scope of work & specifications) of work done duly signed by contractor & GIPCL site in charge for measurement of thickness. The required average thickness of Murrum filling shall be verified based on joint level record. The payment shall be done considering the average thickness of Murrum filling calculated based on level records or jointly measured on site. No additional payment shall be made for Murrum filling thickness more than required laid on site. The width of Murrum filling shall be considered as per given Road section sketch or as per directive of Engineer-in charge.

Further, the protection of edges of Murrum filling extended over the full formation width shall be considered incidental to the work of providing Murrum filling and as such no extra payment shall be made for the same.

Rate

The Contract unit rate for Murrum filling shall be payment in full for carrying out the required operations including full compensation for:

I Making arrangements for traffic.
ii. Supplying all materials to be incorporated in the work including all royalties, fees, rents where applicable with all leads and lifts.
iii. All labour, tools, equipment and incidentals to complete the work to the Specifications.
iv. Carrying out the required tests for quality control.

ITEM NO. 4: Providing and laying granular sub-base avg 200 mm thick layer by providing machine crushed B.T. material satisfying MORTH specification (Fifth revision) of grading III including spreading in uniform layer with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC and compacting with vibratory roller to achieve the desired density etc. complete including all materials, labour, machinery, tests required to be carried out with all leads and lifts etc., complete as per detailed given in technical specification and as directed by Engineer in charge.

This work shall consist of laying and compacting well-graded material on prepared subgrade in accordance with the requirements of these Specifications. The material shall be laid in layers as sub-base according to lines, grades and cross-sections.

4.1 Material requirements

The material to be used for the work shall be natural sand, crushed gravel, crushed stone, crushed slag, or combination thereof depending upon the grading required. The material shall be free from organic or other deleterious constituents and shall conform to the grading given in Table 1 and physical requirements given in Table 2. If the water absorption of the aggregates determined as per IS: 2386 (Part 3) is greater than 2 percent, the aggregates shall be tested for Wet Aggregate Impact Value (AIV) (18:5640). Soft aggregates like Kankar, brick ballast and laterite shall also be tested for Wet AIV (IS:5640).

Table 1 Grading for Granular Sub-base (GSB-III)

Materials IS size (mm)	Percent by Weight Passing the IS Sieve (Grading-III)
75.0	-
53.0	100
26.5	55-75
9.50	-
4.75	10-30
2.36	-
0.85	-
0.425	-
0.075	0-5

Table 2 Physical Requirements for Materials for Granular Sub-base

Physical properties	Test procedure	Requirement
Aggregate Impact Value (%)	IS:2386 (Part 4) or IS:5640	40 maximum
Liquid Limit (%)	IS:2720 (Part 5)	Maximum 25
Plasticity Index (%)	IS:2720 (Part 5)	Maximum 6
CBR at 98% dry density (at IS: 2720-Part 8) (%)	IS:2720 (Part 5)	Minimum 30%

4.2 Construction Operations

4.2.1 Preparation of Sub-grade

Immediately prior to the laying of sub-base, the subgrade already finished shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water, if necessary and rolled with two passes of 80-100 KN smooth wheeled roller.

4.2.2 Spreading and Compacting

The Granular sub-base material of the grading-V and water shall be mixed mechanically by a suitable mixer equipped with provision for controlled addition of water and mechanical mixing so as to ensure homogenous and uniform mix. The required water content shall be determined in accordance with IS: 2720 (Part 8). The mix shall be spread on the prepared subgrade with the help of a motor grader of adequate, capacity, its blade having hydraulic controls suitable for initial adjustment and for maintaining the required slope and grade during the operation. Moisture content of the mix shall be checked in accordance with IS: 2720 (Part 2) and suitably adjusted so that, at the time of compaction, it is from 1 to 2 percent below the optimum moisture content. Immediately after spreading the mix, rolling shall be done by an approved roller. If the thickness of the compacted layer does not exceed 100 mm, a smooth wheeled roller of 80 to 100 kN weight may be used. For a compacted single layer up to 100 mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 kN static weight capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional cross fall or on super elevation. For carriageway having cross fall on both sides, rolling shall commence at the edges and progress towards the crown. Each pass of the roller shall uniformly overlap not less than one-third of the track made in the proceeding pass. During rolling, the grade and cross fall (camber) shall be checked and any high spots or depressions which become apparent, corrected by removing or adding fresh material. The speed of the roller shall not exceed 5 km per hour. Rolling shall be continued till the density achieved is at least 98 percent of the maximum dry density for the material determined as per IS: 2720 (Part 8). The surface of any layer of material on completion of compaction shall be well closed, free from movement under compaction equipment and from compaction planes, ridges, cracks or loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of layer and re-compacted

4.3 Surface Finish and Quality Control of Work

4.3.1 General

All works performed shall conform to the lines, grades, cross sections and dimensions subject to the permitted tolerances described herein-after.

4.3.2 Horizontal Alignment

Horizontal alignment shall be reckoned with respect to the Centre line of the carriageway. The tolerance for edges of the roadway and Sub-base layers of pavement shall be ±25 mm.

4.3.3 Surface Levels

The levels of the Granular sub-base shall not vary from those calculated with reference to the longitudinal and cross-profile of the road beyond the tolerances limit of ±10 mm. For checking compliance with the above requirement for Granular sub-base, measurements of the surface levels shall be taken on a grid of points placed at 6.25 m longitudinally and 3.5 m transversely.

For any 10 consecutive measurements taken longitudinally or transversely, not more than one measurement shall be permitted to exceed the tolerance as above, this one measurement being not in excess of 5 mm above the permitted tolerance.

4.3.4 Surface Regularity of Pavement Courses.

The longitudinal profile shall be checked with a 03 meter long straight edge/moving straightedge as directed by the Engineer at the middle of each traffic lane along a line parallel to the centre line of the road. The maximum permitted number of surface irregularities shall be as per Table 4.

The maximum allowable difference between the road surface and underside of a 3 m straightedge when placed parallel with, or at right angles to the centre line of the road at points decided by the Engineer shall be 8 mm for Granular Sub-base.

4.3.5 Rectification

Where the surface regularity of subgrade and the various pavement courses fall outside the specified tolerances, the Contractor shall be liable to rectify these in the manner described below.

Where the surface is high, it shall be trimmed and suitably compacted. Where the same is low, the deficiency shall be corrected by scarifying the lower layer and adding fresh material and recompacting to the required density. The degree of compaction and the type of material to be used shall conform to the requirements of MoRTH-2013 (Fifth revision) Clause 401. Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900 MoRTH - 2013 (Fifth revision)

4.4 Arrangements for Traffic

During the period of construction, arrangement for traffic shall be provided and maintained.

4.5 Measurements for Payment

Granular sub-base shall be measured as finished work in position in cubic meters considering compacted thickness. Contractor shall maintain joint record of initial level (before starting WMM) and final level (after compacting as per scope of work & specifications) of work done duly signed by contractor & GIPCL site in charge for measurement of thickness. The required average thickness of GSB shall be verified based on joint level record. The payment shall be done considering the average thickness of GSB calculated based on level records or jointly measured on site. No additional payment shall be made for thickness more than required laid on site. The width of GSB shall be considered as per given Road section sketch. No measurement shall be considered for width more than given drawing/sketch for GSB.

Further, the protection of edges of granular sub-base extended over the full formation width shall be considered incidental to the work of providing granular sub-base and as such no extra payment shall be made for the same.

4.6 Rate

The Contract unit rate for granular sub-base shall be payment in full for carrying out the required operations as specified above and also including full compensation for:

i. Making arrangements for traffic.

ii. Supplying all materials to be incorporated in the work including all royalties, fees, rents where applicable with all leads and lifts.

iii. All labour, tools, equipment, consumables and incidentals to complete the work to the Specifications.

iv. Carrying out the required tests for quality control.

ITEM NO. 5: Providing and laying Wet Mix Macadam base course avg 250 mm thick in two layers as per MORTH specification using machine crushed B.T. chips as per required gradation, mixing with required optimum quantity of water, conveying the mix to site of work, spreading in to grade and camber with paver/mechanical means and consolidation each layer with vibratory roller to achieve the desired density including cost of all materials, labour, machinery, test with all leads and lifts etc., complete as per detailed given in technical specification and as directed by Engineer in charge.

This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared Granular sub- base or existing pavement as the case may by in accordance with the requirements of the specifications of Wet Mix Macadam for Base course. The material shall be laid in two layers to lines, grades and cross-sections as directed. The thickness of a single compacted Wet Mix Macadam layer shall be 125 mm.

5.1 Material requirements

Coarse aggregates shall be crushed stone. The aggregates shall conform to the physical requirements set forth in Table 3. If the water absorption value of the coarse aggregate is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS: 2386 (Part-5).

Table 3 Physical Requirements of coarse Aggregates for Wet Mix Macadam

Test	Test Method	Requirements
Los Angeles Abrasion value OR	IS: 2386 (Part-4)	40 percent (Max.)
Aggregate Impact value	IS: 2386 (Part 4) or IS 6640	30 percent (Max.)
Combined Flakiness and Elongation indices (Total)	IS: 2386 (Part-I)	35 percent (Max.)a

Table 4 Grading Requirements of Aggregates for Wet Mix Macadam

IS Sieve size (mm)	Percent by Weight passing the IS Sieve
53.00	100
45.00	95-100
22.40	-
26.50	60-80

11.20	40-60
4.75	25-40
2.36	15-30
0.60	8-22
0.075	0-5

Material finer than 425 micron shall have Plasticity Index (PI) not exceeding 6. The final gradation approved within these limits shall be graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa.

5.2 Construction Operations

5.2.1 Preparation of Base

The surface of the Granular sub-base to receive the Wet Mix Macadam course shall be prepared to the specified grade and camber and cleaned of dust, dirt and other extraneous material. Any ruts or soft yielding places shall be corrected in an approved manner and rolled until firm surface is obtained. The existing surface shall be scarified and re-shaped to the required grade and camber before spreading the coarse aggregate for WMM.

5.2.2 Provision of Lateral Confinement of Aggregates

While constructing wet mix macadam (WMM), arrangement shall be made for the lateral confinement of wet mix.

5.2.3 Preparation of Mix

Wet Mix Macadam shall be prepared in an approved mixing plant of suitable capacity having provision for controlled addition of water and forced/positive mixing arrangement like pugmill or pan type mixer of concrete batching plant. The plant shall have following features:

i. For feeding aggregates- three/ four bin feeders with variable speed motor.
ii. Vibrating screen for removal of oversize aggregates.
iii. Conveyor Belt.
iv. Controlled system for addition of water.
v. Forced/positive mixing arrangement like pug-mill or pan type mixer.
vi. Centralized control panel for sequential operation of various devices and precise process control.
vii. Safety devices.

Optimum moisture for mixing shall be determined in accordance with IS:2720 (Part-8) after replacing the aggregate fraction retained on 22.4 mm sieve with material of 4.75 mm to 22.4 mm size. While adding water, due allowance should be made for evaporation losses. The mixed material should be uniformly wet and no segregation should be permitted.

5.2.4 Spreading of Mix

Immediately after mixing, the aggregates shall be spread uniformly and evenly upon the prepared Granular sub-base in required quantities. In no case shall these be

dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed stretch be permitted. The mix may be spread by a paver finisher. The paver finisher shall be self-propelled of adequate capacity with following features:

i. Loading hoppers and suitable distribution system, so as to provide a smooth uninterrupted material flow for different layer thicknesses from the tipper to the screed.
ii. Hydraulically operated telescopic screed for paving width up to 8.5 m and fixed screed beyond this. The screed shall have tamping and vibrating arrangement for initial compaction of the layer.
iii. Automatic levelling control system with electronic sensing device to maintain mat thickness and cross slope of mat during laying procedure.

Paver OR mechanical means like motor grader may be used. The motor grader shall be capable of spreading the material uniformly all over the surface. The surface of the aggregate shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate as may be required. The layer may be tested by depth blocks during construction. No segregation of larger and fine particles should be allowed. The aggregates as spread should be of uniform gradation with no pockets of fine materials. The Engineer may permit manual laying of wet mix macadam where small quantity of wet mix macadam is to be executed. Manual laying in inaccessible remote locations and in situations where use of machinery is not feasible can also be permitted. Where manual laying is intended to be used, the same shall be done with the approval of the Engineer.

5.2.5 Compaction

After the mix has been laid to the required thickness, grade and cross fall/camber the same shall be uniformly compacted to the full depth with suitable roller. The compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100 kN with an arrangement for adjusting the frequency and amplitude. An appropriate frequency and amplitude may be selected. The speed of the roller shall not exceed 5 km/h. In portions having unidirectional cross fall/super elevation, rolling shall commence from the lower edge and progress gradually towards the upper edge. Thereafter, roller should progress parallel to the center line of the road, uniformly over-lapping each preceding track by at least one-third width until the entire surface has been rolled. Alternate trips of the roller shall be terminated in stops at least 1 m away from any preceding stop. In portions in camber, rolling should begin at the edge with the roller running forward and backward until the edges have been firmly compacted. The roller shall then progress gradually towards the center parallel to the center line of the road uniformly overlapping each of the preceding track by at least one-third width until the entire surface has been rolled. Any displacement occurring as a result of reversing of the direction of a roller or from any other cause shall be corrected at once as specified and/or removed and made good. Along forms, kerbs, walls or other places not accessible to the roller, the mixture shall be thoroughly compacted with mechanical tampers or a plate compactor. Skin patching of an area without scarifying the surface to permit proper bonding of the added material shall not be permitted.

Rolling should not be done when the sub-grade is soft or yielding or when it causes a wavelike motion in the sub-base/base course or sub-grade. If irregularities develop during rolling which exceed 12 mm when tested with a 3 m straight edge, the surface should be loosened and premixed material added or removed as required before rolling again so as to achieve a uniform surface conforming to the desired grade and crossfall. In no case shall the use of unmixed material be permitted to make up the depressions.

Rolling shall be continued till the density achieved is at least 98 percent of the maximum dry density for the material as determined by the method outlined in IS: 2720 (Part-8). After completion, the surface of any finished layer shall be well-closed, free from movement under compaction equipment or any compaction planes, ridges, cracks and loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of the layer and recompacted.

5.2.6 Setting and Drying

After final compaction of wet mix macadam course, the road shall be allowed to dry for 24 hours.

5.3 Opening to Traffic

No vehicular traffic shall be allowed on the finished wet mix macadam surface.

5.4 Surface Finish and Quality Control of Work

5.4.1 Horizontal Alignment

Horizontal alignment shall be reckoned with respect to the Centre line of the carriageway as shown on the drawings. The tolerance for edges of the roadway and WMM layers of pavement shall be ±25 mm.

5.4.2 Surface Levels

The levels of the Base course shall not vary from those calculated with reference to the longitudinal and cross-profile of the road shown on the drawings beyond the tolerances limit of ±10 mm, in case of Machine laid mix and ±15 mm, in case of Manually laid mix. For checking compliance with the above requirement for Wet Mix Macadam, measurements of the surface levels shall be taken on a grid of points placed at 6.25 m longitudinally and 3.5 m transversely. For any 10 consecutive measurements taken longitudinally or transversely, not more than one measurement shall be permitted to exceed the tolerance as above, this one measurement being not in excess of 5 mm above the permitted tolerance.

5.4.3 Surface Evenness

The longitudinal profile shall be checked with a 3 meter long straight edge/moving straightedge as directed by the Engineer at the middle of each traffic lane along a line parallel to the center line of the road. The maximum permitted number of surface irregularities shall be as per Table.

The maximum allowable difference between the road surface and underside of a 3 m straightedge when placed parallel with, or at right angles to the centre line of the road at points decided by the Engineer shall be 8 mm for Wet Mix Macadam.

5.4.4 Quality Control

Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900 MoRTH-2013 (Fifth revision).

5.4.5 Rectification of Surface Irregularity

Where the surface irregularity of the wet mix macadam course exceeds the permissible tolerances or where the course is otherwise defective due to sub-grade soil getting mixed with the aggregates, the full thickness of the layer shall be scarified over the affected area, re-shaped with added premixed material or removed and replaced with fresh premixed material as applicable and recompacted in accordance with Clause 7.2. The area treated in the aforesaid manner shall not be less than 5 m long and 2 m wide. In no case shall depressions be filled up with unmixed and ungraded material or fines.

5.5 Arrangement for Traffic

During the period of construction, arrangements for traffic shall be done.

5.6 Measurements for Payment

Wet mix macadam shall be measured as **compacted** finished work in position in cubic meters considering average 250mm thickness of WMM as per requirement of site. Contractor shall maintain joint record of initial level (before starting WMM) and final level (after compacting as per scope of work & specifications) of work done duly signed by contractor & GIPCL site in charge for measurement of thickness. The required average thickness of WMM shall be verified based on joint level record. The payment shall be done considering the average thickness of WMM calculated based on level records or jointly measured on site. No additional payment shall be made for thickness more than required laid on site. The width of WMM shall be considered as per given Road section sketch. No measurement shall be considered for width more than given drawing/sketch for WMM.

Further, the protection of edges of WMM extended over the full formation width shall be considered incidental to the work of providing WMM and as such no extra payment shall be made for the same.

5.7 Rate

The Contract unit rate for wet mix macadam shall be payment in full for carrying out the required operations including full compensation for:

i. Making arrangements for traffic.
ii. Supplying all materials to be incorporated in the work including all royalties, fees, rents where applicable with all leads and lifts;
iii. All labour, tools, equipment, consumables and incidentals to complete the work to the Specifications.
iv. Carrying out the required tests for quality control.

ITEM NO. 6: Supplying and applying Slow Setting-1 (SS-I) bitumen emulsion confirming to IS 8887 for application of prime coat over Wet Mix Macadam at the rate of 7.50 kg /10 Sq. Meter area including cost of asphalt and preparing the surface heating & applying and also including cost of all materials, labour, machinery, test with all leads and lifts etc., complete as per details in tender specification & as directed by engineer in charge.

Prime coat consists of the application of a single coat of bitumen emulsion to a porous granular surface preparatory to the superimposition of bituminous treatment or mix. The work shall be carried out on a previously prepared Wet Mix Macadam.

6.1 Material

The primer shall be cationic bitumen emulsion SS-1 grade conforming physical and chemical properties shown in Table 5. Quantity of SS-1 grade bitumen emulsion for Wet mix macadam shall be 0.85 kg/Sq.mt. Quantity of Bitumen emulsion shall be such that it can be absorbed by the surface without causing run-off of excessive primer and to achieve desired penetration of about 8-10 mm.The normal range of spraying temperature for a bituminous emulsion shall be 20°C to 70°C.

Table 5 Physical and Chemical properties of Bitumen Emulsion Grade SS-1		
Sr. No	**Properties**	
1	Residue on 600 micron IS Sieve, percent by mass, (Max)	0.05
2	Viscosity by Saybolt Furol viscometer, seconds: At 25° C	20-100
3	Coagulation of emulsion at low temperature	Nil
4	Storage stability after 24 h, percent (Max)	**2**
5	Particle charge	Weak Positive
6	Stability to mixing with cement (percentage coagulation), Max	2
7	Tests on residue:	
	A. Residue by evaporation, percent, (Min)	50
	B. Penetration 25°C / 100g/5 sec	60-350
	C. Ductility 27° C/cm, A4in	50
	D. Solubility: In trichloroethylene, percent by mass (Min)	98
8	Distillation in percent, by volume at	
	A. 190° C	20-55
	B. 225° C	30-75
	C. 260° C	40-90
	D. 315° C	60-100
9	Water content, percent by mass, (Max)	20

If Emulsion is stored for more than 90 days, its properties as mentioned in Table 5 should be checked Preferred source for bitumen emulsion is **Hindustan Colas Ltd. (HINCOL) or equivalent industry** which follows standards of IS: 8887-2004 and must be PSU manufacturers.

6.2 Weather and Seasonal Limitations

Primer shall not be applied during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10°C. Surfaces which are to

receive emulsion primer should be damp, but no free or standing water shall be present. Surface can be just wet by very light sprinkling of water.

6.3 Construction

6.3.1 Equipment

The primer shall be applied by a self-propelled or towed bitumen pressure sprayer equipped for spraying the material uniformly at the rate of 0.75 kg per SM. Hand spraying shall not be allowed except in small areas, inaccessible to the distributor, or in narrow strips where primer shall be sprayed with a pressure hand sprayer, or as directed by the Engineer.

6.3.2 Preparation of Road Surface

Prime coat must be applied immediately after compaction of WMM upto 98% Maximum dry density is achieved on field.

6.3.3 Application of Bituminous Primer

After preparation of the road surface, the primer shall be sprayed uniformly at the rate of 0.85 kg per SM. The method for application of the primer will depend on the type of equipment to be used, size of nozzles, pressure at the spray bar and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified. No heating or dilution of SS-1 bitumen emulsion and shall be permitted at site.

6.3.4 Curing of Primer and Opening to Traffic

A primed surface shall be allowed to cure for at least 24 hours or such other higher period as is found to be necessary to allow all the moisture/volatiles to evaporate before any subsequent surface treatment or mix is laid. Any unabsorbed primer shall first be blotted with a light application of sand, using the minimum quantity possible. A primed surface shall not be opened to traffic other than that necessary to lay the next course.

6.4 Quality Control of Work

For control of the quality of materials and the works carried out, the relevant provisions of IS 8887 shall apply.

6.5 Arrangements for Traffic

During construction operations, arrangements for traffic shall be made.

6.6 Measurement for Payment

Prime coat shall be measured in terms of surface area of application in square meters. For verification weight of empty tanker and weight of loaded tanker will be checked in GIPCL weighbridge.

6.7 Rate

The contract unit rate for prime coat shall be payment in full for carrying out the required operations like cleaning with wire brushes, brooming, collecting unwanted and removal of same including full compensation including full compensation for:

i. Making arrangements for traffic.

ii. Supplying all materials to be incorporated in the work including all royalties, fees, rents where applicable with all leads and lifts.

iii. All labour, tools, equipment, consumables and incidentals to complete the work to the Specifications and

iv. Carrying out the required tests for quality control. Payment shall be made on the basis of the provision of prime coat at an application rate of quantity at 0.75 kg per SM, with adjustment, plus or minus, for the variation between this quantity and the actual quantity approved by the Engineer.

ITEM NO. 7: Providing and laying avg 50 mm thick Dense graded bituminous macadam with tack coat at 2.50 Kg/10 Sq.mt. of Emulsion RS-I by mechanical sprayer and using stone chips as per MORT&H gradation and asphalt VG-30 grade @ 4.50% (As per mix design) by total weight of mix for binder by batch mix hot laid process including transporting the mix and spreading the same by paver finisher and consolidation by vibratory roller including providing and operating required drum mix/batch mix plant & machinery cost of fuel, asphalt, oil, lubricant & labour charges etc. complete.

The specification describes the design and construction procedure for Dense Bituminous Macadam, (DBM). The thickness of a single layer shall be average 50 mm.

7.1 Materials

7.1.1 Bitumen

The bitumen shall be viscosity grade paving bitumen VG 30 complying with the Indian Standard Specification IS: 73 or as otherwise specified in the Contract. The type and grade of bitumen to be used shall be VG 30 grade of paving bitumen satisfying specified in Table 7

Table 7 Requirements for Paving Bitumen VG 30

Sr.No.	Characteristics	Requirement
1	Penetration at 25°C, 100 g, 5 s, 0.1 mm, Min	45
2	Absolute viscosity at 60°C, Poises	2400-3600
3	Kinematic viscosity at 135°C, cSt, Min	350
4	Flash point (Cleveland open cup), °C, Min	220
5	Solubility in trichloroethylene, percent, Min	99
6	Softening point (R&B), °C, Min	47
7	Tests on residue from rolling thin film oven test:	
	a) Viscosity ratio at 60°C, Max	4.0
	b) Ductility at 25°C, cm, Min	40

7.1.2 Aggregates

The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on 2.36 mm sieve. The aggregates shall satisfy the requirements specified in Table 8.

Where crushed gravel is proposed for use as aggregate, not less than 90 percent by weight of the crushed material retained on the 4.75 mm sieve shall have at least two fractured faces. Fine aggregates shall consist of crushed or naturally occurring mineral material, or a combination of the two, passing the 2.36 mm sieve and retained on the 75-micron sieve. Natural sand shall not be allowed in binder courses. However, natural sand up to 50 percent of the fine aggregate may be allowed in base courses. The fine aggregate shall have a sand equivalent value of not less than 50 when tested in accordance with the requirement of IS: 2720 (Part 37). The plasticity index of the fraction passing the 0.425 mm sieve shall not exceed 4, when tested in accordance with IS: 2720 (Part 5).

Table 8 Physical Requirements for Coarse Aggregate for Dense Bituminous Macadam

Property	Test	Specification	Method of Test
Cleanliness (dust)	Grain size analysis	Max 5% passing 0.75 mm sieve	IS:2386 Part I
Particle shape	Combined Flakiness and Elongation Indices	Max 35%	IS:2386 Part I
Strength	Los Angeles Abrasion Value or Aggregate Impact Value	Max 35 % Max 27%	IS:2386 Part IV
Durability	Soundness: Sodium Sulphate or Magnesium Sulphate	Max 12% Max18%	IS:2386 Part V
Water Absorption	Water Absorption	Max 2%	IS:2386 Part lll
Stripping	Coating and Stripping of Bitumen Aggregate Mix	Minimum retained coating 95%	IS:6241
Water Sensitivity	Retained Tensile Strength	Min. 80%	AASHTO 283

7.1.3 Aggregate Grading and Binder Content

When tested in accordance with IS:2386 Part 1 (wet sieving method), the combined grading of the coarse and fine aggregates and filler for the particular mixture shall fall within the limits given in Table 9. To avoid gap grading, the combined aggregate gradation shall not vary from the lower limit on one sieve to higher limit on the adjacent sieve.

Table 9 Composition of Dense Graded Bituminous Macadam

Nominal aggregate size 26.5 mm

Layer thickness 50 mm

IS Sieve (mm)	Cumulative % by weight of total aggregate passing
45	-
37.5	100

26.5	90-100
19	71-95
13.2	56-80
9.5	-
4.75	38-54
2.36	28-42
1.18	-
0.6	-
0.3	7-2
0.15	-
0.075	2-8

The nominal maximum particle size is the largest specified sieve size upon which any of the aggregate is retained.

Bitumen content % by mass of total mix shall be Min 4.5

7.2 Mix Design

The bitumen content required shall be determined following the Marshall mix design procedure contained in Asphalt Institute Manual MS-2. The Fines to Bitumen (F/B) ratio by weight of total mix shall range from 0.6 to 1.2. Apart from conformity with the grading and quality requirements for individual ingredients, the mixture shall meet the requirements set out in Table 10. Alternatively, minimum bitumen content recommended as given in Table 9 can be used for production of mix, provided the mix satisfies the requirements as given in Table 8, Table 9 and Table 10. The compacted layers of Dense Graded Bituminous Macadam (DBM) shall have a minimum field density equal to or more than 92% of the density based on theoretical maximum specific gravity (Gmm) obtained on the day of compaction in accordance with ASTMD 2041.

Table 10 Requirements for Dense Graded Bituminous Macadam

Properties	**Requirement**	**Test Method**
Compaction level	75 blows on each face of the specimen	
Minimum stability (kN at 60ºC)	9.0	AASHTO T245
Marshall flow (mm)	2-4	AASHTO T245
Marshall Quotient(Stability/Flow)	2-5	MS-2 and ASTM D2041
% air voids	3-5	
% Voids Filled with Bitumen (VFB)	65-75	
Coating of aggregate particle	95% minimum	IS: 6241
Tensile Strength ratio	80% Minimum	AASHTO T 283
% Voids in Mineral Aggregates (VMA)	Minimum percent voids in mineral aggregate (VMA) are set out in Table 11	

Table 11 Minimum Percent Voids in Mineral Aggregate (VMA)

Nominal Maximum Particle Size (mm)	Minimum VMA Percent Related to Design Percentage Air voids		
	3.0	4.0	5.0
26.5	11.0	12.0	13.0
37.5	10.0	11.0	12.0

7.2.1 Job Mix Formula

The Contractor shall submit to the Engineer for approval at least 21 days before the start the work, the job mix formula proposed for use in the works, together with the following details:

i. Source and location of all materials
ii. Proportions of all materials expressed as follows: a) Binder type, and percentage by weight of total mix b) Coarse aggregate/Fine aggregate/Mineral filler as percentage by weight of total aggregate including mineral filler
iii. A single definite percentage passing each sieve for the mixed aggregate
iv. The individual gradings of the individual aggregate fraction, and the proportion of each in the combined grading
v. The results of mix design such as maximum specific gravity of loose mix (Gmm), compacted specimen densities, Marshall stability, flow, airvoids, VMA, VFB and related graphs and test results of AASHTO T 283 Moisture susceptibility test
vi. Where the mixer is a batch mixer, the individual weights of each type of aggregate, and binder per batch
vii. Test results of physical characteristics of aggregates to be used
viii. Mixing temperature and compacting temperature.

While establishing the job mix formula, the Contractor shall ensure that it is based on a correct and truly representative sample of the materials that will actually be used in the work and that the mix and its different ingredients satisfy the physical and strength requirements of these Specifications. Approval of the job mix formula shall be based on independent testing by the Engineer for which samples of all ingredients of the mix shall be furnished by the Contractor as required by the Engineer. The approved job mix formula shall remain effective unless and until a revised Job Mix Formula is approved. Should a change in the source of materials be proposed, a new job mix formula shall be forwarded by the Contractor to the Engineer for approval before the placing of the material.

7.2.2 Plant Trials – Permissible Variation in Job Mix Formula

Once the laboratory job mix formula is approved, the Contractor shall carry out plant trials to establish that the plant can produce a uniform mix conforming to the approved job mix formula. The permissible variations of the individual percentages of the various ingredients in the actual mix from the job mix formula to be used shall be within the limits as specified in Table 16and shall remain within the gradation band. These variations are intended to apply to individual specimens taken for quality control tests in accordance with MoRTH-2013 (Fifth revision) Section 900.

Table 12 Permissible Variations in the Actual Mix from the Job Mix Formula

Description	Base/binder Course
Aggregate passing 19 mm sieve or larger	±8%
Aggregate passing 13.2 mm, 9.5 mm	±7%
Aggregate passing 4.75 mm	±6%
Aggregate passing 2.36 mm, 1.18 mm, 0.6 mm	±5
Aggregate passing 0.3 mm, 0.15 mm	±4%
Aggregate passing 0.075 mm	±2%
Binder content	±0.3%
Mixing temperature	± 10°C

7.3 Construction Operations

7.3.1 Weather and Seasonal Limitations

Laying shall be suspended:

i. In presence of standing water on the surface;
ii. When rain is imminent, and during rains, fog or dust storm;
iii. When the base/binder course is damp;
iv. When the air temperature on the surface on which it is to be laid is less than 10° C for mixes with conventional bitumen;

7.3.2 Preparation of Base

The base on which Dense Graded Bituminous Material is to be laid shall be prepared in accordance with above item detail of WMM.

7.3.3 Tack Coat

Tack coat shall be applied at 2.50 Kg/10 Sq.mt. of Emulsion RS-I by mechanical sprayer

7.3.4 Mixing and Transportation of the Mix

Pre-mixed bituminous materials shall be prepared in a hot mix plant of adequate capacity and capable of yielding a mix of proper and uniform quality with thoroughly coated aggregates. Appropriate mixing temperatures are given in Table 13 of these Specifications. The difference in temperature between the binder and aggregate shall at no time exceed 14°C. In order to ensure uniform quality of the mix and better coating of aggregates, the hot mix plant shall be calibrated from time to time.

Table 13 Mixing, Laying and Rolling Temperatures for Bituminous Mixes (Degree Celsius)

Bitumen viscosity grade	Bitumen Temperature	Aggregate Temperature	Mixed material Temperature	Laying Temperature	Rolling Temperature
VG-30	150-165	150-170	150-165	130 Min	90 Min

Bituminous materials shall be transported in clean insulated and covered vehicles. An asphalt release agent, such as soap or lime water, may be applied to the interior of the vehicle to prevent sticking and to facilitate discharge of the material.

7.3.5 Spreading

Prior to spreading the mix, the base shall be prepared by carrying out the required operations as per MoRTH -2013 (Fifth revision) Clause 501.8 depending upon the site conditions.The essential features of the paver finisher shall conform to Annex A of IRC:27. As soon as possible after arrival at site, the materials shall be supplied continuously to the paver and laid without delay. The rate of delivery of material to the paver shall be regulated to enable the paver to operate continuously. The travel rate of the paver, and its method of operations, shall be adjusted to ensure an even and uniform flow of bituminous material across the screed, free from dragging, tearing and segregation of the material. Bituminous material shall be kept clean and uncontaminated. The only traffic permitted to run on bituminous material to be overlaid shall be that engaged in laying and compacting the next course or, where a binder course is to be sealed or surface dressed, that engaged on such surface treatment. Should any bituminous material become contaminated, the Contractor shall make it good to the satisfaction of the Engineer, in compliance with MoRTH-2013 (Fifth revision) Clause 501.8. Bituminous materials shall be laid and compacted in layers, which enable the specified thickness, surface level, regularity requirements and compaction to be achieved. Compaction of bituminous materials shall commence as soon as possible after laying. Compaction shall be substantially completed before the temperature falls below the minimum rolling temperatures stated in the relevant part of these Specifications. Rolling of the longitudinal joints shall be done immediately behind the paving operation. After this, rolling shall commence at the edges and progress towards the center longitudinally except that on super-elevated and unidirectionally cambered portions, it shall progress from the lower to the upper edge parallel to the center line of the pavement. Rolling shall continue until all roller marks have been removed from the surface. All deficiencies in the surface after laying shall be made good by the attendants behind the paver, before initial rolling is commenced. The initial or breakdown rolling shall be done with 8-10 tonne static weight smooth-wheel rollers. The intermediate rolling shall be done with 8-10 tonne static weight or vibratory roller or with a pneumatic tyre roller of 12 to 15 tonne weight, with a tyre pressure of at least 0.56 MPa. Rollers should move at a speed of not more than 5 km per hour. The roller shall not be permitted to stand on pavement which has not been fully compacted, and necessary precautions shall be taken to prevent dropping of oil, grease, petrol, diesel or other foreign matter on the pavement either when the rollers are operating or standing. The wheels of roller machine shall be in good working order, to prevent the mix from adhering to the Wheels. Only sufficient moisture to prevent adhesion between the wheels of rollers and the mix should be used. Surplus water shall not be allowed to stand on the partially compacted pavement.

7.4 Surface Finish and Quality Control of Work

7.4.1 Horizontal Alignment

Horizontal alignment shall be reckoned with respect to the Centre line of the carriageway. The edges of the carriageway as constructed shall be correct within a tolerance of ±10 mm there from.

7.4.2 Surface Levels

The levels of the Binder course shall not vary from those calculated with reference to the longitudinal and cross-profile of the road beyond the tolerances limit of ±6 mm..

7.4.3 Surface Evenness

The longitudinal profile shall be checked with a 3 meter long straight edge/moving straightedge as directed by the Engineer at the middle of each traffic lane along a line parallel to the center line of the road. The maximum permitted number of surface irregularities shall be as per **Table 4.**

The maximum allowable difference between the road surface and underside of a 3 m straightedge when placed parallel with, or at right angles to the center line of the road at points decided by the Engineer shall be 6 mm for Dense graded Bituminous Macadam.

7.4.4 Quality Control

Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900 MoRTH-2013 (Fifth revision) which is reproduced in chapter 20.

7.5 Arrangements for Traffic

During the period of construction, arrangements for traffic shall be made.

7.6 Measurement for Payment

The payment of Dense Graded Bituminous Materials shall be made on the MT basis of weigh mat slip from GIPCL Weigh Bridge. For verification weight of empty dumpers and weight of loaded dumper will be recorded in slip and SAP report.

Weight of mix materials will be done in presence of Weighbridge operator. The weight of each dumper shall be recorded on weigh mat slip and SAP report. Record of each dumper will be mentioned separately, which will be maintained by the Company's representatives and signed by the contractor.

The Contract unit rate for Dense Graded Bituminous Materials (DBM) shall be measured in MT. Weight shall be considered final from GIPCL Weighbridge only, no other weigh bridge will allow for final certification. No extra payment shall be made work done is excess quantity beyond the direction of Engineer-in charge.

7.7 Rate

The contract unit rate for Dense Graded Bituminous Macadam shall be payment in full for carrying out all the required operations as specified and shall include, to all components listed below,

i. Making arrangements for traffic.
ii. Cleaning of the surface using air compressor machine.
iii. Providing all materials to be incorporated in the work including arrangement for stock yards, all royalties, fees, rents where necessary and all leads and lifts
iv. Mixing, transporting, laying and compacting the mix, as specified including all wastage in cutting joints
v. All labour, tools, equipment, plant including installation of hot mix plant, power supply units and all machinery, incidental to complete the work to these Specifications
vi. Carrying out the work in part widths of the road where directed.
vii. Carrying out all tests for control of quality.
viii. The rates include for all testing, mix design, transporting and testing of samples, and cores and tests as directed by the Engineer; and
ix. The cost of all plant as specified to prove the mixing and laying methods shall be deemed to be included in the Contractor's rates.
x. Sand or dust flushed surface (if necessary) as required without any extra cost.

The rate shall include the provision of bitumen, 4.5 percent by weight of the total mixture. The variation in actual percentage of bitumen used shall be assessed and the payment adjusted accordingly.

ITEM NO. 8: Providing and laying avg 30 mm thick compacted Bituminuous Concrete using Emersion RS-1 for Track coat at 2.5 Kg./10Sq.mt. with mechanical sprayer, stone chips as per MORT&H gradation & VG-30 grade asphalt for mixing @ 5.50% (As per mix design) by weight of total mix for binder including heating the aggregate and asphalt by Drum mix/Batch mix plant and spreading the same by sensor paver finisher and consolidation with vibratory roller including providing all materials, equipments, tools and plants, oil, kerosene, fire wood, labour charges etc. complete.

Description

This work shall be used as a wearing coat and shall not be used directly over wet mix surface, consist of laying and compacting mix seal surfacing in single course composed of suitable aggregates premixed work, a bituminous binder on a previously prepared base in accordance with the requirement of these specification.

Materials

Binder

The bitumen shall be viscosity grade paving bitumen VG 30 complying with the Indian Standard Specification IS: 73 or as otherwise specified in the Contract. The type and grade of bitumen to be used shall be VG 30 grade paving bitumen satisfying the requirements specified in below table

Requirements for Paving Bitumen VG 30

Sr.No.	Characteristics	Requirement
1	Penetration at 25°C, 100 g, 5 s, 0.1 mm, Min	45
2	Absolute viscosity at 60°C, Poises	2400-3600
3	Kinematic viscosity at 135°C, cSt, Min	350
4	Flash point (Cleveland open cup), °C, Min	220
5	Solubility in trichloroethylene, percent, Min	99
6	Softening point (R&B), °C, Min	47
7	Tests on residue from rolling thin film oven test:	
	a) Viscosity ratio at 60°C, Max	4.0
	b) Ductility at 25°C, cm, Min	40

Coarse Aggregates

The aggregate shall consist of angular fragment, clean, hard, tough and durable rock of uniform quality throughout. The aggregate shall be obtained by crushing rock gravel or river single and be free of clan gated and flaky pieces, soft disintegrated materials and vegetation or other deleterious matter. They shall preferably be hydrophobic type.

The aggregate shall satisfy the quality requirement set forth in Table 7, except that the Index shall be limited to a maximum of 30.

TABLE - 7
PHYSICAL REQUIREMENT OF AGGREGATES

Sr. No.	Test	Test Method	Requirements
[1]	[2]	[3]	[4]
1.	Los Angles Abrasion Value *	IS:2386 (Part-IV)	35% Maximum
2.	Aggregates Impact value *	- do -	30% Maximum
3.	Flakiness Index	IS:2386 (Part-I)	35% Maximum
4.	Stripping Value	IS : 6241	25% Maximum
5.	Water Absorption	IS : 2386 (Part-III)	2% Maximum

Fine Aggregates

The fine aggregate shall consist of crusher run screenings, natural sand or a mixture of both. These shall be clean, hard, durable, uncoated, dry and free from injurious, soft or flaky pieces and organic or deleterious substances.

Aggregate Gradation

The coarse sand, fine aggregate shall be so graded or combined as to conform to the grading set forth in Table-8

TABLE - 8

AGGREGATE GRADATION FOR MIX SEAL SURFACING

Sieve Designation	Percentage by Weight Passing the Sieve Mix seal surfacing
13.20 MM	--
11.20 MM	100
5.60 MM	52-88
2.80 MM	14-38
90 Micron	0 - 05

Proportioning of Materials

The total quantity of the aggregates used for mix seal surfacing shall be based on design mix of bituminous concrete. The quantity of binder used for pre-mixing in terms of straight run bitumen shall be 5.50% by weight of the total mix i.e. 55KG per tonne of mix.

Before starting the work, the contractor shall get the job mix formulae for the mix approved by the Engineer-in-charge.

Construction Operations

Weather and Seasonal Limitation

Bituminous concrete shall not be laid during rainy weather or when the base course is damp or wet.

Preparation of Base

The base over which the bituminous concrete is to be laid shall be completely free from dust, caked, mud, etc. before laying the surface course. Where existing base is potholes or rutted, the irregularities shall be filled in with premixed materials and well rammed. If existing base is extremely irregular and wavy, it may be considered worthwhile to lay a bituminous leveling course of adequate thickness to avoid an excessive use of costly surface course. A tack coat at the rate of 2.5 kg per 10m2 shall be given over DBM base

Preparation and Transport of Mix

It is imperative that the Bituminous concrete be manufacturing by using Batching Plant of adequate capacity and capable to yield a mix of proper and uniform quality with thoroughly coated aggregates. The plant shall be Batching plant type. The plant shall have co-ordinated set of essential units capable of producing uniform mix within the job mix formula such as down in Appendix-A.

(a) In case of Batching Plant, the cold feed system shall have variable speed belt conveyors/or other suitable devices for regulating the accurate proportioning of aggregate to an even flood flow automatically from a Control Operation / Control Cabin.

(b) **BITUMEN CONTROL UNIT**

Capable of measuring / metering and spraying required quantity of bitumen at specified temperature with automatic synchronization of bitumen and aggregate feed.

(c) **FILLER SYSTEM**

A fines feeder system suitable to receive bagged or bulk supply of filler materials and its incorporation to the mix in the correct quantity shall be necessary auxiliary.

(d) **DUST CONTROL**

A suitable built in Dust Control Equipment for the dryer to contain the exhaust of fine dust into atmosphere for environmental control, wherever so specified by the Engineer.

(e) Suitable auxiliary bitumen Boiler of adequate capacity with self-heating arrangement and temperature control device. The boiler should be fitted with temperature indicating instruments.

The temperature of binder at the time of mixing shall be in the range of 160^{o}C to 177^{o}C and of the aggregate in the range of 155^{o}C to 163^{o}C provided also that at no time shall be the difference in temperature between the aggregates and the binder exceeds 14^{o}C.

Mixing shall be thorough to ensure that a homogeneous mixture is obtained in which all particles of the mineral aggregates are coated uniformly.

The mix shall be transported from the mixing plant to the point of use in suitable vehicles. The vehicles employed for transport shall be clean and covered over the transit if so directed by the Engineer-in-charge.

Spreading

The mix transported from the Batching Plant to the site shall be spread by means of a self-propelled mechanical paver with suitable screeds capable of spreading temping, finishing the mix, true to specified grade, lines and cross sections. The temperature of mix at the time of laying shall be in the range of 121^{o}C - 168^{o}C.Before spreading of SDBC, applied tack coat of 2.5 kg per 10 m2 on existing bitumen surface.

Longitudinal joints and edge shall be constructed true to the delineating lines paralleled to the centre line of the road. Longitudinal joints shall be offset by at least 150 mm from those in the binder course. The joints shall be cut vertical to the thickness of the previously laid mix and the surface painted with hot bituminous before placing fresh materials.

Rolling

Immediately after spreading of mix, it shall be thoroughly compacted by rolling with a set of rollers moving at a speed not exceeding 5 KM. per hours. The initial or break down rolling shall be with 10 tonne vibro rollers and the surface finished by final rolling with 10 tonne vibro rollers or suitable pneumatic rollers.

The roller wheels shall be kept damp to prevent the mix from adhering to them but in no case shall fuel, lubricating oil be used for this purpose. Rolling shall commence longitudinally from the edge and progress towards the centre, except that on super elevated portions, it shall progress from the lower to upper edge parallel to the fresh material with rear or mixed wheel loading so as to minimise the pushing of the mix and each pass of the roller shall uniformly overlap not less than one third of the Tack made in the preceding pass. Rolling shall continue until the entire surface has been rolled to compaction and all the roller marks eliminated.

Opening to Traffic

The traffic may be allowed immediately after completion of the final rolling when the mix has cooled down to the surrounding temperature.

Surface finish and Quality Control of work

The surface finish of construction shall conform to the requirement of MORTH specification Clause-901, control on the quality of material and works shall be exercised by the Engineer-in-charge in accordance with MORTH specification, Clause-902.

Arrangement for Traffic

During the period of construction, arrangement of traffic shall be done as per Clause 112 of MORTH.

Measurements for Payment

The payment shall be made on the MT basis of weigh mat slip from GIPCL Weigh Bridge. For verification weight of empty dumpers and weight of loaded dumper will be recorded in slip and SAP report.

Weight of mix materials will be done in presence of Weighbridge operator. The weight of each dumper shall be recorded on weigh mat slip and SAP report. Record of each dumper will be mentioned separately, which will be maintained by the Company's representatives and signed by the contractor.

The Contract unit rate for Bituminous concrete shall be measured in MT. Weight shall be considered final from GIPCL Weighbridge only, no other weigh bridge will allow for final certification. No extra payment shall be made work done is excess quantity beyond the direction of Engineer-in charge.

Rate

The contract unit rate for the work shall be paid in full for carrying out the required operations including full compensation for :-

(a) Making arrangements for traffic to clause-112 of MORTH book of specifications for Roads and Bridges work, second edition, 1988 except for initial treatment to verge shoulders and construction of diversions.
(b) Providing all materials to be incorporated in the work including all royalties, fees, rents, where necessary and all leads and lifts.
(c) All labour, tools, equipments, plants and incidentals to complete the work to the specifications and
(d) Sand or dust flushed surface (if necessary) as required without any extra cost.

Item no 9 Asphalt Painting :- Providing and applying evenly TACK COAT on road surface with bitumen 60/70 (VG-30) grade @ 5.0 Kg per 10 M2 including heating the asphalt and spraying the same using Bitumen tanker with burner facility & sprayer then spreading approved sand/aggregate/dust over the treated surfaces at the rate of 0.03 M3 per 10 M2. The rate shall be also including cleaning of surface using Air compressor/brush & disposal of dust/waste outside the premises etc. complete all as per specifications and instruction of Engineer-in-charge.

Mode of Measurement :- Tack coat painting shall be measured in terms of surface area of application in square meters. For verification weight of empty tanker and weight of loaded tanker will be checked in GIPCL weighbridge.

Item no 10 :- Providing and laying hot applied thermoplastic compound 2.5 mm thick including reflectorizing glass beads at 250 grams / Sq.mt. area. Thickness of 2.5 mm is exclusive of surface applied. Glass beads as per I.R.C. 35. The finished surface to be level uniform and free from streaks and holes etc. completes all as per specifications and instruction of Engineer-in-charge.

ROAD MARKINGS :-

General :-The colour, width and layout of road markings shall be in accordance with the Code of Practice for Road Markings IRC : 35, and as specified as directed by the Engineer.

Materials :- Road markings shall be hot applied thermoplastic compound and the material shall meet the requirements as specified below.

Hot Applied Thermoplastic Road Marking :-

General:-

(i) The work under this section consists of marking traffic stripes using a thermoplastic compound meeting the requirements specified herein.
(ii) The thermoplastic compound shall be screened lextruded on to the pavement surface in a molten state by suitable machine capable of controlled preparation and laying with surface application of glass beads at a specific rate. Upon cooling to ambient pavement temperature, it shall produce an adherent pavement marking of specified thickness and width and capable of resisting deformation by traffic.

(iii) The colour of the compound shall be white or yellow as specified as directed by the Engineer.

Thermoplastic Material:

General:- The thermoplastic material shall be homogeneously composed of aggregate, pigment, resins and glass reflectorizing beads.

Requirements:-

Composition: The pigment, beads and aggregate shall be uniformly dispersed in the resin. The material shall be free from all skins, dirt and foreign objects. When applied at a temperature specified by the manufacturer and to the required thickness, the material shall set to bear traffic in not more than 15 minutes

Marking:- Each container of the thermoplastic material shall be clearly and indelibly marked with the following information:

1. The name, trade mark or other means of identification of manufacturer
2. Batch number
3. Date of manufacturer
4. Colour (white or yellow)
5. Maximum application temperature and maximum safe heating temperature.

Sampling and testing:

The thermoplastic material shall be sampled and tested in accordance with the appropriate ASTM/BS method. The contractor shall furnish to the employer a copy of certified test reports from the manufacturers of the thermoplastic material showing results of all tests specified herein and shall certify that the material meets all requirements of this specification.

REFLECTORISING GLASS BEADS :-

General :- The glass beads shall be transparent, colourless and free from milkiness, dark particles and excessive air inclusions.

Specific requirements:-

(A) Gradation :- The glass beads shall meet the gradation requirement as per relevant IS Code.
(B) Roundness :- The glass beads shall have a minimum of 70 per cent true spheres.
(C) Reflective Index :- The glass beads shall have a minimum reflective index of 1.50.
(D) Free flowing properties :- The glass beads shall be free of hard lumps and clusters and shall dispense readily under any conditions suitable for paint striping. They shall pass the free flow test.

Application properties of thermoplastic material:-

The thermoplastic material shall readily get screeded/extruded at temperatures specified by the manufacturers for respective method of application to produce a line of specified thickness which shall be continuous and uniform in shape having clear

and sharp edges. The material upon heating to application temperatures, shall not exude fumes, which are toxic, obnoxious or injurious to persons or property.

Preparation:-

(i) The material shall be melted in accordance with the manufacturer's instructions in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic material to avoid local overheating. The temperature of the mass shall be within the range specified by the manufacturer, and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer. The molten material should be used as expeditiously as possible and for thermoplastic material which has natural binders or is otherwise sensitive to prolonged heating, the material shall not be maintained in a molten condition for more than 4 hours.

(ii) After transfer to the laying equipment, the material shall be maintained within the temperature range specified by the manufacturer for achieving the desired consistency for laying. Properties of finished road making:-
   (a) The stripe shall not be slippery when wet.
   (b) The making shall not lift from the pave in freezing weather.
   (c) After application and proper drying, the stripe shall show no appreciable deformation or discolouration under traffic and under road temperatures up to 60 degree C.
   (d) The marking shall not deteriorate by contract with sodium chloride, calcium chloride or oil drippings from traffic.
   (e) The stipe or marking shall maintain its original dimensions and position. Cold ductility of the material shall be such as to permit normal movement with the road surface without chopping or cracking

ITEM NO 11 TO 23 :- As per item description.

SPECIAL CONDITIONS FOR BITUMINOUS SURFACE WORK WITH USE OF "BATCHING/HOT MIX PLANT AND PAVER FINISHER"

1. The Hot Mix Plant/Batching Plant and accessories to be used for the work shall be in conformity with the specifications prescribed by Ministry of Transport. The plant shall be equipped with all units and accessories as per latest I.S as amended from time to time. The contractors will have to modify their plants suitably within a period of six months from the date of issue of latest I.S. Specification or codes.
2. The work shall be of laying aggregate mixed with bitumen shall start on site of work only after 7.00 hours in the morning and continue upto 17.00 hours in winter season and up to 18.30 hours in summer.
3. Quantity of bituminous aggregate mix to be laid shall be restricted to 500 tons per day for 80-120 t/hr capacity plant and may be more or less depending upon the rated capacity of the plant.
4. The contractor shall invariably get the job mix formulae for the mix approved by the Engineer-in-charge before starting the work.
5. If any machinery i.e. plant and paver is break down and the work is kept closed for some period, the machinery shall not be shifted from the work site and other work shall be done during that period from the same machinery.
6. The contractor will collect on site of work only the materials approved as per the specifications of the work. The work can only be started after removing of materials of low quality collected from site of work.

APPENDIX - "A"

TECHNICAL REQUIREMENTS OF DRUM MIX PLANTS

GENERAL

The drum mix plant should be of reputed make and proven design, sturdy in structure and capable of producing desired quality of mix as per specification for laying bituminous road surface and should have following essential arrangements :-

1. COLD AGGREGATE FEEDER

The cold aggregate feeder arrangement should have minimum 3 bins of sufficient capacity capable to storing different sizes of aggregates and fines to ensure continuous uninterrupted supply of aggregate matching the capacity of the plant. Each bin should have independent belt feeder system driven by a variable speed motor and a control gate to ensure accurate aggregate feed to meet design mix formulae. It is pre-requisite that only properly screened and graded materials are fed to the bins.

There should be a gathering conveyor to receive and transport material discharged from this bins with separate drive arrangement.

There should be a suitable arrangement like baffle plate at the discharge end of gathering conveyor for rejection of any oversize metal above the permits of limit. The conveyor should be fitted with suitable electronic weigh device for weighing quantity of cold aggregate being fed to dryer drum.

The plant shall have a mineral filler arrangement with suitable control device. Proportion the flow of filler material into dryer drum at appropriate stage.

2. DRYER DRUM

It should be termodrum type with smooth rotation arrangement to give rated output and capable of reducing the moisture content of the aggregate to desirable limit of 2% to 6% and achieving hot mix temperature (upto 160^{o}C) as per the requirement) with such design that no blue smoke is emitted from the exhaust. The drum may have optional arrangement for feeding reclaimed material. There should be arrangement to restrict burner flame upto certain length in the drum before bitumen is injected.

It should be fitted with positive displacement bitumen pump drived by variable speed motor automatically controlled from control cabin, capable of feeding desired quantity of bitumen synchronised with aggregate feed system. Thermo mix fluid system or hot oil circulation system should be an in-built feature to keep bitumen pump and pipes sufficiently hot to avoid clogging of pipes.

3. BURNER

The burner used should be capable of burning the fuel efficiently and develop the required temperature. It should be fitted with remote control system, to defect flame failure, and also electric spark ignition system or some other suitable arrangement. Burner operation should have thermostatic control of flame within the specified temperature range.

4. **BITUMEN HEATER**

It should consist of an insulated teak of adequate capacity fitted with effective and positive control of temperature, for allowing continuous circulation of bitumen between Bitumen Heater and proportioning units. Suitable arrangements should be provided for recording the temperature at the tank and in circulation system.

5. **FUEL SYSTEM**

Fuel tanks should be of sufficient capacity and fitted with suitable type of fuel pump to receive the fuel from storage tank supply to line heater and burner.

6. **CYCLONE SYSTEM**

Cyclone unit is required to control dust discharge within the admissible standard of pollution level.

7. **OPERATING CONTROL UNIT**

The drum mix plant must have centralised control system with operation from a control cabin located adjacent to the drum mix plant. The control system should be capable of following:-

(i) Automatic control of speed of each bin feeder conveyor and gate so as to control and regulate the flow of various grades of material to ensure constant and accurate proportion of aggregates.

(ii) Pre-set and control the percentage of flow of aggregate and asphalt required as per design mix.

(iii) Automatic detection of plant operation, failure, display of aggregate temperature, asphalt and mix temperature, aggregate flow etc.. Fully automatic aggregate blending, bitumen / aggregate ratio control and burner control system.

(iv) Control for pre-setting the moisture content of aggregate display digitally.

(v) Digital control system should be such that if desired, it would be operated manually also.

8. **SURGO SILO**

The plant may have optional arrangement to store hot mix materials for at least equivalent to 30% of rated capacity to cater for any delay in loading the tippers. Temporary storage silo should have adequate automatic hydraulic unloading arrangement operated either from the control cabin or manually with necessary safety control.

TECHNICAL REQUIREMENTS OF BATCHING PLANTS

GENERAL

The Batching Plant should be of reputed make and proven design, sturdy in structure and capable of producing desired quality of mix as per specification for laying bituminous road surface and should have following essential arrangements :-

1. COLD AGGREGATE FEEDER

The cold aggregate feeder arrangement should have minimum 3 bins of sufficient capacity capable to storing different sizes of aggregates and fines to ensure continuous uninterrupted supply of aggregate matching the capacity of the plant. Each bin should have independent belt feeder system driven by a variable speed motor and a control gate to ensure accurate aggregate feed to meet design mix formulae. It is pre-requisite that only properly screened and graded materials are fed to the bins.

There should be a gathering conveyor to receive and transport material discharged from this bin with separate drive arrangement.

There should be a suitable arrangement like baffle plate at the discharge end of gathering conveyor for rejection of any oversize metal above the permits of limit. The conveyor should be fitted with suitable electronic weigh device for weighing quantity of cold aggregate being fed to dryer drum.

The plant shall have a mineral filler arrangement with suitable control device. Proportion the flow of filler material into dryer drum at appropriate stage.

2. DRYER DRUM

It should be termodrum type with smooth rotation arrangement to give rated output and capable of reducing the moisture content of the aggregate to desirable limit of 2% to 6% and achieving hot mix temperature (up to 160^{o}C) as per the requirement) with such design that no blue smoke is emitted from the exhaust. The drum may have optional arrangement for feeding reclaimed material. There should be arrangement to restrict burner flame up to certain length in the drum before bitumen is injected.

It should be fitted with positive displacement bitumen pump drived by variable speed motor automatically controlled from control cabin, capable of feeding desired quantity of bitumen synchronised with aggregate feed system. Thermo mix fluid system or hot oil circulation system should be an in-built feature to keep bitumen pump and pipes sufficiently hot to avoid clogging of pipes.

3. BURNER

The burner used should be capable of burning the fuel efficiently and develop the required temperature. It should be fitted with remote control system, to defect flame failure, and also electric spark ignition system or some other suitable arrangement. Burner operation should have thermostatic control of flame within the specified temperature range.

4. BITUMEN HEATER

It should consist of an insulated teak of adequate capacity fitted with effective and positive control of temperature, for allowing continuous circulation of bitumen between Bitumen Heater and proportioning units. Suitable arrangements should be provided for recording the temperature at the tank and in circulation system.

5. FUEL SYSTEM

Fuel tanks should be of sufficient capacity and fitted with suitable type of fuel pump to receive the fuel from storage tank supply to line heater and burner.

6. CYCLONE SYSTEM

Cyclone unit is required to control dust discharge within the admissible standard of pollution level.

7. OPERATING CONTROL UNIT

The Batching Plant must have centralised control system with operation from a control cabin located adjacent to the Batching Plant. The control system should be capable of following:-

(i) Automatic control of speed of each bin feeder conveyor and gate so as to control and regulate the flow of various grades of material to ensure constant and accurate proportion of aggregates.

(ii) Pre-set and control the percentage of flow of aggregate and asphalt required as per design mix.

(iii) Automatic detection of plant operation, failure, display of aggregate temperature, asphalt and mix temperature, aggregate flow etc.. Fully automatic aggregate blending, bitumen / aggregate ratio control and burner control system.

(iv) Control for pre-setting the moisture content of aggregate display digitally.

(v) Digital control system should be such that if desired, it would be operated manually also.

8. SURGO SILO

The plant may have optional arrangement to store hot mix materials for at least equivalent to 30% of rated capacity to cater for any delay in loading the tippers. Temporary storage silo should have adequate automatic hydraulic unloading arrangement operated either from the control cabin or manually with necessary safety control.

SPECIAL CONDITIONS

1. CONSTRUCTION EQUIPMENT

1.1 The methodology and equipment to be used on the project shall be furnished by the contractor to the engineer well in advance of commencement of work and approval of the engineer obtained prior to its adoption and use.

1.2 The contractor shall have a trial run of the equipment for establishing its capability to achieve the laid down specifications and tolerance to the satisfaction of the engineer before commencement of work, if so desired by the engineer.

1.3 All equipments provided shall be of proven efficiency and shall be operated and maintained at all times in a manner acceptable to the engineer.

1.4 No equipment or personnel will be removed from site without permission of the engineer.

2. WORK PROGRAMME AND METHODOLOGY OR CONSTRUCTION

The contractor shall furnish his programme of construction for execution of the work within the stipulated time schedule together with methodology of construction of work and obtain the approval of the Engineer prior to actual commencement of work.

3. ACTION IN CASE OF DISPROPORTIONATE PROGRESS

In case of extremely poor progress of the work at any time at any stage of work which in the opinion of the Executive Engineer cannot be made good by the contractor considering his available resources, GIPCL will get it accelerated to make up the lost time thoroughly any other agency and recover the additional cost incurred. If any in getting the work done from the contractor after informing him in writing about the action envisaged by him.

4. SETTING OUT

a. Contractor shall establish working Bench marks tied with the reference bench mark in the area soon after taking possession of the site. The working bench marks/levels should be got approved from Engineer-in-charge. Checks must be made on these bench marks periodically or as directed by Engineer-in-charge and adjustments, if any, got agreed with Engineer-in-charge and recorded. An up-to-date record shall be maintained by the Contractor and also copy supplied to Engineer-in-charge for his record.

b. The lines and levels of formation, side slopes, carriage ways and shoulders shall be carefully set out and frequently checked, care being taken to ensure that correct gradients and cross sections obtained everywhere

c. In order to facilitate the setting out of the works, the centre lines of the carriageways must accurately established by the Contractor and approved by Engineer-in-charge. It must then be accurately referenced in a manner satisfactory to the Engineer-in-charge, every 50m intervals in plain and rolling area and 20m intervals in all curve points as directed by Engineer-in-charge, with marker pegs and chainage boards set in or near the fence line, and schedule of reference dimensions shall be prepared and supplied by the Contractor to the Engineer-in-charge. The markers shall be maintained until the works reach finished formation level and are accepted by the Engineer-in-charge.

d. The Engineer-in-charge will provide the Contractor with the data necessary for setting out of centre line. All dimensions and levels shall be verified by the contractor on the site and he shall immediately inform to Engineer-in-charge of any apparent errors or discrepancies in such dimensions or levels.

e. After obtaining approval of Engineer-in-charge, work on wet mix macadam can commence and the profile and cross sections shall form the basis for measurements and payment. The contractor shall be responsible for ensuring that all the basis traverse points are in place at the commencements of the contract and if any are missing, or appear to have been disturbed. The contractor shall make arrangements to re-establish these points. A 'Survey file containing the necessary data will be made available for this purpose. If in the opinion of the Engineer-in-charge, design modifications of the centre line or grade are advisable, the Engineer-in-charge will issue detailed instructions to the Contractor and the Contractor shall perform the modification in the field, as required, and modify the ground levels on the cross sections accordingly as many times as required. There will be no separate payment for any survey work performed by the Contractor. The cost of these services shall be considered as being included in the cost of items of work in the Bill of Quantities.

f. The work of setting out shall be deemed to be a part of general works, preparatory to the execution of work and no separate payment shall be made for the same.

g. Precision automatic levels, having a standard deviation of ±2mm per Km shall be used. Setting out of the road alignment and measurement of angles shall be done by using theodolite with traversing target, having accuracy of one second.

5. ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION

Action for arrangement for traffic during construction will be taken by the contractor envisaged in the contract documents and spelt out in clause-112 of Ministry's Specifications for Road and Bridge Works (2nd Revision).

6. QUALITY CONTROL

The norms of achieving quality of work will be on the contractor who will take actions in herewith.

MINISTRY'S SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (2ND REVISION)

The Ministry's Specifications for Road and Bridge works (2nd Revision) will form part of the contract documents and the contractor will be legally bound to the various stipulations made therein unless and otherwise specifically relaxed or waived wholly or partly by any special clause in the contract document.

7. DOCUMENTATION

The contractor will prepare drawing (9s) of the work as constructed and will supply in original with three copies to GIPCL who will verify these drawings. After approach finally drawing (s) shall then be prepared by the contractor and supplied in triplicate along with a micro film of the same to GIPCL for record and reference purpose.

8. APPLICABLE IN CASE OF ROAD WORKS ONLY :-

The details of the paver, specified in the clause-504.3.5 will be relaxed in case of bituminous macadam (Clause-504) where it is going to be covered by any wearing course including 25 mm. Semi-dense concrete (clause-519) other than 40 mm. Semi dense Bituminous concrete (clause-511) / Bituminous concrete clause (clause-512) or by a base course of Dense Bituminous macadam (Clause-507) with the provision that Bituminous macadam and 25 mm. Bituminous concrete can be laid by means of self propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix true to the specified lines/grades and cross sections. (MORTHGOL.No.RW/ NH/ 33045/88-dO-II, dated 6.4.1990).

The work shall be executed with the equipment as per MORTH Specification (IInd Revision), 1988, wherein details of the types of equipment are given for various specifications.

QUALITY CONTROL PLAN

Sr. No.	Material	Test to be conducted		IS Code	Frequency	Test Conducted by
1	Murrum	Cohesive and non-swelling test			Two Test randomly by Engineer-in-charge	GIPCL Approved lab
2	Granular Sub-base	Gradation test by Sieve Analysis		GSB-III	Two Test randomly by Engineer-in-charge	Approved lab
3	Wet Mix Macadam					
		i	Gradation test by Sieve Analysis		Two Test randomly by Engineer-in-charge	Approved lab
		ii	Aggregate impact value	IS 2386 (Part 4)	Two in beginning or decided by Engineer-in-charge	Approved lab
		iii	Los Angeles Abrasion value	IS 2386 (Part 4)	Two in beginning or decided by Engineer-in-charge	Approved lab
		vi	Combined flakiness and elongation indices	IS 2386 (Part 1)	Two in beginning or decided by Engineer-in-charge	Approved lab
1	DBM & Bituminous concrete (B.C.)					
	A) At source-Properties of binder and aggregate	i	Quality of binder-penetration, softening, ductility and specific gravity test	IS73/217/8887	Two Test randomly by Engineer-in-charge	Approved lab
		ii	Aggregate impact value	IS 2386 (Part 4)	Two in beginning or decided by Engineer-in-charge	Approved lab

Sr. No.	Material	Test to be conducted		IS Code	Frequency	Test Conducted by
		iii	Los Angeles Abrasion value	IS 2386 (Part 4)	Two in beginning or decided by Engineer-in-charge	Approved lab
		vi	Combined flakiness and elongation indices	IS 2386 (Part 1)	Two in beginning or decided by Engineer-in-charge	Approved lab
		vii	Water absorption value	IS 2386(Part 3)	Two in beginning or decided by Engineer-in-charge	Approved lab
		viii	Grading of aggregate	IS 2386(Part I)	Two in beginning or decided by Engineer-in-charge	Approved lab
	b) During laying and compaction	i	Binder content	ASTM-D-2172	Tests randomly or decided by Engineer-in-charge	Approved lab
		ii	Temperature of binder in boiler and agg in drier before mixing	As per specification	At regular close interval	Field test
		iii	Temperature of mix at the time of laying and rolling	As per specification	At regular close interval	Field test
		iv	Rate of spread of mix material	As per specification	On regular basis through check of layer thickness	Field test
	Any other third party testing				As per directive of Engineer in charge	Approved lab

****