



**FRAMEWORK AGREEMENT**

**FOR**

**REFURBISHMENT, MAINTENANCE, REPAIRS AND  
ASSOCIATED WORKS OF LANDSCOPE INDUSTRIAL  
PROPERTIES**

**REF LM-IB-MR24-120**

**PART 2**

**WORKS REQUIREMENTS**

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## **SPECIFICATIONS**

Note: - The term employer mentioned in this technical specification refers to Landscape Mauritius Ltd (LM). The terms engineer and project manager refer to the same person. The Codes specified are deemed to be the latest at the time of execution.

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# SECTION 1 – GENERAL

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## **Article 1.1 - Sites of Works**

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The works shall consist of rail/road works which include, but not limited to the construction of new roads, upgrading and resurfacing of existing roads and associated works such as construction of footpaths, concrete works, provision of handrails, provision of bus laybys, raising of manholes, line marking, fixing of traffic signs, implementation of road safety measures of all types, among others, for the period of the contract. These works generally are on main roads and motorways but may also be undertaken on urban roads, rural roads, track roads; yards and premises of public properties.

## **Article 1.2 - Scopes of Works**

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The works consist of earthworks, constructions of sub-grade, crushed stone sub-base and base, laying of bituminous base course and wearing course, constructions of unlined or lined drains in either masonry or in-situ/pre-cast concrete which can be open or covered by slabs, road marking, traffic signs and other road furniture, implementation of road safety measures of all types, street lightings, diversion of services as per schedules of rates. Such works will be defined in Works Orders issued by the Project Manager.

The contractor must be able to work on several fronts simultaneously within the capacity of the resources listed in the contract. Due to traffic constraints in some areas, the contractor may be instructed to carry out some or all of the works in that area at night or during week-end. The contractual rates will apply in these situations.

## **Article 1.3 - Third Party Obligations**

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The Contractor shall not demolish or otherwise interfere with any dwelling or building or anything connected therewith unless and until permitted to do so by the relevant authority/body.

The Contractor shall take special care to prevent injury, damage, trespass on private lands, crops, fences, entrances and other properties including the adjoining sites of other contracts, adjacent to the works.

The Contractor must make all necessary arrangements in this connection with adjoining landowners and other Contractors or with the officer appointed for the purpose in case of Government property and assure the observance by his workmen of all regulations and laws appertaining thereto.

The Contractor shall make his own arrangements with landowners concerned for access on the site of the works. Similarly, the Contractor shall make his own arrangements for access to and for procurement of, any materials for the construction of the works.

The Contractor shall indemnify the Employer against all claims from failure to fulfill the above obligations and against all other claims arising from failures of a similar nature.

## **Article 1.4 - Works Executed by Employer or Other Contractors**

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The Employer reserves the right to execute works, on site, that are not included under this Contract and to employ for this purpose either his own employees or another Contractor whose contract may be either a sub-contract under this contract or an entirely separate contract.

The Contractor shall ensure that neither his own operations nor trespass by his employees shall interfere with the operations of the Employer or his contractor employed on such works and the same obligations shall be imposed on the Employer or Contractor in respect to the works being executed under this Contract.

## **Article 1.5 – Permit to Work from LM**

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To perform any work on LM's premises, the contractor needs to firstly have an authorized Permit to Work (PTW) issue by LM Operational Control Centre (OCC). Prior to any work being conducted, the contractor shall contact and inform the Engineer with regards to his intention to carry out the works. The contractor will have to carry out a risk assessment (RA) and submit to the Engineer for evaluation. The Engineer shall review and approve the methodology proposed to be adopted by the contractor and shall then arrange for the PTW. The Engineer shall assign a LM Person in Charge (PiC) who will assist and monitor the work of the contractor with a view to ensure safety of trains, passengers, and workers. The PiC shall also ensure that the contractor's supervisors and the workers have clearly understood the safety aspects and requirements to be adopted and followed while executing the work. The contractor shall always be under the command of a LM PiC.

## **Article 1.6 - Liaison with Police, Authorities, and Other Officials**

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The Contractor shall keep in close contact with the Police Department, the Ministry of Public Infrastructure and Community Development, the Ministry of Land Transport and Light Rail, the Ministry of Agro Industry and Food Security, the Mauritius Telecom, the Central Electricity Board, the Central Water Authority, the Wastewater Management Authority, the Irrigation Authority and other relevant institutions of the areas concerned regarding their requirements for the control of workmen, movement of traffic, passage through inhabited zones or other matters and shall provide all assistance or facilities which may be required by such officials in the execution of their duties and same is deemed to be already included in their rates.

## **Article 1.7 - First Aid, Welfare and Safety Precautions**

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The Contractor shall provide, equip and maintain an adequate First Aid Station on the site of the works and provide all necessary transport and shall have experienced First Aid personnel available for attending minor accidents.

The Contractor shall allow in his prices and be responsible for the cost of all site welfare arrangements and health requirements.

All works is to be executed in a safe and responsible manner and the Contractor is to proceed in accordance with the provisions of the appropriate legislation. Particular attention is drawn to the need for adequate handrailing and fencing off dangerous areas, e.g., excavations on roads.

### **Article 1.8 - Alterations to and Preservation of Existing Services**

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For the purpose of this clause, the Contractor shall be responsible for liaising with the various authorities concerned and shall ensure the timely arrangements of works affecting or touching the services.

Where work is being out in the vicinity of overhead power lines, the Contractor is responsible for ensuring that all persons working in such areas are aware of the relatively large distance that high voltage electricity can short to earth when cranes, or other large masses of steel, are in the vicinity. The Contractor's attention is drawn to BS EN 61936-1:2010 + A1:2014 which states safe clearance for various voltages.

In all cases where such works are exposed, they shall be properly shored or hung up. Special care must be exercised in refilling to compact the ground under mains, cables, etc..., and not to cover up exposed water meters and stopcock boxes, among others.

Poles supporting cables adjacent to the works shall be kept securely in place until the work is completed and then shall be made safe and permanent.

Should the Contractor expose any existing services which may interfere with or be damaged by the construction, he shall submit details of such services to the Project Manager who will instruct the Contractor as to what measures are required to remove, alter, change or re-direct the existing services. Precautions shall be taken to maintain the flow of water in streams, rivers, conduits and pipelines. The work required to protect services shall be notified to the Contractor after approval by the relevant services authorities.

The foregoing requirements will apply equally to any work on services or roads completed by the Contractor in an earlier stage of the Contract.

Should any existing services be uncovered (such as power lines, water lines, telephone lines, among others) in the area of works, the Contractor shall be responsible for arranging for the protection of such services including the removal, modification or diversion if necessitated by the works, subject to the approval of the Project Manager.

The Contractor shall also seek approval from the authorities concerned whenever required.

Any damage to or interference with existing services occasioned during the progress of the works, shall be deemed to be the responsibility of the Contractor, who shall undertake to make good at his own expense and shall be solely liable in respect of all claims arising from such damages or interferences however caused.



## **Article 1.9 - Traffic Deviations, Traffic Control and Signs**

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The Contractor shall be responsible for the safe and easy movement of road and pedestrians traffic, by day and night through the sections of the existing roads where works are being carried out.

The Contractor shall bear the costs of all temporary warning signs which shall be in accordance with GN 154 of 1990 for the safety and direction of the Public as required by the Laws of Mauritius or local by-laws, or as ordered by the Project Manager. All such arrangements shall receive the prior approval of the Project Manager.

Provisions and maintenance of traffic diversion will be the responsibility of the Contractor. The Contractor shall allow in his rates for the provision of traffic signs and the regulation of traffic flow necessary for normal traffic diversion. If a major deviation requiring measures over and above that required for normal traffic diversion is required, the same will have to be submitted to the Engineer for approval prior to start of the works. The Contractor will be entitled to additional payment, if any, for the major deviation at rates to be agreed with the Engineer.

The Contractor shall ensure that neither his own operations nor trespass by his employees shall interfere with the operation and maintenance of traffic diversions.

## **Article 1.10 - Programme to Be Furnished**

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Depending upon the complexity of the works defined in the Works Order, the Project Manager may request the contractor to submit a Program of Works within the time specified. No extension of time will be considered if the contractor fails to submit a program of works.

## **Article 1.11 - Setting Out**

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The Contractor shall be responsible for the full and proper setting out of the works. The principal setting out points and benchmarks shall be referenced out during construction and the Contractor shall maintain these throughout the Contract Period.

Throughout the Contract, both the general and detailed methods of the complete setting out of the works shall be submitted by the Contractor for the prior approval by the Engineer.

The dimensions and levels shown on the Drawings are believed to be correct, but the Contractor shall verify same on site and is no way be absolved from the responsibility from any consequences arising from the inaccuracy of such dimensions or levels.

The Contractor may be required to prepare and submit additional drawings to complete the working drawings. He shall give the Engineer not less than 24 hours' notice, of his intention to set out or give levels for any part of the works, in order that arrangements can be made for inspection. The Contractor shall provide all the necessary instruments, appliances, labour and any material or staging that the Engineer may require to check the setting out or levels as specified in the Article hereof.

Any remarks made by the Engineer shall be carefully preserved. Works shall be suspended for such time as it is necessary for checking the dimensions, lines and level marks on any part of the works.

The Contractor shall ensure that all plant operators, gangers and key men working on site are made aware of the positions of all important dimensions, lines and level marks and the importance of reporting the least disturbance of the same. In the event of any reference marks being damaged or misplaced during the Works, the contractor shall replace or reinstate such marks to the satisfaction of the Engineer.

### **Article 1.12 - Temporary Works**

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The Contractor shall be wholly responsible for obtaining a site for his camps, offices, stockpiles of aggregates, construction plants and other temporary works outside the road reserves and shall provide all services required therewith. All temporary buildings or stores and plant shall be located only on sites approved by the Engineer. The Contractor shall make his own arrangements with the landowners at his own expense.

All land to be permanently used or occupied by the works shall be provided by the Employer, in whole at the start of works or in part as the works progress.

The Contractor shall maintain all offices required by his site staffs, workshops, storage sheds, etc., and clear away upon completion of the works and leave the site in clean and tidy condition.

The Contractor shall provide latrines and ablutions for his employees, maintain them in a sanitary condition throughout the Contract and clear away on completion and leave the site in a clean and tidy condition. The Contractor shall be solely responsible for any living accommodation required by his employees.

When no longer required for the Contract, all such provisions shall be left or dismantled and disposed of as directed by the Engineer and their sites shall immediately be cleaned and left as far as practicable in the same condition as that obtained immediately prior to occupation.

### **Article 1.12 - Maintenance of Existing Access and Services**

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The Contractor shall provide at all times, access for vehicles and pedestrians to their premises for owners and occupiers of land along the route of the works. Provisions must be made to ensure that sanitary services remain unimpeded at all times.

The Contractor shall be responsible for the maintenance of the existing roads of which he has been given possession and shall reinstate it to its original state if damaged during the Construction and if the damages is due to the contractor's activities.

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### **Article 1.14 Progress Report**

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The Contractor shall submit to the Engineer on the last day of each month a Progress Report for the preceding period, showing up-to-date progress during the previous period on all important items in each section of the Work in the manner prescribed by the Engineer including the plant and personnel schedule. The progress report shall be related to the programme such as defined in Article 1.9 of these Technical Specifications.

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### **Article 1.15 - Water and Electricity Supplies**

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It is the Contractor's responsibility to provide water and electricity for both construction purposes and also for the camps and offices. The Contractor's attention is drawn to the fact that no separate payment will be made for the provision of water and electricity and the Contractor shall be deemed to have included for these in his rates and prices. The Engineer may reject any water, which in his opinion is contaminated and not sufficiently clean for the purpose intended.

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### **Article 1.16 - Nature of Ground and Conditions of Work**

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The Contractor must satisfy himself as to the general circumstances at the site of the Works and the construction thereon, the form of river beds, and banks, the flows in the river, the surface of the ground and nature of the materials to be excavated, the possibility of subsidence from soft ground and bad and broken materials, and falls of rock in or arising out of the Works, and the possibility of floods and landslides, and the rates and prices in the Bills of Quantities will be held to cover all such contingencies.

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### **Article 1.17 - Rejected Materials and Defective Work**

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Any work, which fails to comply with this Specification, shall be classified as rejected materials or defective works and the Contractor shall, at his own expense, shall be cut out and removed from the Works and replaced, as directed by and to the satisfaction of the Engineer.

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### **Article 1.18 - Particulars of Existing Works**

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Such information may be given on the Drawings, as to the present condition and character of the existing structures, roadways and other services, and as to the form and dimensions of various parts of the existing structures and positions and particulars of pipes, cables and other mains and information arising as a result of trial pits and boreholes is given without guarantee of accuracy and neither the Employer nor the Engineer will be liable for any discrepancy therein.

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### **Article 1.19 - Protection of Works**

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The Contractor shall take all steps necessary to protect the permanent Works and all stores and materials from the effects of inclement weather, including floods and cyclones, theft and shall

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be entirely responsible for any delay, damage or loss arising therefrom. The Contractor shall take account in his rates for the mitigation of noise and dust pollution generated in the execution of the contract.

### **Article 1.20 Protection from Water**

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The Contractor shall keep the whole of the Works free from water and allow in his prices for all dams, cofferdams, pumping, piling, shoring, temporary drains, sumps etc., necessary for the purpose and shall clear away and make good at his own cost and to the satisfaction of the Engineer all damage caused thereby. The drainage of the natural ground in the vicinity of the earthworks and drainage work generally shall be carried out in advance of the rest of the Works.

### **Article 1.21 - Unauthorized Persons**

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No unauthorized persons are to be allowed on to any part of the Site and the Contractor shall take steps to prevent this and instruct his Foremen and Watchmen accordingly. The cost for ensuring the same is deemed to be already included in the contractor's rates.

### **Article 1.22 - Filling in Holes and Trenches**

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The Contractor immediately upon completion and approval of any work shall fill up all holes and trenches which may have been made or dug, level mounds or heaps of earth that may have been raised or made, and clear away all rubbish which may have become superfluous or have been occasioned or made by the execution of such work; and the Contractor shall bear and pay all costs, charges, damages and expenses which may be incurred or sustained on account or in consequence of any accident which may happen by reason of holes and trenches connected with the work being dug and left unfenced or material being left or placed in improper situations.

### **Article 1.23 - Joint Measurement of Extras**

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In such case as the Contractor shall find it necessary to execute any works, or provide any materials which he feels entitled to claim as extras to the Bill of Quantities he shall obtain written permission from the Engineer before commencing such work and shall make arrangements for the Works, or materials to be measured jointly with the Engineer, and the quantities agreed. Neglect to obtain authority to commence any such work, shall entitle the Engineer to disallow any claim for extras arising there from. The fact that joint measurement took place in no way commits the Engineer to recognise the validity of such claim, if it is considered unjustified. The Engineer, shall at all times, have full access to the Contractor's time books and may daily check the item of any extra works with the Contractor's timekeeper or otherwise, but the fact of his agreeing upon any time, shall in no way bind the Engineer to value the work, other than by measurement if he thinks fit to do so.

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## **Article 1.24 - Inspection by Engineer during Defects Liability Period**

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The Engineer will give the Contractor due notice of his intention to carry out any inspections during the Defects Liability Period and the Contractor shall upon receipt of such notice shall arrange for a responsible representative to be present at the time and dates named by the Engineer. This Representative shall render all necessary assistance and take note of all matters and things to which his attention is drawn by the Engineer. Any remedial or other work instructed by the Engineer shall be executed forthwith within the delay specified by the Engineer.

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## **Article 1.25 Signboards**

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Signboards shall be erected by the Contractor at locations to be given by the Engineer prior to the start of the works. The signboards shall be as per details given by the Engineer.

The Contractor shall obtain instructions from the Engineer in respect of the information to be displayed on the signboards. The Contractor will be deemed to have allowed for the supply and erection of a minimum of one signboard per Works Order.

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## **Article 1.26 - Advertising**

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The Contractor shall not erect any advertisement in any form within the Site or on adjoining ground, but shall provide a project board at the main entrances to the Site bearing suitable inscriptions including the name of the Contractor in accordance with details provided by the Engineer.

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## **Article 1.27 - Photographs**

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The Contractor shall submit photographs for the progress of work if directed by the Project Manager.

If for the purpose of the works, the contractor has to demolish any wall, fence, gate, shed, post, shrine or planted hedge located in a private property, he shall, as directed by the Project Manager, take photographs of the existing structure and jointly measure the extent of the works before proceeding with any demolition work. A copy of each photograph taken shall be submitted to the Project Manager.

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## **Article 1.28 - Laboratory Tests**

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All tests required for the selection of materials, design of mixes, control of materials and workmanship in order to comply with the requirements of this Specification shall be carried out in a laboratory to be approved by LM.

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## **Article 1.29 - Responsibility of the Contractor**

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Where the approval of the Engineer is required under these Technical Specifications, such approval shall not relieve the Contractor of his duties or responsibilities under the framework agreement.

## **Article 1.30 - Units Of Measurement**

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The units of measurement to be used throughout this Contract are in general metric units of metres (m), kilogrammes (kg), Newton (N) degrees Celsius (C) and litres (l).

## **Article 1.31 - Standard Specification**

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In order to establish standards of quality, reference has been made in this Specification to certain British Standards (BS) and to certain other National or International Standards.

The British or other Standards referred to shall be the latest edition published at the date of issue of work order.

All the conditions and particulars as to standard of materials, workmanship and tests contained in such British or other Standards shall be compiled for the various items. Other equivalent National or International Standard Specifications, which will ensure equal or higher qualities of materials or workmanship, may be substituted at the sole discretion of the Engineer if requested by the Contractor.

### **Article 1.32 - Services of Experts**

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The Project Manager may request the contractor to enlist the services of an experienced structural engineer, geotechnical or any other expert if and when required. The contractor shall first submit the CV of the proposed expert and the fees quoted by the latter for approval by the Project Manager. The expert will receive instructions from the Project Manager and the contractor shall cooperate to liaise with the expert if so requested by the Project Manager.

### **Article 1.33 - As built drawings**

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After completion of the works and at least eight (8) working days before the date of provisional acceptance, the contractor shall submit to the Project manager as-built drawings.

The Contractor shall submit As-Made Drawings on completion of Works to the Engineer/Employer in at least 2 hard copies and also in soft copy if so required by the Engineer/Employer.

The failure to supply the as-built drawings in time shall automatically prevent the provisional acceptance.

## **SECTION 2 - MATERIALS**

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## **Article 2.1 - Quality of Materials**

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All materials used in the Works shall be of the qualities and kinds specified and shall be approved by the Engineer. They shall comply with the requirements of the current amended editions, at the date of invitation to tender, of the European Standard (BS EN) British Standards (hereinafter abbreviated to B.S) published by the British Standards Institution, or AASHTO and ASTM Specifications as specified in the Technical Specifications. All materials may be checked both at the source and on Site and approval of any material at its source do not necessarily imply that it will be approved on site.

All materials shall be delivered on to the site in sufficient period before they are required for use in the Works, so that such samples as the Engineer may wish are taken for testing and approval, and the Contractor shall furnish any information required by the Engineer on the materials. Each supplier must be willing to admit the engineer or his representative to his premises for the purpose of obtaining the samples.

No materials of any description shall be used and no approved source of supply may be changed without prior sanction by the Engineer.

Samples of the approved materials will be retained by the Engineer until the completion of the Contract. The Contractor shall provide suitable labelled boxes or bags for the storage of these samples.

Materials used in the Works shall conform to the samples approved by the Engineer.

## **Article 2.2 - Approval of Source of Supply**

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Before ordering any materials, the Contractor shall submit, for the approval of the Engineer, the name of the Manufacturer of all items to be used in the Works and the source of supply of all materials to be used and the relevant Agreement Certificate. The Contractor shall ensure that the materials proposed conform to the Specification and Drawings prior to submission for approval of Engineer.

The approval in writing of the Engineer shall be obtained before relevant items are obtained. The information regarding the names of suppliers may be submitted at different times, as may be convenient, but no source of supply shall be changed without the Engineer's prior approval.

Two copies of each order for materials are to be delivered to the Engineer and if any variation from the Standard or type of materials is subsequently found necessary, it shall be approved in writing by the Engineer.

## **Article 2.3 - Defective Materials**

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All materials which do not comply with the requirements of the Specification will be rejected and all such materials, whether in place or not, shall be immediately removed from the site by the Contractor at his own expense.

## **Article 2.4 - Handling and Storage of Materials**

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2.4.1 The Contractor shall make his own arrangements for the storage space and yards.

2.4.2 All materials for use in the Works shall be handled with due care and whenever not in immediate use, stored or stockpiled as follows or as directed by the Engineer.

2.4.3 Stockpiling of Aggregates & milling materials

Approved aggregates or milling materials shall be stockpiled at approved locations; prior to stockpiling, the site shall be cleaned, levelled and well drained by the Contractor, who shall if required by the Engineer, also lay suitable hard surfacing.

Special care shall be taken to avoid segregation, contamination and mixing of different classes of aggregates. Stockpiles shall be built by layers of about 80 cm high. Material to be loaded shall be taken from the upper layer and never from the toe of the stockpile.

Coral sand for concrete shall be washed as necessary and as required by the Engineer.

2.4.4 Buildings for Storage

The siting of the buildings for storage shall be approved before construction commences. All buildings shall be adequate for the complete protection of the materials to be kept therein and precautions shall be taken against fire particularly with regard to the storage of inflammable materials.

2.4.5 Storage of Cement

Cement shall be stored in well ventilated, watertight buildings with floors raised 50 cm above ground level and cement shall be within 15cm of the sides of the buildings to ensure circulation of air. Each consignment shall be kept separately and the contractor shall use the consignments in the order in which they are delivered on site. When being conveyed to the site in lorries or other vehicles, they shall be properly covered with tarpaulins or other effective waterproof coverings. Cement, which has become unsuitable through absorption of moisture shall be rejected and removed from the site by the Contractor at his own expense.

2.4.6 Storage of Steel Reinforcement

Steel reinforcement shall be stored, sheltered and supported by wooden blocks so as to prevent sagging. Bars shall be stored in separate lots according to diameter and quality.

2.4.7 Bulk Storage for Bitumen and Cement

The Contractor may use bulk storage for bitumen and cement provided he can satisfy the Engineer that the capacities are adequate.

#### 2.4.8 Top Soil

Topsoil to be used later for verges or to cover embankment slopes and borrow pits shall be stockpiled on well-drained ground to be approved by the Engineer.

### **Article 2.5 - Borrow Pits and Spoil Tips**

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2.5.1 The Contractor will be required to obtain naturally occurring materials for the works from sources outside the area occupied by the permanent works.

The Contractor will also be required to locate, prove and propose for the Engineer's approval sources of fill materials and spoil tips. The approved sources for fill materials shall be designated "Borrow Pits". The fill materials proposed shall satisfy the requirements of Article 2.7.1 and 2.7.2. In case naturally occurring stones such as 'Grabbeaux' or similar materials are proposed as borrow pit material, such material shall be clean, free from dust and organic matter, besides satisfying the requirements of Articles 2.7.1 and 2.7.2 as regards maximum size and shall be subject to the approval of the Engineer. Any material which is rejected by the Engineer shall be immediately removed from the site and replaced at the Contractor's expense.

No additional cost shall be paid for substituted material such as 'Grabbeaux' or other in place of borrows pit material.

2.5.2 The Contractor is required to make all arrangements for land and access thereof in compliance with Clause 1.14 of the Specification.

### **Article 2.6- Boulders of Basalt**

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Only clean, dense and not altered boulders of basalt shall be used for production of aggregates.

The Contractor shall submit for the approval of the Engineer and before crushing is started the method he intends to follow for the selection of boulders of basalt conforming to these requirements.

### **Article 2.7 - Materials for Embankment**

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Two types of materials shall be considered:-

- Materials for construction of the main body of the embankments
- Selected materials:-
  - For construction of the top 30 cm of embankment.
  - For filling of holes and depressions and shaping of the surface where excavations have been carried out in soils where exists an important percentage of basaltic boulders.

#### 2.7.1 Materials for Construction Of the Main Body Of The Embankments

The materials shall comply with the following requirements:-

Plasticity Index: not more than 30%

- Liquid limit: not more than 70%
- Maximum Size: 300 mm

- Swelling: not more than 3%

### 2.7.1 Selected Materials

The materials shall comply with the following requirements: - -

Plasticity Index: not more than 25%

- Maximum Size: 100 mm
- C.B.R. value after 4 days soaking, at 95% of the B.S Heavy Maximum Dry Density: not less than 15% (C.B.R. specimen prepared at B.S Heavy Optimum Moisture Content + 2%) - Swelling: not more than 1%

## **Article 2.8 - Subgrade in Cut**

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In accordance with the definition of subgrade in Article 4.19 of the Technical Specifications, the plasticity index of materials in the top 30 cm of subgrade in cut shall not be more than 25%.

If they do not comply with this requirement, they shall be removed as directed by the Engineer and replaced by selected materials.

## **Article 2.9 - Material For Surfacing Side Slopes, Verges**

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Surfacing materials for side slopes and verges shall consist of approved, suitable top soil obtained from the general excavations or from other approved sources and shall be free from all sticks, roots and stones of 3 cm in greatest dimension. Top soil shall not be handled when it is so wet that it will become densely compacted during its placement.

## **Article 2.10- Gabions**

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Where shown on the drawings or as directed by the Engineer, the Contractor shall excavate, trim to line and level, provide and erect gabions including providing selected rock, crushed if necessary, packed and compacted inside the gabions.

Gabions shall include gabion mattresses and gabion boxes and for the purposes of construction and method of measurement and payment, no distinction shall be made between them.

Gabions shall be “Maccaferri” boxes and / or “Reno” mattresses both with diaphragms at one metre centres, or similar approved. The maximum mesh size shall be 100 mm x 120 mm for boxes and 60 mm x 80 mm for mattresses. The wire used for the construction of gabions shall unless otherwise instructed by the Engineer comply with the requirements below.

		Diameter (mm)	Galvanising (g/m <sup>2</sup> )
Mesh	Box	3.4	275
	Mattress	2.7	260
Binder	Box	2.2	240
	Mattress	2.2	240

Selvedge	Box	3.9	290
	Mattress	3.4	275

All wire shall be to BS 1052:1980 having a tensile strength of not less than 40 Kg/mm<sup>2</sup>, and PVC coated.

Galvanising shall comply with the requirements of BS EN 10244-2:2009

Gabions shall be constructed to the shapes and dimensions as shown on the drawings or as directed by the Engineer. Gabions, as constructed shall be within a tolerance of  $\pm 5\%$  on the height or width instructed and  $\pm 3\%$  on the length instructed.

The alignment of the gabion shall be correct within a tolerance of 100 mm of the instructed alignment and the level of any course of gabion shall be correct to within a tolerance of 50 mm of the instructed level. In addition adjacent gabions shall not vary by more than 25 mm in line and / or level from each other.

The surface upon which gabions are to be laid shall be compacted to a minimum dry density of 95% MDD (AASHTO T99) and trimmed to the specified level or shape.

Joints in gabions shall be stitched together with 600 mm minimum lengths of binder wire, with at least one stitch per 50 mm, and each end of the wire shall be fixed with at least two turns upon itself.

Adjacent gabions shall be stitched together with binder wire along all touching edges.

Gabion boxes shall be laid with broken bond throughout to avoid continuous joints both horizontally and vertically. Pre-tensioning of gabions shall be subject to the approval of the Engineer.

Gabions shall be hand packed with broken rock of 150 mm minimum dimension and 300 mm maximum dimension. The sides shall be packed first in the form of a wall, using the largest pieces, with the majority placed as headers with broken joints to present a neat outside face. The interior of the gabion shall be hand packed with smaller pieces. The whole interior and top layers shall be packed with smaller pieces and the top layers shall be finished off with larger pieces. The whole interior and top layers shall be packed tight and hammered into place.

The Contractor shall place filter fabric ('Terram' or similar approved) behind and below gabion faces in contact with existing or backfilled ground. The Contractor shall ensure that the filter fabric is not damaged during the construction or backfilling around the gabion works and any damaged or torn fabric shall be replaced at the Contractor's expense. The filter fabric shall be installed in accordance with the manufacturer's instructions and the filter fabric shall not be left exposed to sunlight for more than 3 weeks.

At the back face and ends of completed gabion work, the existing soil shall be backfilled, thoroughly compacted against the sides of the gabions and finished flush with the top surface of the gabion.

On completion of gabion construction the exposed horizontal faces of the gabions shall be protected with 50 mm thick class 15 concrete to discourage vandalism.

### **Article 2.11- Material For Drainage Layer (0/100)**

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Quality and source of supply of materials to be used for drainage layer shall be submitted to the agreement for the Engineer:-

Coarsely crushed basalt materials or spalls can be used.

- The materials shall be clean and free from impurities and vegetable matter (not more than 1%)
- Maximum Size: not more than 100 mm
- Proportion of particles less than 2 mm: not more than 10%

### **Article 2.12 - Stone Aggregate Generally**

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The stone for use in the works shall be obtained from approved quarries or stockpiles of basalt boulders operated by the Contractor or by an approved Sub-Contractor and consisting of hard, tough, heavy, compact basalt, or other approved rock washed before crushing if necessary, broken, screened and graded as specified hereafter, to the satisfaction of the Engineer and free from flat, flaky, elongated, soft or decomposed pieces, excess dust and any dirt or acids or other deleterious substances.

Aggregates for different purposes are classified hereafter.

### **Article 2.13 - Grading Limits for Sub-Base and Granular Base**

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The gradation of the materials shall be within the limiting curves given in articles 2.14 and 2.15 hereof and shall be approximately parallel to these limiting curves.

### **Article 2.14 - Material For Sub-Base Course**

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The grading limits for crushed basalt sub base course shall be within the following limits:

<b>NOMINAL SIZE OF SIEVE (MM)</b>	<b>PERCENTAGE WEIGHT PASSING</b>
50	100
20	65-90
10	35-62
5	27-46
2	14-34
0.5	5-20
0.2	3-14
0.08	2-10



The Los Angeles Value shall not exceed 32 and the sand equivalent value shall be more than 50.

### **Article 2.15 - Material For base Course**

---

The grading of crushed basalt shall be within the following limits:-

<b>NOMINAL SIZE OF THE SIEVE (MM)</b>	<b>PERCENTAGE WEIGHT PASSING</b>
30	100
20	75 - 100
10	47 - 75
6.3	35 - 60
2	18 - 38
0.5	7 - 22
0.2	4 - 15
0.08	2 - 10

The Los Angeles value shall not exceed 30.

The Flakiness Index shall not exceed 40%.

The Sand Equivalent Value shall be more than 60.

### **Article 2.16 - Material For Bituminous Course**

---

#### 2.16.1 Classes of Aggregates

Aggregates for bituminous course shall be obtained by mixing 3 or more classes  $d$  mm/ $D$  mm of materials defined for each class, by the maximum size ( $D$  mm) and minimum size ( $d$  mm) of particles.

Dimensions  $D$  and  $d$  will be chosen in the following series of sieve sizes: 2 - 6.3 - 10 - 14- 20.

Crusher run 0/20 may be used for the production of bituminous course provided that all the required specifications are satisfied.

Before the Works are started, the Contractor shall submit to the Engineer's approval the gradation curve of reference for material of each class.

The gradation curve of reference for each class shall satisfy the following requirements: - -

Percentage by weight of material retained by sieve  $D$  mm: not more than 10%

- All material shall pass sieve 1. 25  $D$  mm
- Percentage by weight of material passing sieve  $d$  mm: not more than 10 %
- All material shall be retained by sieve 0.63  $d$  mm
- Percentage by weight of material passing sieve

$$\frac{D \text{ mm} + d \text{ mm}}{2} \text{ within the range } 1/3 - 2/3$$

The total variations, by percentage, around the gradation curve of reference for each class of material such as proposed by the Contractor at the commencement of the Works shall not exceed the following values.

SIEVES (MM)	CLASSES						
	0/2	0/4	2/6,3	4/6,3	6,3/10	10/14	6.3/14
0,08	+ - 4	+ - 3					
0,20	+ - 6	+ - 4					
0,63	+ - 7	+ - 5					
1,25	+ - 7	+ - 6	0				
2,00	- 10	+ - 6	+10				
2,50	0	+ - 6	+ - 6	0			
4,00		- 10	+ - 7	+10			
5,00		0	-10	+ - 8	0		0
6,30			0	-10	+10		+10
8,00				0	+ - 12	0	+ - 8
10,00					-15	+10	+ - 8
12,50					0	+ - 12	+ - 8
14,00						-15	-15
18,00						0	0

According to the characteristics of the crusher plant, the Contractor may be allowed to submit for the Engineer's approval production of classes 0/3 instead of 0/2.

Coral sand shall not be used.

Crushed basalt sand shall be used.

2.16.2 The job standard mix, such as defined in Article 5.14 of these Technical Specifications shall be within the following limits:-

i) Bituminous Base Course (Binder Course)

NOMINAL SIZE OF THE SIEVE (MM)	PERCENTAGE WEIGHT PASSING
25	100
20	95 - 100
16	91 - 99
12.5	75 - 91
10	51 - 79
5	38 - 57
2	23 - 38
0.6	10 - 19
0.08	5 - 7

2.16.3 Other Requirements

The Flakiness Index shall not exceed 35 %.

The Los Angeles Value shall not exceed 30.

The Sand Equivalent Value on 0/2 portion shall be more than 60.

2.16.4 Filler

Filler (portion of material passing No. 200 B. S. Sieve) shall consist of Portland Cement or dust of crushed basalt.

The Plasticity Index shall not be measurable.

Passing 0.08 mm > 80%

Passing 0.20 mm = 100%

**Article 2.17 - Material for Wearing course 0/14**

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2.17.1 Materials for wearing course and reshaping shall comply with the requirements of Article 2.16.1 hereof.

2.17.2 The job Standard Mix such as defined in Article 5.14 of these Technical Specifications shall be within the following limits:

NOMINAL SIZE OF THE SIEVE (MM)	PERCENTAGE WEIGHT PASSING
14	100
12.5	100
10	80 - 95
5	40 - 55
0.63	15 - 30
0.080	6 - 10

2.17.3 The Flakiness Index shall not exceed 25. The

Los Angeles Value shall not exceed 25.

The Sand Equivalent Value on 0/2 shall be more than 60.

The Percentage of particles < 0.5 mm, obtained by washing 1 kg of coarse aggregate, shall not exceed 2 %.

- (i) The Los Angeles shall be measured on 6/10 and 10/14 or 6/14 materials after removal of flaky portion.

### **Article 2.18 - Material for Bituminous Surface Treatments**

---

Aggregates used shall be hard, tough and free from vegetable matter, dirt, lumps or ball of clay, adherent film of clay or any other matter which will prevent the adherence of the bitumen and, if required by the Engineer, shall be mechanically washed with an adequate supply of clean water.

- 2.18.1 The Chippings shall comply with the following grading:-  
- First Application: 10/14 mm  
- Second Application: 4/6 mm

The requirements for gradation curves are given in Article 2.14.

- 2.18.2 The other requirements for chippings are as follows:  
The Los Angeles Value shall not exceed 25  
The Flakiness Index shall not exceed 20  
The Proportion of particles less than 0.5 mm size shall not exceed 1%.

- 2.18.3 The sand used for the sealing coat will be 0/3 mm crushed basalt sand, carefully washed in order to have a portion of filler (<0.08 mm) lesser than 8%. The Sand Equivalent Value shall exceed 75%.

### **Article 2.19 – Coloured Asphalt**

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- 2.19.1 Type of Mix  
It shall be coloured cold asphalt 0/6mm (with 2% pigment in total mix).
- 2.19.2 Cold Bin Settings  
The asphalt should be constituted of 70% 4/6mm and 28% 0/4.
- 2.19.3 Bitumen Content  
The percentage of bitumen by dry aggregates shall be 8.5%.

### **Article 2.20 - Material for Concrete**

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- 2.20.1 Coarse Aggregate  
Coarse aggregate shall consist of crushed basalt, complying with BS EN 12620:2002+A1:2008. The aggregate shall be clean, hard, free from soft, friable, porous,

elongated pieces, free from impurities which may adversely affect the strength or durability of the concrete or attack the reinforcement. Aggregate shall be washed if so directed.

The aggregate shall comply with the following requirements.

Sub Class 1: The combined grading of aggregates for use in reinforced concrete, where shown on the Drawings or where directed by the Engineer, shall be uniformly graded from 20 mm down to 5 mm according to BS EN 12620:2002+A1:2008. The Flakiness index shall not exceed 35. The Los Angeles value shall not exceed 30.

Sub-Class 2: The combined grading of aggregate for mass concrete, where shown on the Drawings or where directed by the Engineer, shall be uniformly graded from 40 mm down to 5 mm according to BS EN 12620:2002+A1:2008. The flakiness index shall not exceed 35. The Los Angeles value shall not exceed 35.

#### 2.20.2 Fine Aggregate

Fine aggregate complying with the grading zones of BS EN 12620:2002+A1:2008 shall consist of approved sand clean from clay, organic matter, and other impurities; and it shall be washed if so directed.

The sand equivalent values shall be as follows:-

For class 25 and above concrete the sand equivalent value shall exceed 75.

For class 15 concrete, the sand equivalent value shall exceed 70.

Coral sand shall not be used.

Crushed basaltic sand shall be washed.

### **Article 2.21 - Manholes**

---

Unless otherwise particularly specified or directed, manholes shall be constructed in Grade C25 concrete. Roof slabs shall be reinforced as detailed on the drawings.

Benching and channels of manholes shall be in grade C20 concrete finished with 20mm thick cement mortar on top of the channels and benchings.

Where applicable, half round pipe shall be set in the floor of the manhole to form the channel. Where precast concrete manholes are permitted to be used they shall comply with BS 5911 and be constructed in accordance with the manufacturer's instructions. Individual rings and cover slabs shall have an approved watertight joint. Under roads and paved areas precast concrete manholes shall be surrounded with 150 mm of Concrete Grade C20.

The maximum allowable lift of concrete in the construction of walls shall be 1.2m. The cost of forming key joints as directed by the Engineer shall be deemed to be included in the rates for concrete in manholes.

The ends of all pipes are to be properly built in and neatly finished off, and pipe sockets are to be cut off.

The tops of the chambers and shaft walls are to be level all round to give a proper bearing to the cover slabs which shall be securely bedded and pointed in cement mortar.

Manhole chambers shall be subjected to water test as directed by the Engineer. The chambers to be tested shall be filled with water and allowed to stand full for 48 hours. They shall then be tested and deemed to be watertight if the drop in water level is not more than 12mm in a further 24 hours. Any chambers, which fail the test, shall be repaired and made watertight at the Contractor's expense and retested to the satisfaction of the Engineer.

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### **Article 2.22 - Filter Material**

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Filter material for under drains shall consist of sand or granular material to be approved by the Engineer.

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### **Article 2.23 - Water**

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Water shall be free from oil, acid, alkali, earth, vegetable or organic matter, or other deleterious substances in suspension or solution which may have a harmful effect on the Works. Water used for concrete, mortar shall comply with the requirements of BS EN 1008:2002 and shall be tested if there is any doubt as to its suitability. If water is not available from a public supply, the Engineer's approval shall be obtained regarding the source of supply and manner of its use. Contaminated water shall not be used.

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### **Article 2.24 - Stone Work**

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(a) Generally

Stone for use in masonry work shall consist of sound undecomposed basalt obtained from approved boulders and be of even texture and colour.

(b) Stone for Pitching and Stone Facing

Stone for pitching to drains, inlets and outlets, embankments and around structures shall consist of sound, undecomposed basalt with thickness not less than 15 cm and facing dimensions not less than 22 cm.

(c) Stone for Rip Rap

Stone for use as riprap shall consist of reasonably well-shaped, hard, dense, and durable rock. Separate lumps of stone shall weigh generally between 10 and 80 kg of which 80% shall be 20 kg or larger and not more than 10% less than 10 kg.

(d) Hardcore

Hardcore filling where required shall be clean hard quarry chips, clean basalt, hard broken stone or other approved material broken to 75mm gauge. All fillings shall be laid in layers not exceeding 150mm thick well packed, rammed and blinded on top with fine stone or other approved fine material and watered to receive concrete.

(e) Rock Armour

The rock armour consists of loose assemblage of big size broken stones erected in water or on soft ground as revetments of road or earth embankments. Its permeability allows it to dissipate the energy of storm waves and prevent corrosion. The rocks are placed against a cliff, bank or existing seawall in order to reduce the energy of incident waves. Dissipation of the wave energy should reduce wave reflection from the structure, thus reducing scour from the toe of the defence. The median of the rock armour is approximately to about 1400 kg.

Article 2.25 – Cement stabilized graded crushed stone sub base 0/31.5

The graded crushed stone sub base shall be as per the requirements of road sub base in the Specifications. The Contractor shall propose a job mix formula and carry out trials. The graded crushed stone sub base shall be transported in suitable clean vehicles to prevent loss of fines and closely covered with impermeable sheeting during transit to prevent loss of moisture, and shall not be laid when its temperature exceeds 35°C.

Cement stabilised graded crushed stone sub base shall not be laid during rainfall as this will affect the moisture content and remove cement and fine material. Upon completion of compaction the surface shall be covered closely with plastic sheeting weighted down to prevent it being removed by the wind and the whole arranged to prevent loss of moisture.

Cement stabilized graded crushed stone sub base shall be laid by bob cat or by hand in a uniform layer without segregation, so that compaction shall be completed within sixty minutes of commencement of mixing. Care shall be taken to compact effectively adjacent to structures using small compaction if necessary in confined spaces. The thickness of each layer shall not exceed 200 mm and shall receive the required number of passes.

On completion of the compaction the surface shall be well cleaned, free from movement under compaction and free from compaction planes, ridges, cracks or loose material. In situ density tests shall be made on each compacted layer in accordance with BS 1924 and the next layer shall not be laid until it is at least seven days old or as instructed by the Engineer.

The minimum 7 day compressive strength (150 mm test cubes) shall be 4.5 to 10.0 N/mm<sup>2</sup> sampled at mixing point, and the in situ dry density shall be 95% of the maximum cube dry density.

The cement content shall not in any case be less than 3%.

## **MANUFACTURED MATERIALS**

### **Article 2.26 - Cement**

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#### **General**

The cement shall be of approved manufacture and shall be delivered in bags with seals unbroken, or if delivered in bulk, it shall be delivered in approved containers.

Test Certificates from the manufacturers or supplier shall be submitted for each consignment and shall indicate the results of the tests for compressive strength, setting time, soundness and fineness carried out in accordance with the requirements of the relevant British Standard, but the Engineer may require further tests to be made after the cement is delivered to the site.

If such certificates are not available, samples shall be taken from different bags or containers of the consignment, suitably packed, and sent for testing in accordance with B. S. to an approved laboratory, or where directed by the Engineer.

The Engineer may require further tests to be made if any cement is stored on site for a longer period than three months.

The failure of any sample to satisfy the requirement of the relevant British or other approved Standard shall entitle the Engineer to reject the entire consignment from which it was taken.

### **Cement Received Through Importing Agents**

Each consignment of cement received through importing agents shall be accompanied by a further certificate stating that no cement has been rebagged or the percentage of rebagging (which shall not exceed 10 % ) as the case may be.

The Contractor shall state the name of the local supplier or importing agent and the approval of the Engineer, in writing, shall be obtained before the order of any consignment.

### **Ordinary Portland cement**

Cement shall be manufactured by an approved firm and comply in all respects with the requirements of the BS EN 197-1: 2011

## **Article 2.27 - Steel Reinforcement**

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Steel reinforcement shall comply with the requirements of BS 4449:2005+A3:2016. The steel shall be free from oil, grease, dirt and paint and any loose rust shall be removed before use.

No heating except for fishtailing and no welds except in reinforcing fabric shall be made in any bar without permission in writing from the Engineer. All bending shall be done in an approved machine with the steel cold and in accordance with BS 4466.

The Contractor shall supply the Engineer with a certificate stating the origin and process of manufacture and test sheets, signed by the maker, giving the results of each of the tests applied. If and when required he shall also grant all necessary facilities to the Engineer for the selection of test pieces and shall cause these to be prepared and submitted where directed for test. The Engineer shall have the option of testing and approving at the works of the suppliers of all or any of the steel required under the Contract, and the Contractor shall advise the Engineer when the whole or any of the steel is ready for test at the Works, in order to conform with the provisions of the BS as regards Test and Inspection.

## **Article 2.28 - Mould Oil**

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Mould oil shall be of an approved proprietary brand and shall be used in accordance with the Manufacturer's recommendation or as directed by the Engineer.



## **Article 2.29 - Material for Forms, Falsework and Centering**

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All timber used for forms, false work and centering shall be sound wood, well-seasoned and free from loose knots, shakes, large cracks, warping and other defects. Before use on the work, it shall be properly stacked and protected from injury from any source. Any timber, which becomes badly warped or cracked, prior to the placing of concrete shall be rejected. Forms, which are unsatisfactory in any respect, shall not be used. All shuttering for all outside surfaces above final ground level shall be either tongued and grooved or provided with a suitable lining to produce a smooth surface finish and shall be termed thin facing shuttering. Other shuttering shall be termed normal shuttering.

Irrespective of nature or position, all joints in shuttering shall be sufficiently tight to prevent leakage of liquids from concrete.

If the Contractor proposes to use steel shuttering, he shall submit to the Engineer, dimensioned drawings of all the component parts, and give details of the manner in which it is proposed to assemble or use them. Steel shuttering will only be permitted if it is sturdy in construction and if the manner of its use is approved by the Engineer.

Struts and props shall, where required by the Engineer, be fitted with double hardwood wedges or other approved devices so that the moulds may be adjusted as required and eased gradually when required. Wedges shall be spiked into position and any adjusting device locked before the concrete is cast.

## **Article 2.30 - Concrete Pipes**

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Concrete pipes shall comply with the requirements of BS 556. Where pipes are manufactured on site, all the clauses in this specification shall be applicable to the manufacture and testing of concrete pipes.

Notwithstanding any of the requirements outlined above, for routine control purposes, the cube compressive strength shall satisfy the requirements of Class 30 concrete as shown in article 3.12 of these Technical Specifications.

## **Article 2.31 - Concrete Porous Pipes**

Concrete porous pipes for French drain shall comply with the requirements of BS 1194.

## **Article 2.32 - Precast Concrete**

---

Precast kerbs, slabs, channel edging and quadrants shall comply with the requirements of BS EN 1339:2003 and with the Drawings.

Where the Contractor is permitted to carry out precasting on site, the precast units shall in addition to complying with the relevant BS, be manufactured in steel moulds on a vibrating table or as directed by the Engineer.

## Article 2.33 – Admixtures

Unless agreed by the Engineer, neither admixtures nor cement containing additives shall be used.

## Article 2.34 - Bitumen Products

2.34.1 The following types of bitumen products will be used:-

- For the bituminous concrete, straight run bitumen penetration grade 35/50 shall be used.
- For the prime coat, cut back bitumen MC 30, ECI 50 or other equivalent shall be used.
- For the tack coat, cutback bitumen RC 3000 (or cut back 400/600) or rapid setting bitumen, emulsion (with 60% of residual bitumen) shall be used.

2.34.2 Bitumen products shall comply with AASHTO or ASTM requirements. Some of the requirements for different grades of bitumen are indicated hereunder: -

GRADE	80/100	60/70	35/50
Softening Point, °C	41 - 51	43 - 56	47 - 60
Penetration Test, mm	80 - 100	60 - 70	40 - 50
Density (25 C), g/cm <sup>3</sup>	1 - 1,07	1 - 1,1	1 - 1,1
Flash Point, °C	>230	>230	>250
Ductility (25 C), cm	>100	>80	>60
Solubility CS 2	>99,5	>99	
Loss of heating	>99,0	>99,0	>99
163 C, 5 h	>2 %	< 1%	<1%
Penetration of residue from rolling thin film over test at 25	< 1%		
100 gas % of original	> 70%	>70%	>70%

2.34.3. Emulsions shall be of the cationic type. They shall comply with the following specifications:-

- The water content shall not exceed the required nominal rate by more than 1 % of the weight of emulsions.
- The sensitivity to temperature, of the emulsion shall be such that its viscosity shall not decrease by more than 30 % if the temperature increases from 20 degree to 40 degree C.
- The emulsion shall not contain free particles likely to obstruct the sparge pipes.

Any bitumen or bitumen emulsion delivered in leaking containers or deteriorated in the containers may be rejected.

During the course of the contract, the Contractor shall, at his own expense, satisfy the Engineer from time to time that the bitumen and bitumen products being used are in accordance with the Specification. Any laboratory testing that he arranges to satisfy this Clause shall be carried out in an approved laboratory.

### **Article 2.35 - Hydrated Lime**

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Lime for stabilisation shall be Hydrated Calcium Lime (not Magnesium) and shall generally comply with BS EN 459-1:2015, Class B, and with a free lime content of 50%.

The proportion of filler shall be more than 90%.

Locally manufactured limes may be proposed for the approval of the Engineer. The Contractor shall submit with all consignments, at his own expense, the manufacturer's certificate certifying that they comply with BS EN 459-1:2015, or his chemical analysis.

### **Article 2.36 - Precast Concrete Slabs**

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Precast concrete slabs shall be "Trief" interlocking concrete blocks, type Super Trief Blocks (125 mm - (5 in) - thick with a finish) or similar.

### **Article 2.37 (Glazed Vitrified Clay). Pipes and Fittings**

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Clay pipes shall conform to the requirements of BS 65 and 540 or EN 598 as appropriate. The pipes shall be supplied with Type 1 sockets and supplied complete with the manufacturer's flexible joint.

### **Article 2.38 - Ducts For Cables**

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Ducts for cables shall have a smooth internal bore without any sharp edges to the ends of the pipes, and shall be either: -

- (i) G.V.C. ducts with self-aligning flexible sleeve joints manufactured in accordance with the tolerances, permeability and strength requirements of BS 65 and 540 or EN 598 as appropriate. The internal ends of ducts shall be radiused to 3 mm minimum, or
- (ii) U.P.V.C. ducts complying with Class B or C or BS 3506 or with BS 4660.

### **Article 2.39 – Geotextiles**

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#### **2.39.1 General Characteristics**

Geotextile shall be of the non-woven type having the following characteristics:

	Subgrades	French Drains	Mud Screen
Mass per unit area	≥250 g/m <sup>2</sup>	≥200 g/m <sup>2</sup>	≥250 g/m <sup>2</sup>
Tensile strength	≥20 KN/m	≥15 KN/m	≥16 KN/m

Penetration load (CBR) at rupture	3 KN	2.5 KN	3 KN
Elongation	≥50%	≥50%	≥50%
Pore size $O_{90}$ (dry)	≤100 Mm	≤100 Mm	≤80 Mm
Permeability (10 cm head)	130 $\ell/s/m^2$	160 $\ell/s/m^2$	60 $\ell/s/m^2$
Thickness (2k pa)	≥1.5mm	≥1.5mm	≥1.5 mm

Geotextiles shall be delivered in rolls wrapped in a protective layer of plastic to avoid degradation from direct sunlight, ingress of dust, mud and water during storage.

### 2.39.2 Laying at Subgrade level

Prior to laying of geotextiles, the site will be graded and sharp objects such as rocks, stumps of trees or bushes which might puncture or tear the fabric shall be removed. Any significant hollows or unevenness in the site should be filled.

During the rolling out into position of the geotextile, sufficient allowance shall be made in order to provide an overlap at least 500 mm between adjacent sheets. The edges of the geotextiles shall be properly weighted to maintain the position of the geotextile before covering with sub base materials or other fill. Once the geotextile is laid it shall not be trafficked until an adequate layer of fill is placed over it. Blades or buckets of construction plant must not be allowed to come in to contact with the fabric during filling operations.

For drainage applications, all sharp stones and projections shall be removed from the bottom and walls of trenches before lining of trenches with geotextiles.

The edges of the fabric shall be laid on the ground at the edges of the trench and held by small piles of aggregates.

During the filling process, no attempt shall be made to restrain the top of the fabric.

Upon completion of filling of the trenches, the free lengths of fabric shall be wrapped over the drainage layer. The overlaps shall be at least 500 mm.

### 2.39.3 Jointing/Cutting

The minimum overlap shall be 500 mm. In applications where the geotextile is subject to tensile stress, the overlap shall be increased by 100 mm. Overlaps shall be sown or stapled as per the manufacturer's recommendations. Stitching should be at least 50 mm back from the free edges of the fabric.

## Article 2.40 – Cast Iron Gully

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Cast iron gully shall of Grade A type and shall comply with the requirements of BS EN 1241:2015.

## **Article 2.41 – Polystyrene**

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The board shall be formed of polystyrene base resin in an extrusion process and shall be homogeneous and essentially unicellular. It shall conform to the requirements of ASTM 11230.

## **SECTION 3 - TESTING**

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## **Article 3.1 - General**

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The Contractor shall carry out on the Site tests for selection and control of materials and workmanship in accordance with the Technical Specifications and as instructed by the Engineer. Such instructions shall in no way affect the responsibility of the Contractor to ensure that all materials and workmanship are in accordance with the Contract.

## **Article 3.2 - Tests**

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### **3.2.1 General**

All tests shall be carried out by the Contractor's technicians, but the Engineer shall be allowed free access at all times to the Laboratory and testing facilities. The Laboratory shall be under the direct control and supervision of the Engineer.

The Contractor should note that all tests to comply with quality of materials and workmanship are deemed to be included in the unit price for the works and that no extra claim would be entertained under laboratory tests.

The Contractor shall provide and maintain all labour, tools and equipment that may be required for the digging of trial pits and collection of samples in connection with all tests.

All tests to be performed shall be in accordance with Standard Specifications of the BS, LCPC, AASHTO and ASTM as specified in these Technical Specifications.

### **3.2.2 Design of Mixes**

The Contractor shall carry out tests to establish proper proportions and characteristics of mixes.

### **3.2.3 Tests on Materials**

The Contractor shall carry out tests to ensure that all materials to be used in the Works are in accordance with the Technical Specifications.

### **3.2.4 Tests on Workmanship**

The Contractor shall carry out tests at the frequencies specified herein, or as directed by the Engineer to ensure that all workmanship is in accordance with the Technical Specifications.

### **3.2.5 Tests carried out by a Nominated Testing Authority**

Whenever the facilities of the Contractor's laboratory are determined to be inadequate by the Engineer to carry out control tests on materials or workmanship, such tests shall be carried out at the Contractor's expense by any other testing laboratory which shall be nominated by the Engineer, and the Contractor shall be fully responsible for any delays in the testing or work which may ensue.

### **3.2.6 Test Results**

All samples and records shall be preserved for as long as the Engineer may direct and they shall be kept and labelled in an orderly fashion to his satisfaction. The results of all

tests shall be entered on standard forms, samples of which will be provided by the Engineer and two legible copies of each completed form shall be delivered to him with the minimum of delay. No material shall be incorporated in or rejected from the Works until the results of all relevant tests have been approved.

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### **Article 3.3 - Additional Tests**

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In addition to the tests required under other articles hereof, the Engineer shall have power to order independent tests of all materials to be carried out by some person appointed by him at such place as he may determine and from the result of such tests there shall be no appeal. No payment shall be made for these additional tests and the costs thereof shall be deemed to be included in other rates and prices.

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### **Article 3.4 - Inspection and Testing of Manufactured Materials**

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Whenever considered desirable by the Engineer, inspectors may be sent to the factory to test the materials or to supervise their manufacture. Materials shall be tested before leaving the factory as well as after delivery to the site and the Engineer shall be at liberty to reject materials notwithstanding the preliminary test at the factory. Should the Engineer not decide to send an inspector to the manufacturer's works, the Contractor shall obtain from the manufacturer certificate of test, proof sheets, mill sheets etc. showing that the materials have been tested in accordance with the requirements of these Specifications relating thereto and shall provide adequate means of identifying the materials on site with the corresponding certificates etc..., but neither the omission of the Engineer to send an inspector nor the production of the manufacturer's certificate of test shall affect the liberty of the Engineer to order further tests on samples selected from the materials delivered to the site and to reject after delivery materials found to be unsuitable or not in accordance with these Technical Specifications.

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### **Article 3.5 - Tests on Suspect Materials and Workmanship**

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Where so directed, tests other than the tests specified herein, shall be carried out on the completed works or portions thereof at any time until the final handing over certificate has been issued. Where there is any doubt that the work has not been carried out in accordance with the provisions of the contract or the Engineer's instructions, such tests shall be carried out jointly by the Engineer and the Contractor, or at the request of either party, by an independent Testing Authority which shall be nominated by the Engineer.

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### **Article 3.6 - Location of Materials**

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The Contractor shall be responsible for locating all naturally occurring materials to be used in the works.

The Contractor shall open up trial pits and carry out tests, to locate materials suitable for use in the works, all as directed. The frequency of the trial pits shall be at the discretion of the Engineer.



## Article 3.7 - Sampling of Materials

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### 3.7.1 General

Samples of materials to be tested shall be carried out in accordance with the methods hereinafter described, or as referred to in the appropriate method of testing. In all other cases, the method shall be as directed.

### 3.7.2 Trial Pits

Trial pits, dug by hands, shall have a minimum plan area of 1 metre by 1 metre.

Samples shall not be taken from the spoil of the trial pit but shall be obtained from equal increments taken from each face of the pit, each increment being a representative sample of the material taken from any single horizon. The four increments so obtained shall be thoroughly mixed by turning over three times and then quartered or riffled down to the size required for testing.

### 3.7.3 Stockpiles

The surface material of the stockpile shall be removed before sampling. At least twelve equal portions shall be taken from different parts of the stockpile, and thoroughly mixed by hand before being quartered down or riffled down to the size required for testing.

## Article 3.8 - Testing of Naturally Occurring Materials

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### 3.8.1 Preparation of Disturbed Samples for Testing

The preparation of disturbed samples for testing shall be carried out in accordance with the procedure given in BS 1377.

### 3.8.2. Tests on Naturally Occurring Materials

The tests shown below shall be conducted in accordance with the relevant British Standard:

Moisture Content	: BS 1377
Speedy Moisture Content	: as directed by the Engineer
Liquid Limit	: BS 1377
Plastic Limit	: BS 1377
Plasticity Index	: BS.1377
Linear Shrinkage	: BS.1377
Specific Gravity	: BS EN 932-1:1997
Bulk Density	: BS EN 932-1:1997
Particle Size Distribution	: BS 1377
Particle size analysis by Hydrometer method	: BS 1377
(If required at the discretion of Engineer)	
Sand Equivalent	: AASHTO T 176

All sieving shall be done by the wet method. Dry sieving may only be carried out with the specific permission of the Engineer.

### 3.8.3 Compaction Tests

The tests shall be carried out in accordance with BS 1377.

### 3.8.4 California Bearing Ratio Test

The test shall be carried out in accordance with BS 1377 dynamic compaction method 1.

All C.B.R. Specimen shall be prepared at B. S. Heavy Optimum Moisture Content and at B. S. Heavy Optimum Moisture Content + 2%.

All C.B.R. tests on unstabilised soils are to be carried out after 4 days soaking.

## Article 3.9 - Testing of Aggregates

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### 3.9.1 Sampling of Aggregates

The sampling of aggregates shall be carried out in accordance with the procedure given in BS EN 932-1:1997.

### 3.9.2 Tests on Aggregates

Sieve Analysis	:	BS EN 932-1:1997
Amount passing No. 200	:	BS EN 932-1:1997
BS Sieve		
Flakiness Index Test	:	BS EN 932-1:1997
Specific Gravity	:	BS EN 932-1:1997
Bulk Density	:	BS EN 932-1:1997
Los Angeles Abrasion Test	:	AASHTO Designation T 96-49
Sand Equivalent Test	:	AASHTO T 176
Moisture Content	:	BS EN 932-1:1997
content of soil or aggregate		
subject to the Project	Manager's	
approval by	Speedy Moisture Content	
	to maker's instructions with	
calibration against	Oven-	
drying method		
Test for silt, clay and	:	BS EN 933-1:2012
impurities of fine aggregate	by	
Sedimentation or	decantation method	
	(in case of discrepancies	
	the Sedimentation method	
shall rule)		

### **Article 3.10 - Tests for Water Purity**

The tests shown below shall be conducted in accordance with the relevant BS EN 1008:2002.

### **Article 3.11 - Tests for Manufactured Materials**

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Each batch of cement delivered to site must be accompanied by a Manufacturer's Certificate giving results of tests proving its compliance with the requirements of BS EN 197-1:2011 or BS 4027 as appropriate. The tests shall be carried out in accordance with BS EN 197-1:2011 together with the tests for determining the percentage of alkali in the Cement expressed as Na<sub>2</sub>O.

In addition to the above the Engineer may order that any cement which has been stored on site for more than one month shall be tested in accordance with BS EN 197-1:2011, and used only when it meets the design requirement.

Further, the Engineer may require the Contractor to take samples from cement bins or bagged cement and to carry out the following tests:

#### **3.11.1 Ordinary and Rapid Hardening Portland cement**

Compressive Strength Test	: BS 4550
Consistency of Standard Cement Paste	: BS 4550
Initial and Final Setting	: BS 4550
Soundness Test	: BS 4550
Fineness Test	: BS 4550

#### **3.11.2 Bituminous Materials**

Sampling Bituminous Materials	: AASHTO T 40
Specific gravity	: ASTM D70
Penetration Test	: AASHTO T 49
Softening Point	: AASHTO T 53
Ductility Test	: AASHTO T 51
Viscosity	: AASHTO T 201/T 59
Solubility Test	: AASHTO T 44
Distillation	: AASHTO T 78
Residue from Distillation	: AASHTO T 59
Flash Point	: AASHTO T 48/T 79

#### **3.11.3 Tests on Steel Bars and Wire**

All reinforcement shall be supplied with a manufacturer's test certificate showing that it has been tested and found to comply with the relevant standards BS 4449, 4482, 4461, 4483, 2691, and 4360. If required by the Engineer, the Contractor shall provide samples free of charge for testing at an approved laboratory. No payment shall be made for these tests and the costs thereof shall be deemed to be included in other rates and prices.

## **Article 3.12 – General Control and Tests During Construction**

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### **3.12.1 Description**

**The Contractor shall be responsible for the quality of all materials to be included in the permanent works.**

The Engineer or his representative shall inspect the materials and works from time to time during and after construction and get the quality of the materials and Works tested by himself, by his Testing and Quality Control Units or by any other agency deemed fit by him generally as per the requirements stipulated in the Specifications. Additional tests may also be conducted where, in the opinion of the Engineer, need for such tests exists, in the absence of clear indications and frequency of tests for any item procedures and tests as directed by the Engineer shall be followed.

The Contractor shall provide necessary co-operation and assistance in obtaining the samples for tests and carrying out the field tests as required by the Engineer from time to time. This shall include provision of labour, attendant and assistance necessary in connection with the tests. For the work of embankment, subgrade and pavement, construction of subsequent layer of same or other layer over the finished layer shall be done after obtaining permission from the Engineer.

Similar permission from the Engineer shall be obtained in respect of other items of work prior to proceeding with the next stage of construction.

For cement, bitumen, mild steel deformed bars, high tensile steel, prestressing materials, bearings, and similar other materials essential tests are to be carried out at the manufacturers' plants or at laboratories other than the site laboratory. The Contractor shall also furnish the test certificates to the Engineer. For testing of cement concrete at site during construction, arrangement for supply of samples, sampling, testing and supply of test results shall be made by the Contractor as per the frequency and number of tests as stipulated in these Specifications or as approved by the Engineer.

The method of sampling and testing of materials shall be as required under relevant clauses stipulated in these Specifications or as approved by the Engineer.

Where the Engineer consider that for the interest of the quality on materials or workmanship, modifications, if any, are necessary, such shall be carried out as per direction of the Engineer by the Contractor at his own expenses.

### **3.12.2 Field Moisture Content Test**

This test shall be carried out in accordance with BS 1377 or by using a Speedy Moisture Tester as directed by the Engineer. When using the latter method it must be noted that the instrument requires calibration for each type of material being tested.

To improve the accuracy of the instrument, at least six small ball bearings should be placed in the Speedy Tester and these will assist in breaking up the soil, so allowing the calcium carbide to react with the moisture more readily.

### **3.12.3 In-Situ Dry Density Control**

The test shall be carried out using the sand-cone method or the rubber-balloon method or nuclear density and/or moisture method as directed by the Engineer. In case the nuclear densometer is used, at each test location the average of four readings taken at positions rotated by 90 will be used. A check/comparison test using the sand replacement method (sand cone or the rubber balloon test methods) will be carried out at a 50 test interval. Initial calibration of the instrument will be done by carrying out at least fifty tests in parallel with the sand replacement method for each different material encountered. The check tests will be used to update the initial calibration of the instrument. The instrument shall have a valid calibration certificate before the initial site calibration mentioned above is carried out.

### **3.12.4 Measurement of Deflection under a 8.2 Ton Axle Load**

This test shall be carried out using the Benkelman beam along the centreline and at offsets of 2.5 m, from the centre line and at each profile and half profiles intervals on both sides on each layer in the construction of pavement construction layers on embankment, main body of the embankment, sub grade in cut and fill, the carriageway i.e. strengthening layers and finished level or as directed by the Engineer.

### **3.12.5 Bituminous Concrete and Road Base**

Sampling of Bituminous Mixture	: AASHTO T 41
Bulk Density	: as directed by the engineer
Specific gravity	: ASTM D1188 or 2726
Bitumen Content	: AASHTO T 58
Marshall	: ASTM D 1559
Duriez/LCPC	: .Mode operateire LCPC

The samples for Marshall tests shall be compacted with 50 blows on each face.

### **3.12.6 Surface Treatment** As directed by the Engineer

### **3.12.7 Concrete**

Sampling	: BS 1881
Slump Test	: BS 1881
Compressive Strength Test	: BS 1881
Indirect Tensile Strength	: BS 1881
Compressive Strength of Concrete Pipes	: BS 556

### **3.12.8 Plate Load Test**

Plate Load Test is a field test for determining the ultimate bearing capacity of soil and the likely settlement under a given load. The Plate Load Test basically consists of loading a steel plate placed at the [foundation](#) level and recording the settlements corresponding to each load increment. The test load is gradually increased till the plate starts to sink at a rapid rate. The total value of load on the plate in such a stage divided

by the area of the steel plate gives the value of the [ultimate bearing capacity of soil](#). The ultimate bearing capacity of soil is divided by suitable factor of safety (which varies from 2 to 3) to arrive at the value of safe bearing capacity of soil. For better understanding, this Plate Load Test can be sub-divided into the following heads,

1. *Test set-up*
2. *Procedure*
3. *Interpretation*

### **1. Test Setup:**

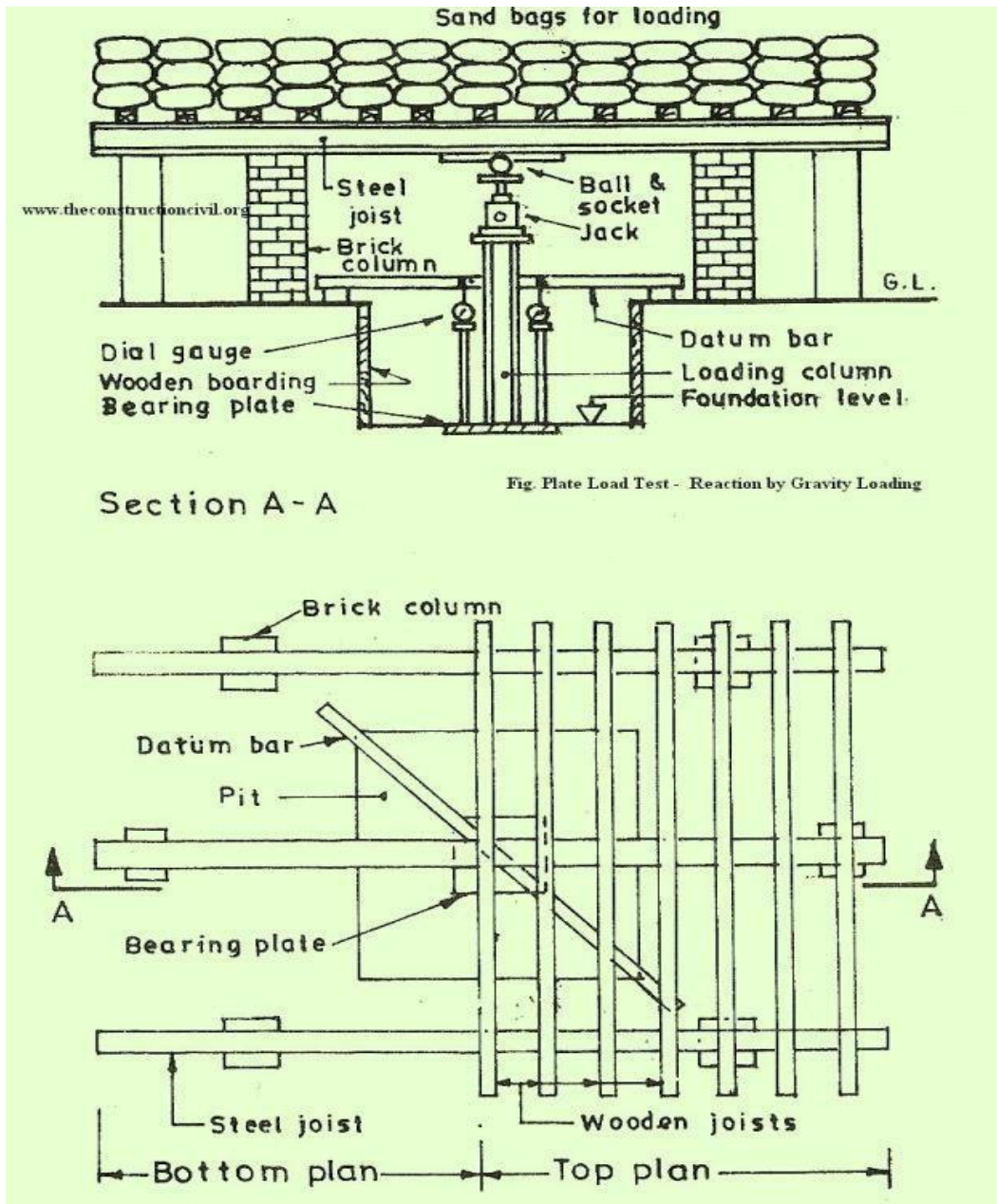
A [test pit](#) is dug at site up to the depth at which the [foundation](#) is proposed to be laid. The width of the pit should be at least 5 times the width of the test plate. At the centre of the pit a small square depression or hole is made whose size is equal to the size of the test plate and bottom level of which corresponds to the level of actual foundation. The depth of the hole should be such that the ratio of depth to width of the loaded area is approximately the same as the ratio of the actual depth to width of the foundation. The mild steel plate (also known as **bearing plate**) used in the test should not be less than 25 mm in thickness and its size may vary from 300 to 750 mm. The plate could be square or circular in shape. Circular plate is adopted in case of circular footing and square plate is used in all other types of footings. The plate is machined on side and edges.

### **2. Testing Procedure:**

The load is applied to the test plate through a centrally placed column. The test load is transmitted to the column by gravity loading or reaction loading method.

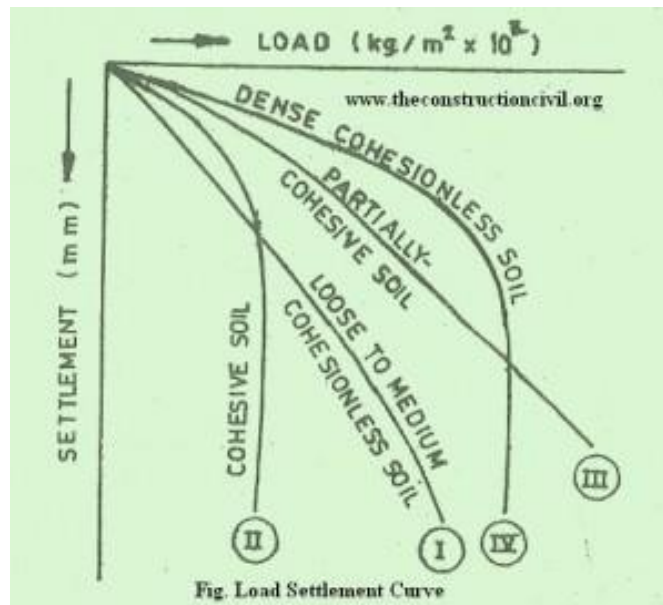
(i) Gravity loading or reaction loading method:

In case of gravity loading method, a loading platform is constructed over the column placed on the test plate and test load is applied by placing dead weight in the form of sand bags, pig iron, concrete blocks, lead bars etc. on the platform. Many a times a hydraulic jack is placed between the loading platform and the column top for applying the load to the test plate – the reaction of the hydraulic jack being borne by the loaded platform. This form of loading is termed as reaction loading.



### 3. Interpretation of Results:

The load intensity and settlement observations of the plate load test are plotted in the form of load settlement curves.



*Load Settlement Curves*

The figure below shows four typical curves applied to different soils. **Curve I** is typical for loose to medium non cohesive soils. It can be seen that initially this curve is a straight line, but as the load increases it flattens out. There is no clear point of shear failure. **Curve II** is typical for cohesive soils. This *may* not be quite straight in the initial stages and leans towards settlement axis as the settlement increases.

**Curve III** is typical for partially cohesive soils.

**Curve IV** is typical for purely dense non-cohesive soil.

The safe bearing capacity is obtained by dividing the ultimate bearing capacity by a factor of safety varying from 2 to 3. The value of safe bearing capacity thus arrived at, is considered to be based on criterion of *shear failure*.

Safe bearing capacity (SBC) based on permissible settlement. As indicated earlier the settlement of footing is also related to the SBC of the soil. The value of ultimate bearing capacity and hence the SBC in this case, can be obtained from the load settlement curves by reading the value of load intensity corresponding to the desired settlement of test plate. The value of permissible settlement (*S<sub>f</sub>*) for different types of footings (isolated or raft) for different types structures are specified in the I.S. code. The corresponding settlement of test plate (*S<sub>p</sub>*) can be calculated from the following formula,

$$S_f = S_p \left\{ \frac{B (B_p + 0.3)}{B_p (B + 0.3)} \right\}^2$$

Where,

B = Width of the footing in mm

B<sub>p</sub> = Width of the test plate in mm

S<sub>p</sub> = Settlement of the test plate in mm

S<sub>f</sub> = Settlement of footing in mm



### **Article 3.13 - Frequency for Other Manufactured Materials**

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For all other manufactured materials, the frequency of testing shall be as indicated in the relevant British or other approved Standards, or as directed by the Engineer.

### **Article 3.14 - Alteration in Frequency of Tests**

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Notwithstanding any provision in these Technical Specifications as to the frequency of tests, the Engineer shall be empowered to alter the number, type or nature of such tests, as may in his opinion, be necessary for the proper execution of the works. The Engineer shall be at liberty to increase the frequency of testing, and repeat tests which, in his opinion, are unsatisfactory and vary the nature and type of test.

### **Article 3.15 - Control of Surfaces**

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The Contractor shall provide straight edges, templates for checking the finish of the surfaces. They shall be maintained in good condition during all the works.

### **Article 3.16 – Responsibility of the contractor**

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Where the approval of the Project Manager is required under these Technical Specifications, such approval shall not relieve the Contractor of his duties or responsibilities under the Contract.

## **SECTION 4 - SITE CLEARANCE AND EARTHWORKS**

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## **Article 4.1 - Mass Diagram**

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The Contractor shall prepare a mass diagram showing in as much detail as the Engineer may consider necessary the programmed movement of the earth for measurement purposes. The programme for earthworks shall be submitted for the approval of the Engineer before the commencement of the Works. Such approval shall not be deemed to relieve the Contractor of any of his responsibilities under the Contract. The Contractor shall before preparing his earthworks programme, carry out such soil testing as necessary to determine the suitability of materials for use in the Works.

## **Article 4.2 - Existing Structures and Services**

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The existing structures and services on the Site include:-

- (a) Services such as channel, water-mains, telephone, electricity cables, overhead lines, street lighting etc.
- (b) Masonry, concrete, reinforced concrete
- (c) Structures
- (d) Existing Roads

## **Article 4.3 - Demolition and Dismantling**

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The Engineer must be given 7 days' notice of any proposal to demolish or dismantle all or any part of the existing structure on the Site, which is necessary for the completion of the Works.

The Contractor shall give the Engineer an explanation of the method and order of demolition and the steps taken to ensure the safety and stability of any remaining structure affected thereby.

The approval of the Engineer shall not relieve the Contractor from his responsibility for injury, loss, inconvenience and annoyance to persons, damage to animals, property and Works consequent on the demolition and dismantling.

## **Article 4.4 - Demolition of Masonry, Concrete, and Reinforced Concrete Structures**

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Demolition of existing masonry, concrete, reinforced concrete structure if any shall be carried out in accordance with the Drawings or as directed by the Engineer.

The Works as directed by the Engineer shall include: -

- Demolition (reinforcement shall be cut off close to concrete)
- Removal of material
- Loading, carting away & disposal of material as directed by the Engineer
- Filling under embankment of all inspection pits and openings made in connection with the removal of these structures to the original ground or to the lines and levels as directed by the Engineer, to be levelled with an approved material compacted to a density at least equal to that of the surrounding ground or as directed by the Engineer.

## **Article 4.5 - Site Clearance**

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Clearing site shall consist of clearing the ground of trees, bush, hedges, fences, shrubs, stumps, rubbish, loose boulders, piles of boulders and other objectionable material excluding soil and rock, including disposal from areas shown on the Drawings or as directed by the Engineer, and shall include the grubbing up of all root and backfilling with approved materials of all cavities caused by the clearing to a density at least equal to that of the surrounding ground.

The Works include the loading, carriage and disposal of all materials to tip as directed by the Engineer.

## **Article 4.6 - Cutting of trees**

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Trees defined as having a girth of 1,000 mm, measured 1,000 mm from the ground shall be cut by the Forestry Service or by owners, at the request of Engineers. Otherwise, this work shall be carried out by the Contractor and paid under day work schedule. The Contractor must seek the approval of the Forestry Service prior to the removal of any trees.

The removal of stumps and roots of such trees as defined above is included in the works. Holes left by the removal of stumps and roots shall be backfilled and compacted to 90% B.S. Heavy Compaction with approved materials up to the top of the sub-grade level or as directed by the Engineer.

## **Article 4.7 - Ownership Of Materials**

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Materials, components and other items which the Contractor has demolished, dismantled or otherwise removed in compliance with the Contract shall remain the property of Employer unless and until the Contractor is informed in writing by the Engineer that ownership of all or any of the materials, components and other items belong to a third party.

## **Article 4.8 - Classification of Excavated Materials**

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### **4.8.1 Topsoil**

Topsoil shall consist of a material containing vegetable root system existing in a thin layer on the natural ground surface complying with Article 2.9 of these Technical Specifications.

### **4.8.2 Approved Material**

Approved material shall consist of all material complying with Articles 2.7 and 2.8 of these Technical Specifications or which, in the opinion of the Engineer, is suitable for incorporation in the construction.

### **4.8.3 " Rock"**

Rock is defined as all materials, which in the opinion of the Engineer, require blasting or the use of metal wedges and sledgehammers, or the use of compressed air drilling for their removal and which cannot be extracted by ripping with a tractor of at least 300

brake hp with a single, rear mounted, heavy duty ripper. Tractor shall be in good order, operating weight forty (40) tones, operated by qualified operator.

#### **4.8.4 Power of the Engineer**

Should any difference of opinion arise between the Contractor and the Engineer, as to the classification of the material, the Engineer's decision shall be final.

### **Article 4.9- Removal of Top Soil**

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Where embankment/subgrade will be constructed on natural ground, removal of topsoil depth shall be directed by the Engineer, shall be stripped after clearing and grubbing. In the fill areas containing humus or other deleterious materials harmful to the stability of road, the Engineer may order for a depth greater than 300 mm within the area designated. The stripped area shall be compacted as per Article 4.26. The stripped materials shall be stockpiled for use on the surfaces before turfing and surplus material shall be disposed off as directed by the Engineer to a site identified by the Contractor and approved by the Engineer at any distance from the work site.

Where the removal of topsoil has not been specifically directed, any top soil excavated shall be deemed to be part of the general excavation.

### **Article 4.10- Dewatering**

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During construction of the roadway, the roadbed shall be maintained in such a condition that it is well drained at all times. In order that the embankment, subgrade, sub-base and/or base may not be subject to wetting, during or after construction, the Contractor shall at all times, and especially at an early stage of the work be required to provide adequate drainage by scheduling ditch work and outlet construction so as to prevent such wetting. The Contractor shall clean and trim all such drainage ditches from time to time during the work or when directed by the Engineer, so that there may be a free water flow throughout the whole period of work. The Contractor shall immediately repair damage attributable to wetting through failure to provide such measures.

No separate payment shall be made for this work as these are deemed to be included in the relevant items of the Bill of Quantities.

### **Article 4.11 - Excavation**

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4.11.1 "Excavation" shall consist in the loosening, digging, loading, hauling and disposal of normal, soft, ripable, loose, unsuitable and boulders materials to the lines, levels, slopes and widths shown on the Drawings or as directed by the Engineer. It shall include compaction, finishing and shaping of all surfaces formed by such excavations in accordance with these Technical Specifications.

The Contractor shall take special care for the saving of all suitable excavated materials for embankment or subgrade construction.

4.11.2 Removal of existing structures, site clearance, removal of topsoil and removal of unsatisfactory material shall be carried out in proper sequence so that one operation does

not interfere with another. Sufficient time shall be allowed between each operation for any measurement required by the Engineer to be carried out and the Contractor shall not proceed with any other operation until such time as any measurement has been agreed and approved.

- 4.11.3 where a firm foundation is not encountered at the bottom of the excavation due to presence of soft, spongy or other unstable material, the Contractor shall, at his own expense, remove such unstable material and replace with approved material thoroughly compacted to a density not less than 95% B. S. Heavy Maximum Dry Density.
- 4.11.4 All excavations shall be carried out in such a manner that the back slopes are neatly trimmed to the lines shown on the Drawings or as directed by the Engineer.
- 4.11.5 Where excavation reveals a combination of suitable and unsuitable materials, the Contractor shall, wherever the Engineer considers it practicable and so directs, carry out the excavation in such manner that the suitable materials are excavated separately for use in the works without contamination by the unsuitable material.
- 4.11.6 In wet weather clay cuttings shall not be excavated and shall not be taken down to less than 25 cm above final level of the subgrade.
- 4.11.7 The Contractor shall take all necessary precautions to prevent slips and falls to the sides of the excavation, but if any should occur, the Contractor shall remove, at his own expense, all such fallen or displaced materials and replace if required with suitable material compacted to a density not less than that of the adjoining ground at his own expense.

## **Article 4.12 - Road Excavations**

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Road excavations will be carried out in order to cart away unsuitable materials from existing pavement to widen carriageway or shoulder or adjust level of existing road.

They shall consist in excavation of any material from pavement or subgrade to such a depth as shown on the Drawings or as directed by the Engineer.

The works include:

- Dismantling and removal of existing cats eyes
- Scarifying, loosening and digging asphaltic material including crusher run from the carriageway shoulder or verge
- Loading, carting away and disposal of all materials in spoil tips, temporary stockpiles or in subgrade of new pavement as directed by the Engineer
- Shaping and Compaction of the bottom of the excavation to 95% B.S. Heavy Compaction or as directed by the Engineer.

Excavation in any other material except bituminous materials shall be paid as normal excavation.

## **Article 4.13 - Borrow Pits**

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4.13.1 Before opening of any borrow pits for the removal of material for forming embankments, the Contractor shall submit his proposals for the carrying out of the work, in writing, for the Engineer's approval.

The proposals shall state the location of the proposed borrow-pit, the thickness of topsoil or unsuitable material to be removed, the depth of suitable material to be excavated, the type or types of material to be secured and the areas for stockpiling top soil to be reused to cover the borrow pit area. Any modification that the Engineer may require shall be made by the Contractor.

The approval of the borrow pit area by the Engineer shall not relieve the Contractor of his obligations to ensure that all the material used as fill is as approved by the Engineer.

The Contractor may be required to mix the materials excavated by bulldozing into stockpiles and face loading by shovel into lorries.

4.13.2 The Contractor shall be responsible for the access to any borrow pits, quarries or stockpiles.

Any cost, rent royalties or fees which can arise in connection with access to such areas shall be borne by the Contractor and are assumed to be included in Bill No. 1 and Bill No. 2.

4.13.3 On completion of the excavation of borrow pit material, the Contractor shall leave the borrow pit in a tidy condition, top soil being replaced to cover completely the borrow pit area as directed by the Engineer. Where borrow pits are required to be drained, the Contractor shall do so at his own expense and in a manner as approved by the Engineer.

## **Article 4.14 - Use of Explosives**

Blasting is strictly forbidden.

## **Article 4.15 - Preparation Prior To Embankment Construction**

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4.15.1 The construction of embankment shall not commence until the work under Articles 4.1 to 4.10 of these Technical Specifications has been completed as directed.

If after topsoil stripping the ground is considered unacceptable by the Engineer, the Contractor shall excavate to such depths as required and dispose of the material to spoil tips as directed.

4.15.2 The Contractor shall execute all works necessary to drain the natural ground prior to forming of the embankment. Should any subsequent embankment filling be adversely affected through lack of such drainage, the Contractor shall remove and replace it at his own expense.

4.15.3 Prior to placing fill material in embankments, the Contractor shall compact the top 30 cm of the natural ground in accordance with Article 4.17 and Article 4.20.



## **Article 4.16 - Proof Rolling Section**

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Before commencing any embankment construction, the contractor shall, at his own expense, carry out compaction trials by establishing proof rolling sections. The purposes of these trials are to determine, for each main type of materials to be used in embankment, subgrade, sub base, base and bituminous courses, the proper compaction plant to be used, the number of passes and the thickness of loose material for each layer, in order to achieve the required degree of compaction and a minimum value for the deflection under a 8.2 tons axle load.

The trial stretch shall be of such length and width as directed by the Engineer and in no case shall be less than one lane in width and 100 m in length.

The Contractor shall submit to the Engineer for approval a procedure for carrying out these compaction trials, supplemented by any necessary laboratory and in-situ tests.

These trials and tests shall be completed before the Works with the corresponding materials will be allowed to commence.

No payment shall be made for these trials and the costs thereof shall be deemed to be included in the other rates and prices.

## **Article 4.17 – Preparation of Natural Ground**

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The natural ground or the surface of an earth/gravel road after removal of top soil as per Article 4.9 on which the embankment / subgrade is to be constructed shall be prepared in accordance with the following requirements:

When an existing earth/gravel road, referred to as natural ground on which subgrade is to be constructed falls below within 0.3 m of the subgrade level, and if existing material is suitable for subgrade, the natural ground shall be prepared as subgrade preparation in earth cut as per Article 4.18.

When the natural ground or an existing earth / gravel road, referred to as natural ground on which the embankment is beyond 0.3 m of the subgrade level and existing material is suitable for construction of embankment, the natural ground shall be prepared as embankment by loosening and recompacting the existing natural ground to a depth of 300 mm or as directed by Engineer, before placing new embankment and subgrade layers.

## **Article 4.18 - Construction of Embankment**

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4.18.1 All fill material shall be supplied from the general excavation wherever possible, or from approval borrow pits or quarries.

4.18.2 No material shall be deposited until the ground shall have been prepared in accordance with Article 4.15 and approved by the Engineer.

The material shall be neatly and evenly spread over the area of the embankment to such an extent that the embankment is composed of fully compacted material for the widths required in uniform horizontal layers in accordance with Articles 4.16. The layers shall be kept shaped and trimmed and levelled by approved equipment. The surface of the layers shall at all times be maintained to such camber or cross falls as will shed water and prevent ponding. No subsequent layers shall be placed until each layer has been properly shaped, compacted and approved by the Engineer. If before the approval of a layer, damages, if any, such as cracking, rutting, corrugations, potholes, softening, erosion etc, are caused to the lower layer for any reasons whatsoever, such damages shall be made good by the Contractor at his own cost to the satisfaction of the Engineer before placing of materials for overlying layer. The methods employed for making good of damages as above shall include scarification with recompaction or reconstruction using new materials, as directed by the Engineer. Embankments shall be formed according to the Drawings or as directed by the Engineer. Side slopes shown on the Drawings are indicative only of the expected slope required for the material used and may be altered to suit the requirements of the material where directed by the Engineer.

- 4.18.3 Compaction shall not proceed until the moisture content of the material has been adjusted in accordance with Article 4.26. Any adjustments involving the incorporation of additional moisture shall be carried out by approved plant and shall be so arranged that the required moisture content shall be uniform throughout the layer to be compacted and shall remain uniform during compaction. The removal of excess moisture content shall be carried out by spreading out the material for aeration by mechanical means and remixing it at regular intervals. Should circumstances arise when the removal of excess moisture cannot be achieved, work on the compaction of the material shall be suspended until the conditions of weather and drainage are such as permit the required moisture content to be attained. The contractor's attention is drawn to the fact that no claim for extension of time and / or additional costs will be entertained for any stoppage of work arising for the conditions of weather and drainage preventing the drying of the material and it will be assumed that the contractor's rates and prices shall provide for such stoppages.

The contractor may opt to use imported fill from borrow pits to replace any material with an excess moisture content in order to avoid stoppage of the work. However the cost of such replacement shall be borne entirely by the contractor, unless same has been specifically ordered by the Engineer.

Where soft area has resulted from negligence on the part of the Contractor, it shall be removed and replaced with suitable material at his own expense.

Watering and compaction plant shall be approved by the Engineer prior to the commencement of the Work but such approval shall not relieve the Contractor of his responsibility to provide suitable and adequate plant for the construction of the works.

#### 4.18.4 Rock Embankment and Boulders Embankment

The embankment shall be built in layers not exceeding 50 cm in thickness of loose material. Top 150 mm of rock fill embankment shall be well-graded granular material (crusher run), having maximum size of particle of 100 mm. This will act as top of subgrade. There should be a minimum of 175 mm thick sub-base cushion over the rock fill.

The Contractor shall take special care to minimise segregation of material during handling and placing.

Compaction shall be carried out as follows: - First pass: Using a pressure-type roller

Following passes: Using a vibrating roller with an out-of-balance weight of 10 tons at least or other approved plant.

Compaction control shall be carried out by survey method (levelling) or as directed by the Engineer.

The interstices between the lumps shall be filled with smaller lumps, aggregates and sand as directed by the Engineer. Compaction shall be as directed by the Engineer.

Each layer shall be approved by the Engineer.

### **Article 4.19 - Subgrade**

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The subgrade is defined as the surface on which the sub-base is placed or on which the base is placed and where no sub-base is required as shown on the Drawings or as directed by the Engineer.

The subgrade, once it has been finally shaped and compacted and approved by the Engineer, shall be protected from damage and kept well drained at all times. Storage or stockpiling of plant or materials on the finished subgrade shall not be permitted.

Where the subgrade is damaged by the Contractor's own vehicles or vehicle belonging to the general public or by rain or from any other cause, then the damaged or deformed material shall be dug out and shall be replaced with approved compacted material at the Contractor's expense.

### **Article 4.20 - Embankment against Sloping Ground**

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When embankment is to be placed and compacted on hill sides, or new embankment is to be compacted against existing embankment, where the slopes are steeper than 4:1 (H:V), continuous horizontal benches each at least 300 mm wide shall be cut into the old slope for ensuring adequate bond with the fresh embankment/subgrade material to be added. The material obtained from cutting of benches could be utilised in the widening of the embankment/subgrade. However, when the existing slope against which the fresh material is to be placed is flatter than 4:1 the slope surface may only be scarified instead of resorting to benching.

Where the width of the widened portions is insufficient to permit the use of usual wider rollers, compaction shall be carried out with the help of tandem rollers, small vibratory rollers, mechanical tampers or other approved equipment. Benching of slopes shall be considered incidental to the work and shall not be measured separately.

### **Article 4.21 - Embankment and Subgrade around Structures**

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To avoid interference with the construction of abutments, wing walls or return walls of culvert/bridge structures, the Contractor shall, at points to be determined by the Engineer suspend work on embankments forming approaches to such structures until such time as the construction of the latter is sufficiently advanced to permit the completion of approaches without the risk of interference or damage to the structures.

Unless directed otherwise, the filling around culverts, bridges and other structures up to distance of twice the height of the road from the back of the abutment shall be carried out independent of the work on the main embankment. The fill material shall not be placed against any abutment or wing wall unless permission has been given by the Engineer but in any case not until the concrete or masonry has been in position for 14 days. The embankment and subgrade shall be brought up simultaneously in equal layers on each side of the structure to avoid displacement and unequal pressure. The sequence of the work in this regard shall be approved by the Engineer.

Where it may be impracticable to use power rollers or other heavy equipment, the compaction shall be carried out by mechanical tampers or other methods approved by the Engineer. Care shall be taken to see that the compaction equipment does not hit or come too close to any structural member so as to cause any damage to them or excessive pressure against the structure. Payment shall not be measured separately and deemed to be included in other rates and prices.

#### **Article 4.22 - Construction of High Embankments and Embankments on Soft Foundation**

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Where the embankment exceeds 6 metre in height or where directed by the Engineer, the embankment shall be constructed in stages as instructed by the Engineer. The subgrade layer, that is the top 500 mm of the embankment, shall be constructed only after the Engineer is satisfied that the embankment is stable and no more consolidation settlement is expected to take place.

On soft foundations, such as in marshy areas, the embankment work shall be given priority in construction operation so that sufficient time is available for the ground to consolidate prior to application of the pavement layers. For such cases, the Engineer may order surcharging of embankments by the addition of fill to such levels as determined by him for effecting quick consolidation of sub-strata. The surcharge shall be removed only when the Engineer is satisfied that no more settlement is possible. Removal of the surcharge shall be to a level 500 mm below the subgrade level. The stripped embankment surface shall be scarified to an average depth of 100 mm and compacted to the designated density. Only after this operation the subgrade layer shall be constructed. The surcharge fill shall be deemed as if additional embankment has been constructed and measured accordingly. Removal of the surcharge and recompacting the surface of the stripped embankment shall be considered incidental to the work and shall not be measured separately.

#### **Article 4.23 - Subgrade Preparation in Earth Cuts**

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The objective of this operation is to ensure that the subgrade and its foundation comprise suitable material and specified density, that it is compacted to the specification limits and that it is levelled, shaped and made to a condition fit for receiving subsequent pavement layers.

For this purpose, the material in earth cut to be used as subgrade shall be tested for conformity to Article 3.8.2. If found suitable, the surface shall be loosened to a depth of 200 mm or as directed by the Engineer, the moisture content adjusted, shaped to the specified levels and cross fall, and compacted to the density specified in Article 4.26.2 considering top 500 mm as subgrade.

If the material is found unsuitable, the same shall be sub-excavated to a depth of 500 mm below subgrade level or as ordered by the Engineer, replaced by suitable material and compacted to the specified degree.

Where a strata of boulder mixed with soil is met with, the same shall be sub-excavated to a depth of 500 mm or as directed by the Engineer and replaced by suitable subgrade material.

### **Article 4.24 - Subgrade Preparation in Rock Cuts**

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The rock cut for subgrade shall be made true to the designated line and levels in the drawing. The gaps/holes and unevenness so created in the process of rock cutting shall be made up to the required depth through levelling, shaping and compaction of crushed stones conforming to sub-base quality as per Article 2.14.

### **Article 4.25 - Tolerances**

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4.25.1 The finished subgrade shall be properly shaped and compacted to a smooth surface which shall not show any departure from the required cross section greater than within the range -2 cm to +2 cm at any point. When measured with a 3 meters straight edge, deflections shall not be greater than 2 cm.

If for two consecutive working days, more than 10% of the measurements do not comply with these requirements, the Work shall be stopped in order to examine and improve the methods and equipment used and if necessary substitutes any defective equipment.

4.25.2 The deflections measured under 8.2 tons axle load shall not exceed the maximum value determined during the proof rolling section as described in Article 4.16 hereof.

### **Article 4.26 - Compaction of Earthworks**

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4.26.1 The moisture content of fill material of natural ground during compaction shall never exceed B.S. Heavy Optimum Moisture Content (OMC) for the densities specified in Article 4.26.2 hereof of more than 2%.

4.26.2 The compaction requirements are as follows:- (Heavy Maximum Dry Density: H.M.D.D.)

- (a) Compaction of the top 30 cm of natural ground under the embankment: not less than 90% B.S H.M.D.D.
- (b) Compaction of the top 30 cm of cuts under the pavement structure: not less than 95% B.S H.M.D.D.
- (c) Compaction of embankment except for the top 30 cm: not less than 90% B.S H.M.D.D.

- (d) Compaction of the top 30 cm of the embankment other than rock or boulder embankment: not less than 95% B.S H.M.D.D.

### **Article 4.27- Side Slopes**

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The Contractor shall construct at his own expense temporary kerbs and downspouts to protect the embankment's side slopes from erosion due to surface water.

All side slopes shall be neatly trimmed and the finished slopes shall not vary by more than 5 cm from the required cross section. Steep slopes in cuttings shall be cleared of all loose and insecure fragments.

All excess material including accumulation, at the foot of side slopes of embankments, of boulders, lumps or other rubbish shall be taken to tip.

No sharp change in the inclination shall be left, edges being rounded off to provide gradual change and discourage erosion.

Any slips or falls of materials shall be removed and the faces retrimmed in accordance with this Article at the Contractor's expense.

The side slopes given on the Drawings whether for cut or for embankment are subject to variation by the Engineer according to the nature of the soil.

### **Article 4.28 - Earthworks for structures**

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#### **4.28.1 Excavation**

Foundation excavation shall include the removal of all material, of whatever nature, necessary for the construction of the foundations and sub-structures in accordance with the plans or as directed by the Engineer.

It shall include the construction of all cribs, cofferdams, dewatering, etc., which may be necessary for the excavation of the work. It shall also include the subsequent removal of cofferdams and cribs and the placement of necessary backfill as specified. It shall also include stock-piling of the suitable excavated material for return as backfill and compaction as specified, and the disposing of excavated material that is not required for backfill, in a manner or in locations so as not to affect the waterway of the channel and be unsightly.

All sub-structures, where practicable, shall be constructed in open excavation and, where necessary the excavation shall be shored, braced, or protected by cofferdams in accordance with approved methods.

Foundation excavation shall be classified according to Clause 4.8 of the Specification. Separate measurement and payment shall be made of each class of material respectively.

Excavations shall be kept free from water. The bottom of the excavation shall be thoroughly cleaned of loose material, mud and water and carefully trimmed and shaped

to the correct levels and dimensions and, after approval in writing by the Engineer, the Contractor shall lay a blinding layer of concrete Class 15 to receive the concrete floor or footing, tamped to a smooth finish, providing all forms and screeds and any sump holes for drainage and pumping. Any pockets of soft soil in the bottoms shall be removed and replaced with Class 15 concrete. The Contractor shall make good with Class 15 concrete any additional excavation below the bottom of the foundations to remove material that the Contractor allows to become unsuitable, the cost of which shall be borne by the Contractor.

Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete. No pumping will be permitted during the placing of concrete, or for a period of at least 24 hours thereafter, unless it is to be done from a suitable sump separated from the concrete work by approved means. Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure.

#### **4.28.2 Cofferdams**

##### **(i) General**

Cofferdams for foundation construction shall be carried to adequate depths and heights, be designed and constructed to the Engineer's satisfaction and be made as watertight as is necessary for proper performance of the work that must be done inside them. In general, the interior dimension of cofferdams shall be such as to give sufficient clearance for the construction of forms and the inspection of their exteriors, and to permit pumping outside of the forms. Cofferdams that are tilted or moved laterally during construction shall be righted, reset or enlarged so as to provide necessary clearance.

When conditions are encountered which, in the opinion of the Engineer, render it impracticable to dewater the foundation before placing concrete he may require the construction of a concrete foundation seal of such dimensions as may be necessary. The foundation shall be then pumped out and the balance of the concrete placed in the dry. During the placing of a foundation seal, the elevation of the water inside the cofferdam shall be controlled to prevent any flow through the seal and if the cofferdam is to remain in place, it shall be vented or ported at low water level.

##### **(ii) Protection of concrete**

Cofferdams shall be constructed so as to protect fresh concrete against damage from water, from any source whatsoever.

No timber or bracing shall be left in cofferdams in such a way as to extend into the substructure, without written permission from the Engineer.

##### **(iii) Drawings required**

For sub-structure work, the Contractor shall submit drawings showing his proposed method of cofferdam construction and other details. Such drawings shall be approved by the Engineer before construction is commenced.

The drawings shall be submitted at least 2 weeks in advance of the time the Contractor intends to commence the construction of the cofferdam. Such approval shall not relieve the Contractor of his responsibility for the safety and adequacy of the structure so approved.

#### **(iv) Removal on completion**

Unless otherwise provided, cofferdams or cribs, with all sheeting and bracing, shall be removed after the completion of the sub-structure, care being taken not to disturb or otherwise injure the completed structure.

#### **4.28.3 Backfill to structures**

Up to the rock line, materials for foundation fill shall consist of lean concrete of Class 15 and as required by the Engineer.

Above the rock line, all materials used for backfill shall be crusher run 0/31.5 stabilised with cement to produce compressive strength at seven days of 150 mm cubes of not less than 8 N/mm<sup>2</sup> and not greater than 10 N/mm<sup>2</sup>.

All spaces excavated and not occupied by abutments, or other permanent work shall be backfilled with approved material up to the surface of the surrounding ground, with a sufficient allowance for settlement. All backfill material shall be placed in horizontal, uniform layers not exceeding 200 mm in thickness, and not less than 75mm after compaction, and shall be brought up uniformly and simultaneously on all sides of the structure. Each layer of backfill shall be compacted to a density of not less than 95% B.S. Heavy Compaction.

For filling to structures above existing ground level, the Contractor shall so arrange his programme for the construction of structures and earthworks that the filling behind and around any structure is carried but concurrently with, and as part of, the earthwork operation.

#### **4.28.4 Cement stabilised fill to earth retaining structures**

All materials used for compaction against earth retaining structures shall be of a quality acceptable to the Engineer, free from large lumps, wood or other extraneous matter. Granular fill shall consist of well-graded crusher 0/31.5 stabilised with cement to produce a compressive strength of between 8 and 10 N/mm<sup>2</sup> at 7 days on cubes of 150 mm.

The fill behind abutments, wing walls and culverts shall be deposited in wellcompacted horizontal layers not exceeding 200 mm in thickness and not less than 75 mm in thickness after compaction and shall be brought up uniformly and simultaneously on all sides of the structure. Each layer of the backfill shall be compacted to a density of not less than 90% of B.S. Heavy Compaction. The material to a depth of 1500 mm below the soffit of the approved slab or finished road level shall be compacted to 95% B.S. Heavy Compaction, and shall consist of a graded crushed stone of a similar quality as the road sub base.

No backfill shall be placed against any abutment, wing wall or culvert until permission has been given by the Engineer and not until the concrete has been in place 14 days or until the cubes results show the specified strength, whichever is the later.



The material shall not contain more than 0.2 % of sulphate ions as determined by BS 1377 unless special precautions to the approval of the Engineer are taken to protect the concrete.

#### **4.28.5 Mixing of Backfill Material**

The cement stabilised crusher run material to be used for backfilling to structures and earth retaining structures may be mixed in place or in a plant.

##### **Mixing in Place**

The Constructional Plant and method shall include:

(a) A cement spreader or approved method which will spread cement uniformly on to the material and provides the required proportion of cement per cent by weight to provide the specified compressive strength with a tolerance of plus or minus 0.5 per cent.

(b) A rotary mixer fitted with tines and capable of mixing the cement uniformly into the material for the full depth of the layer in a single pass. The mixer shall be capable of adjustment to control the depth of processing and shall be equipped with a water spray bar. The spray bar shall be regulated to spray water onto the material at a predetermined rate fixed in relation to the speed of travel of the mixer and providing the required proportion of water per cent by weight, with a tolerance of plus or minus 1.0 per cent. Alternatively a bowser which is similarly equipped may be used.

The first pass of the mixer shall be made to mix in the cement without adding water; one or more further passes shall be made, mixing in the required amount of water.

Each pass of the mixer shall overlap the adjacent pass at longitudinal joints by at least 100 mm and at traverse joints by 1.0 metre.

##### **Plant Mixing**

The mixing plant shall be capable of producing uniformly mixed material having the required proportion of cement per cent by weight to achieve the specified compressive strength with a tolerance of plus or minus 0.5 per cent and the required proportion of water per cent by weight with a tolerance of 1.0 per cent.

Twin shaft paddle mixers or gyratory pan mixers shall be used for material containing more than 50 per cent of particles passing a 5.0 mm sieve and for material containing more than 6.0 per cent of particles passing 0.15 mm sieve.

#### **Quality Control**

Test cubes shall be made cured and tested at the rate of one group of three cubes for every 1000m<sup>2</sup> of base laid. The average strength of each group of three shall not be less than the strength specified.

#### 4.28.6 Measurement and payment for earthworks for structures

The unit of measurement for earthworks shall be cubic metre. The volume paid for will be as indicated below.

Where the structure excavation is performed within road excavation, the quantity of excavation to be paid shall be the actual number of cubic metre of in situ material excavated within a volume banded by vertical planes parallel to the neat lines of the footing of the structure and the planes of the bottom and side slopes of the road excavation. No extra payment will be made for working space, the cost of which is deemed to be included in the excavation rates.

Where the structure excavation is performed in new road embankment the quantity of excavation to be paid shall be the actual quantity of cubic metres of in situ material excavated prior to the embankment construction within a volume banded by vertical planes parallel to neat lines of the footing or structure (no allowance will be made for working space ) and the lower limit shall be the level of the road subgrade while the upper limit shall be the original ground stripped of topsoil.

In case of independent footings the quantity of additional excavation to be paid shall be the actual number of cubic metres of in situ material excavated within a volume banded by vertical planes banded by neat lines of the footing, with no allowance for working space, and the planes of the bottom of the footing foundation and the road subgrade.

For raft foundation, the quantity of additional excavation to be paid shall be as for independent foundations but the planes of the bottom shall be the foundation of the raft.

No allowance shall be made for structure excavation where road excavation cannot be executed prior to the structure excavation.

The Contractor will be paid separately for each class of material excavated as specified in Clause 4.8 and for excavation to any depth.

## **SECTION 5 - ROAD WORKS**

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## Article 5.1 - General

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### 5.1.1 Terminology

- Subgrade Surface or Formation Level on embankments and in cuttings shall be the surface level of the earthworks after completion of the earthworks.

-The subgrade shall be the material immediately underneath the subgrade surface.

-The pavement shall be formed by the materials laid above formation level. It shall comprise the sub-base where required, the stone road base or the bituminous base course and the wearing course. The finished level shall be the surface of final layer of the pavement.

-On drawings or in Technical Specifications hereof

"Bituminous Concrete" applies for a hot premix bituminous concrete used for wearing course

"Bituminous Base" applies for a open graded base course bituminous concrete

"Crusher run" applies for a graded crushed stone material used for sub base or road base with grading between 0 and 25 mm (0/25) or 0 and 50 mm (0/50)

-Bituminous Surface Treatment applies for a film of bituminous binder covered by a layer of nominal single sized stone chippings.

-A sealing coat composed of a film of bituminous binder covered with a layer of fine aggregate shall complete double bituminous surface treatment on carriageways.

### 5.1.2 Works to Be Executed

The roadworks shall consist of the following operations: -

- (a) Preparation of subgrade surface
- (b) Construction of crushed stone sub base
- (c) Construction of crushed stone
- (d) Construction of bituminous mix base course
- (e) Construction of bituminous concrete wearing course
- (f) Construction of shoulder or footpath
- (g) Application of a surface treatment
- (h) Construction of verges and slopes of embankment and top soiling
- (i) Strengthening of existing pavements

The pavement structure is defined on typical cross sections and layout plan and longitudinal profiles.

It is specified that no layer shall be laid until the underlying layer has been inspected and approved by the Engineer.

### **5.1.3 Programme to be Furnished**

The Contractor shall submit to the Engineer for his approval the programme and drawings specified in Article 1.10 of T.S.

It is advisable to complete drainage works before starting road/pavement works on a section.

The method of construction of the pavement shall be such that a subsequent layer shall be placed as soon as possible after the results of the tests and measurements (density, deflection etc...) carried out on the laid layer have been found as specified or as directed by the Engineer.

### **5.1.4 Typical Cross Section**

- The typical cross sections shown on Drawings shall be applied on cross sections levelled as specified in Article 1.11 and to be approved by the Engineer.
  
- Some adaptations are to be foreseen, particularly the theoretical camber fixed at 2.5% in alignment which may vary between 2.5 and 3%. Nevertheless in alignment and for the same cross section, the camber on each half of the carriageway shall not differ by more than 0.5%.
  
- The nominal thickness specified on typical cross sections and on plan and longitudinal profiles are deemed to be the minimal thickness of material to be laid down.

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## **Article 5.2 - Preparation of Subgrade Surface For Existing Road**

The subgrade surface shall be cleaned of all foreign matter; and any loose material, potholes, ruts, corrugations, and other defects which may have appeared shall be corrected; if directed by the Engineer, the Contractor shall scarify, water, grade and recompact the subgrade to line and level. No payment shall be made for preparation of subgrade surface and the costs thereof shall be deemed included in the other rates and prices.

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## **Article 5.3 - Precautions During Rains**

Adequate measures shall be taken by the Contractor during period of rains to protect all work by providing drainage of all exposed surfaces. No placing of layer shall be permitted until the surface, on which the layer is to be laid, is dry.

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## **Article 5.4 - Proof Rolling Sections**

Before commencing any pavement work, the Contractor shall carry out compaction trials by establishing proof rolling sections. The purposes of these trials are to determine the proper compaction plant to be used (including number of rollers, wheel load, inflation pressure of tyres, rolling patterns, speed of rollers, distance between the asphalt paver and the compaction plants), the number of passes, the thickness of loose material for each layer, the temperature for

spreading in order to achieve the required thickness of compacted material, the required density and a minimum value for the deflection under a 8.2 tons axle load.

The Contractor shall submit to the Engineer for approval a procedure for carrying out these compaction trials supplemented by any necessary laboratory and in-situ tests.

These trials and tests shall be completed before works with the corresponding materials will be allowed to commence.

The results of these trials such as defined above shall be submitted to the Engineer for his approval; such approval shall not relieve the Contractor of any of his duties and responsibilities under the Contract.

No payment shall be made for these trials and the costs thereof shall be deemed included in the other rates and prices.

### **Article 5.5 - Drainage Layer**

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Drainage layer materials shall be placed as shown on typical cross section or where required by the Engineer. The materials shall be spread on subgrade surface with a grader and compacted with vibrating roller or heavy self-propelled tyred roller. Depending on the type of the materials, compaction requirements and method of compaction shall be specified in accordance with results of proof rolling sections. Drainage layer in shoulders or as backfilling of masonry or drainage structures shall be hand-placed and compacted with hand-propelled vibrating roller.

### **Article 5.6 - Crushed Stone Sub Base and Base Construction**

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The crushed stone sub base and base materials (crusher run) shall comply with the requirements of Articles 2.11, 2.12, 2.13 and 2.14 of these Technical Specifications and shall be provided and laid to the lines, levels and cross section shown on the Drawings or as directed by the Engineer. The crushed stone sub base as well as the base course shall be placed in layers over the entire formation. The thickness of one layer shall never be less than ten (10) cm and more than twenty (20) cm for base material and less than twelve (12) cm and more than twenty five (25) cm for sub base.

Spreading of the approved material shall be carried out by plant or vehicles designed or equipped with suitable devices capable of depositing the material in a continuous uniform layer of the correct thickness, width, shaping, and surface tolerances.

The paver shall be capable of spreading the material to a thickness sufficient to provide a compacted layer of at least 20 cm over a width of at least 3.20 m.

During spreading of material, precautions shall be taken to avoid segregation. If segregation occurs, the Contractor shall remix the material by a method to be approved by the Engineer.

Where the addition of fine is necessary, it shall be thoroughly mixed in with the aggregate before the introduction of any water that might be required.

Where it is necessary to add water to adjust the moisture content, the water shall be added by an approved mechanical sprinkler and mixed into the full depth of the loose material by means of a harrow or other mixing equipment approved by the Engineer.

Compaction of crusher run layer shall be carried out only after the construction of edge concrete kerbs provided for retaining the material has been completed.

Equipment for compacting shall be composed of vibrating rollers with W/L ratio greater than 20 kg/cm and heavy tyred roller of more than 2.5 T by wheel. The thickness of the processed layer shall be checked continuously at all stages of the construction to ensure that the thickness of the final compacted layers is at all points within the tolerances specified in Article 5.15.

### **Article 5.7 - Compaction Requirements for Sub Base and Base Courses**

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The moisture content of the material shall be continuously checked before and during rolling and shall be in the range of -2% to + 2% of O.M.C. (O.M.C. Optimum Moisture Content)

The layers shall be compacted to a minimum density of 95% of B.S. Heavy Compaction for sub base and 98% of B. S. Heavy Compaction for base. These requirements must be fulfilled for 90% of measurements.

Compaction shall continue until -

- (i) The specified density is achieved when measured with a Nucleo-Gamma densometer type troxler or any other method as approved by the Engineer.
- (ii) The compacted pavement layer contains not more than 15% voids for road base, or 20% voids for sub base, voids being air voids and voids filled with water.

All rolling shall be longitudinal and shall commence at the outer edges except that on super-elevated curves, rolling may progress from the lower to the higher edge.

The surface of the material shall on completion of compaction, be well closed, free from movement under the compaction plant and free from compaction planes, ridges, cracks or loose material. All loose, segregated or otherwise defective areas shall be dug out and made good with new material to the full thickness of the layer and recompacted all at the Contractor's expense.

### **Article 5.8 - Tolerances For Crushed Stone Sub Base And Base Course**

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#### **5.8.1 Surfaces**

The finished surfaces of crushed stone sub base and base shall not show any departure from the required cross sections exceeding 1.5 cm (15 mm). When measured with a 3 metres straight edge, deformations shall not be greater than 1.5 cm (15 mm).

If the departures are greater than these tolerances, the Contractor shall at his own expense scarify, reshape, add water, if necessary, and compact such areas.



If for two consecutive working days more than 10% of the measurements do not comply with these requirements, the work shall be stopped in order to examine and improve the methods and equipment and if necessary substitute any defective equipment.

### **5.8.2 Deflection Measurement under a 8.2 Ton Axle Load**

More than 90% of deflections measured on a length corresponding to a day's work shall be within the limit specified by the Engineer in accordance with the results of proof rolling sections.

If on a limited area localised in a homogeneous section (in regard of geotechnical conditions and strengthening solutions carried out) the characteristic deflections (D + 20 \*) exceed the average level of deflections in this section by more than 25%, additional compaction shall be required. If, in the opinion of the Engineer, no significant improvement is obtained, excavation shall be ordered in order to replace the subgrade or sub base materials, at the own cost of the Contractor.

## **Article 5.9 - Shoulder Construction**

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The construction of shoulders and crushed stone footpath shall in all respects be the same as for sub base and base courses, except for compaction requirements which shall be fixed to 95% B. S. Heavy Compaction. Where crushed stone base (and sub base) is provided, construction and especially compaction of shoulder layers shall be carried out at the same time as the corresponding works on the carriageway. Where bituminous base course and wearing course are provided, the laying and first compaction of shoulder material shall be made before the construction of the bituminous courses.

## **Article 5.10 - Preparation Of Crushed Stone Base for Prime Coat**

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The surface shall be thoroughly brushed by mechanical brooms and all loose sand, dust, dirt and other unsuitable material shall be removed, to the approval of the Engineer.

The finished base surface shall be true to line, grade and cross section as specified in Article 5.8. The base shall be in the condition of compaction and finishing as specified. Prime coat shall be applied when the surface to be treated is dry. The prime coat shall not be applied on dust or when the weather is rainy.

## **Article 5.11 - Application of Prime Coat**

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5.11.1 On completion of the preparation of the base and approval of the surface by the Engineer, the prime coat of MC 30 or other approved binder as required in Article 2.34, shall be applied immediately by means of a pressure distributor at the rate of spread of 1.2 Kg/m<sup>2</sup>.

The rate and number of application shall be such that the prime penetrates at least 1.5 cm the base course and dries to a uniform matt surface in 24 hours.

The area to be primed shall extend to the whole width of the base course, including shoulders to be covered by the wearing course.

The nozzles of the distributor shall be checked prior to spraying.

The base surface where too closely knit may be slightly moistened by a mechanical sprinkler.

During spraying of binder all elements such as, culvert head walls, kerbs and the like which are liable to be disfigured by splashing of bitumen shall be protected and any such feature which is accidentally marred by bitumen shall be cleaned off with a suitable solvent or made good.

Any areas insufficiently covered shall be re-sprayed by spray lance to the satisfaction of the Engineer.

Where the prime coat does not completely penetrate into the base, the excess should be blotted with sand or single sized aggregate 4/6.

The prime shall be completely cured before spreading asphaltic concrete or placing of paving slabs.

The prime coat shall be left undisturbed for a period of at least 24 hours, and shall not be opened to traffic until it has penetrated and cured sufficiently so that it will not be picked up by the wheels of passing vehicles. The Contractor shall maintain the prime coat until the next course is applied. Care shall be taken that the application of bituminous material is not in excess of the specified amounts and any excess shall be blotted. All areas inaccessible to the distributor shall be sprayed manually using the device for hand spraying from the distributor.

5.11.2 Where required by the Engineer, or in order to protect the base surface under traffic, the prime coat shall be covered with sand or single sized aggregate 4/6 at the rate of 6 litre/m<sup>2</sup>.

### **Article 5.12 - Tack Coat**

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A tack coat shall be applied between the existing bituminous surface and the bituminous concrete base course or wearing course. The tack coat may also be ordered by the Engineer between the bituminous base course and wearing course.

The surface to be tacked shall be swept clean of all loose particles and dust immediately prior to the application of the tack coat, at the rate of 0.600 Kg/m<sup>2</sup> of RC 250 or 0.300 Kg/m<sup>2</sup> of residual bitumen from bitumen emulsion.

### **Article 5.13 - Surface Treatment**

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Following spraying and curing of prime coat, a surface treatment shall be applied where specified on drawings.

### 5.13.1 Average Rates

The rate of application of binder and chippings shall be determined on site according to type of binder and chippings. The following table gives the average rates upon which bill prices have to be based: -

	CUTBACK RC 250 KG/M SQ	CHIPPINGS Litre / M <sup>2</sup>		
		2/4	4/6	10/14
Single Surface Treatment	1.0		8.0	
Double Surface Treatment				
1st Layer	1.3		6.0	
2nd Layer	1.2			11.0

### 5.13.1 Spraying Binder

The binder RC 250 or equivalent shall be sprayed mechanically by means of a pressure distributor after road base has been cleaned as specified for priming.

The distributor shall be such that the spraying is uniform on an adjustable width. The spraying pressure shall be uniform whatever the running speed may be. A competent foreman shall continuously supervise the spraying of binder.

All road furniture shall be protected.

### 5.13.2 Spreading Chippings

Chippings shall be spread mechanically immediately after the binder has been applied. A maximum delay of 5 minutes shall be authorised.

10/12 ton self-propelled tyred roller shall be exclusively used. They shall make 3 to 5 passes, subject to approval of the Engineer.

### 5.13.3 Completion

When the surface dressing has been completed, all surplus material shall be swept away by mechanical brooms.

The rates shall be checked every day for each layer of binder and chippings in cross section as well as in longitudinal direction. Nowhere the departure from the required rate shall exceed 10%.

## Article 5.14 - Bituminous Concrete Base Course and Wearing Course

### 5.14.1 Mix Design

The Contractor shall carry out trial mixes to determine the job mix formulae (gradation of aggregates, precise proportions of bitumen and aggregates) at least 30 days before production of bituminous mixes are started and as soon as possible after commencement of aggregate production.

The study shall permit to check that, in spite of the normal fluctuations of a welladjusted plant, the performances of the materials satisfy the requirement of these Technical Specifications.

The Contractor shall submit for the approval of the Engineer full details of his proposed aggregates grading and bitumen content together with details of the mix design and results of test carried out at ranges of bitumen contents from below the proposed bituminous content to above. Specimens at each bitumen content shall be made in quadruplicate.

The approved laboratory design mix shall be confirmed by full-scale plant trials using the full range of bitumen contents. The approved plant trial mix shall be termed the Job Standard Mix.

### 5.14.2 Mix Requirements

The Job Standard Mix shall be determined by the Contractor in conformity with the following requirements.

		Base Course	Wearing Course
Bitumen Content	(%)	4.3 – 5.0	5.7 – 6.2
Marshall Stability	(kN)	Min. 8.0	Min. 9.0
Flow	(mm)	1 - 4	1 - 4
Air Voids	(%)	3 – 8	3.5 – 4.5
Voids in Mineral Aggregate	(%)	14 - 18	16 - 20
Voids filled with Bitumen	(%)	67 – 77	75 - 82

The gradation and quality of aggregates and filler shall satisfy the requirements defined in Articles 2.14 and 2.15.

### 5.14.3 Working Mix

The Contractor shall maintain the composition of the working mix within the following tolerances from the Job Standard Mix.

- (1) Bitumen: 5% (five per cent) of the specified weight of bitumen
- (2) Filler: 1.5% (one and a half per cent) by weight of total mix
- (3) Aggregate retained on 5.00 mm B. S. Sieve: 7% by weight of total mix

- (4) Aggregate passing 5.00 mm B. S. Sieve but retained on 75 micron B.S. Sieve: 5% by weight of total mix.

The bituminous concrete shall be checked every day, 2 bitumen extractions shall be carried out. For Marshall test, at least 6 samples shall be taken as specified in Part III of T.S.

The Contractor shall not be allowed to modify the setting of the asphalt plant after production is started without informing the Engineer.

#### **5.14.4 Asphalt Plant**

The nominal capacity of the asphalt plant shall be at least 60 T/H when moisture content of aggregates is equal to 3%.

There shall always be sufficiently large stockpiles of all required sizes of aggregates to prevent delays because of low quantities.

The asphalt batch plant or continuous asphalt plant shall be submitted to the Engineer for approval: the storage tank shall be of sufficient capacity to keep the plant supplied with due allowance for delays in delivery; the bins for storage of aggregates shall be such that contamination is prevented; the plant shall be equipped with gauges, thermometers, mechanical, electrical, luminous, resonant devices and systems, timers in order to adjust, measure and control with a precision compatible with the Job Standard Mix approved by the Engineer.

The plant shall be operated under skilled supervision and maintained in a satisfactory working condition.

The Contractor shall keep accurate records of proportions and temperature of material incorporated, plant operation performed, tests performed, at all times.

The new "TSM" type or equivalent asphalt plant shall comply with special requirements as specified in "Complements Pour Utilisation Des T.S.E." Direction Des Routes Et De La Circulation Routiere - Ministere Des Transports - Paris/Novembre 81 - No. D 8122.

#### **5.14.5 Control of Mixing and Asphalt Plant**

The temperature of the binder at the time of mixing shall be in the range of 145 C to 155 C. The temperature of the bitumen shall never exceed 170 C.

The temperature of heated bitumen shall be kept within a range of 10 C around the required temperature for mixing.

The mixing time shall not be less than that recommended by the plant manufacturer, or such longer time as may be required to ensure adequate coating of aggregate and uniform distribution of the bitumen through the mix as directed by the Engineer. The plant shall not be operated at a higher speed than the manufacturer's rated capacity. The plant shall be such that the mineral filler shall be kept dry and be separately stored and weighed. It shall be possible to introduce the filler separately into the mixer if required by the Engineer. All aggregates on leaving the drier shall have a moisture content of less than 1 % by the mass.

The frequency for checking the precision of the components of the asphalt plant for delivery of materials (adjustable gates, gradation control unit, metering pump, scales etc...) shall be as specified in the following table which applies to traditional asphalt plant.

#### **5.14.6 Transport**

The mixed materials shall be transported from the asphalt plant to the site of the work in trucks having clean, tight, smooth bodies, which shall be treated to prevent adhesion of the mixture. Soapy water or lubricating oil but not in excess may be used for coating the bodies but gasoline, kerosene or other solvent shall not be used for this purpose.

The bodies of the trucks shall be covered and insulated to maintain the heat loss within the requirements.

#### **5.14.7 Laying**

The bituminous concrete shall not be laid when the base is wet, when there are pools and during rainfall. The surface shall be kept thoroughly clean, free from dust and foreign matter, using mechanical broom or blown off by compressed air. The bituminous concrete binder course as well as the wearing course shall be placed in one layer, except where reshaping work is provided. The temperature of the mix at delivery of the plant shall be approximately 140 C.

The bituminous concrete shall be spread and tamped by a self-propelled paver operated by a fully- trained and experienced man. The paver shall be capable of laying to a width of 4 meters.

The screed unit shall be adjusted before laying is started in order to produce a compacted layer with the required thickness as shown on the Drawings or as directed by the Engineer. During laying the screed unit shall be blocked; in other words adjustment of the thickness during laying using the so-called floating action of the screed unit shall not be authorised.

The mixed material shall be supplied continuously to the machine and laid as soon as possible after delivery.

The speed of paver shall be adjusted to that of the asphalt plant and hauling capacities so that the paving operation is maintained as continuously as possible during the work. The temperatures of mixes measured in the receiving hopper of the asphalt paver shall not be lower than 130 C.

Mixes which have a lower temperature shall be discarded.

Transverse joints in the wearing course shall be offset at least 500 mm from those in the base course. Longitudinal joints shall be offset at least 150 mm. At transverse joints between existing compacted asphalt and newly laid asphalt, the edge of the existing asphalt along the joint shall be neatly cut away in straight lines over a sufficient width to ensure that the full specified thickness of new asphalt is placed. The exposed edge in the existing work shall, if directed, be painted with hot bitumen or emulsion immediately in advance of placing the new work.

When the asphalt layers are laid in half widths, the longitudinal joints between them shall, if directed, be treated similarly to the transverse joints.

Cold joints shall be neatly cut away in straight lines except that they have been compacted to the required rate by means of a special equipment (lateral wheel). They shall be painted with hot bitumen or emulsion. The Contractor shall organise his work so that there are no exposed longitudinal joints left at the end of any day's work.

Before opening to traffic, new layer shall be linked up with the existing one by means of a chamfered edge with a slope not exceeding 8%. Before carrying on the layer this chamfered edge shall be cut away.

### **5.14.8 Compaction**

The attention of the Contractor is drawn to Article 5.7. The roller operators shall be fully-trained and experienced men. An indicative composition of compaction equipment is:

- A heavy self-propelled tyred roller (> 3T/Wheel)
- A smooth wheeled (vibrating) roller (10T)

Rollers shall not stand on newly laid materials while there is a risk that the material will be deformed thereby. When the bituminous concrete is spread in areas that are inaccessible to the rollers, compaction shall be obtained by hot hand compactors.

During initial breakdown rolling and finish rolling, no vibratory compaction shall be resorted to. The exact pattern of rolling shall be established after trial compaction as approved by the Engineer. 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. The rollers shall not be permitted to stand on pavement freshly rolled. Necessary precautions shall be taken to prevent dropping of oil, grease, petrol or other foreign matter on the pavement either when the rollers are operating or standing.

The wheels of roller shall be kept moist to prevent the mix from adhering to them. But in no case shall fuel/lubricating oil nor excessive water poured on the wheels. Rolling shall commence longitudinally from edges and proceed towards the centre, except that on super elevated and unidirectional cambered portions, where it shall progress from the lower to upper edge parallel to the centre line of the pavement. The roller shall proceed on the fresh material with rear or fixed wheel leading so as to minimise the pushing of the mix and each pass of the roller shall overlap the proceeding by one half of the width of the rear wheel.

The layers shall be compacted while the mixed materials temperature is within 115 C to 130 C.

### **5.14.9 Control of Compaction**

The density of the material of each layer shall be in conformity with the following requirements:

-The density shall be more than 97% of the density determined by the Marshall test, and more than 100% of the LCPC density.

-Densities measured by "Troxler" type apparatus shall be gauged with densities measured on drilled core-samples. If for two consecutive working days, more than 10% (ten per cent) of the measurements do not comply with these requirements, the work shall be stopped in order to examine and improve the methods and equipment used and if necessary substitute any defective equipment.

-Deflection measurements shall be carried out and requirements of Article 5.8.2 apply for bituminous concrete courses.

#### **5.14.10 Tolerances**

When measured with a 3 metres straight edge, deflection shall not be greater than 0.8 cm for bituminous base course and 0.5 cm for wearing course.

The thickness for each layer shall be controlled on the samples taken for control of compaction. The tolerances shall be within the range -10%, +20% of the thickness defined on the Drawings or as directed by the Engineer.

If for two consecutive working days, more than 10% (ten per cent) of the measurements do not comply with these requirements, the work shall be stopped in order to examine and improve the methods and equipment used and if necessary substitutes any defective equipment.

In any case for each working day, the average of all results shall be at least equal to the required thickness.

### **Article 5.15 - Asphalt thickness**

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The Contractor shall obtain confirmation and approval from the Project Manager of the type of material to be used and the thickness to be provided on each road, and the terminal points, before any material is laid.

### **Article 5.16 - Trial Area**

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The Contractor shall arrange for a trial area of bituminous concrete to be laid in an area to the required thickness using the plant and methods to be used for the permanent surfacing to the full width normally produced by the plant and not less than 50 metres long. Samples shall be taken and tested in accordance with the relevant clauses of Section 1 from a representative part of the road base, base course, and surfacing where directed by the Project Manager. In case the trial lay fails to meet the design standards, the mix and/or workmanship shall be adjusted and new trial lays repeated until a satisfactory and Specification complying layer is achieved, all to the expense of the Contractor. At the risk of the Contractor the trial area may be laid as part of the permanent work. In that case any layer proved by tests to be defective shall be removed by the Contractor at his own cost. The Contractor shall allow for the cost of complying with the above in his tender.



## **Article 5.17 - Joints**

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Transverse joints in the wearing course shall be offset at least 1 m from those in the base course. Longitudinal joints shall be offset at least 150 mm. At transverse joints between existing compacted surfacing and newly laid surfacing the edge of the existing surfacing along the joint shall be neatly cut away in straight lines over a sufficient width to ensure that the full specified thickness of new surfacing is placed. The exposed edge in the existing work shall if directed, be painted with hot bitumen immediately in advance of placing the new work. Where the bituminous layers are laid in half widths, the longitudinal joints between them shall, if directed, be treated similarly to the transverse joints.

## **Article 5.18 - Weather Limitations**

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Bituminous pavement materials shall not be mixed when the moisture content of the aggregate is such as to interfere with the uniformity of the mixing temperature or with continuous plant operations. It shall not be laid when the underlying layer is damp or dusty.

## **Article 5.19 - Defects**

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Any defects in the bituminous work, caused by faulty workmanship or materials shall be corrected and made good at the Contractor's own expense. Care shall be taken when starting and stopping the paver to prevent the formation of humps and depressions. Any material that becomes mixed with foreign bodies, or is in any way defective, shall be removed and replaced with fresh material and compacted as specified.

For wearing course where the surface levels of the newly laid bituminous concrete fall outside the tolerances specified, the entire thickness of the wearing course shall be considered defective and shall be trimmed off and removed and fresh layer relaid in accordance with the Specification, all at the Contractor's own costs. Skin patching of an area that has been rolled will not be permitted.

## **Article 5.20 - Crack Sealing**

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The prime shall consist of an “inverted emulsion” prime manufactured from a base bitumen of 80/100-penetration grade. An MSP/1 prime or equivalent shall be used.

### **5.20.1 Emulsion for cold applied sealant**

The emulsion for the crack treatment shall consist of an Anionic Stable Grade Emulsion or Cationic Spray Grade Emulsion. When blended on site, “Revertex” or other rubber latex emulsion shall be added to the bitumen emulsion to give 8% net rubber on net bitumen content. If a proprietary brand blend is used, the constituents shall conform to the manufacturer’s specification.

### **5.20.2 Blowing out cracks**

The Contractor must provide a mobile compressor capable of discharging 3m<sup>3</sup>/min compressed air at 750 kPa pressure. The compressed air shall be free of deleterious matter that may adversely affect the bond between the sealant and the cracks. The compressor shall be free of oil and diesel leaks. A lance shall be used to direct the force of the air into the cracks and must be manoeuvrable enough to follow the path of the

crack accurately. If hot air is specified, the compressed air must be heated by a hot air lance capable of achieving a temperature of 300°C in the combustion chamber.

### **5.20.3 Prime injectors**

A special prime injector for injecting prime into open cracks using compressed air propulsion shall be manufactured. Essentially the equipment shall consist of a blowpipe with nozzle to direct the jet of compressed air into the cracks, a venturi or similar device shall be fitted to the blow pipe for sucking in prime from the storage vessel. A suitable throttling valve shall be fitted on the prime supply line to adjust the prime flow, i.e. to adjust the compressed air to prime ratio. The blow pipe shall be of approximately 20mm diameter steel tubing, threaded at the open end so that suitable bitumen spray nozzles can be fitted. The other end shall have a suitable coupling to connect to the compressor, complete with a shut-off valve to isolate the injector from the compressed air source.

The injectors, blowpipes, storage vessel interconnecting piping, etc., shall all be capable of safely withstanding the pressure generated by the compressors. Design sketches of the equipment shall be submitted to the Project Manager for approval.

### **5.20.4 Sealant**

The sealant shall be applied through an applicator manufactured specifically for this purpose. Essentially the equipment for the hot sealant shall consist of a mobile vessel capable of heating the sealant to the required application temperature by indirect heat, controlled by a thermostat to prevent overheating. A calibrated thermometer shall be fitted in an accessible position to accurately measure the sealant temperature in the tank. Special pumps, which can deliver the sealant to the crack in a controlled fashion, shall be used.

Proprietary brand seals shall be applied as specified by the suppliers.

## **Article 5.21 – Cold Milling of Bituminous Pavement**

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### **5.21.1 Controlled Milling Machine**

The milling machine shall be self-propelled, capable of milling the pavement to a specified depth and smoothness to control the paving slope during its operation. The machine shall have the ability to remove the millings and cuttings from the pavement and load them into the trucks. On the other hand, the machine shall reduce the risk of dust pollution and not cause any damage to the pavement structure that is not being removed.

### **5.21.2 Cleaning Equipment**

As part of the milling works, provision should be made for cleaning equipment that is suitable for the removal and cleaning of loose material from the pavement structure.

### **5.21.3 Straightedge**

The straightedge shall be of aluminium or of any light metal type with blades of box or girder box cross section with flat bottom reinforced to insure rigidity and accuracy; it shall have handles to facilitate movement on the pavement.

#### **5.21.4 Finished surface**

The finished surface at the juncture with other pavements shall coincide with the finished surfaces of the abutting pavements,

The finished surface shall not deviate from the testing edge of a straightedge more than 6 mm in the traverse and longitudinal direction

Skin patching for correcting low areas will not be permitted. Sufficient amount of material will be required to be removed to allow for a minimum of 25 mm of asphalt concrete to be placed.

#### **5.21.5 Cores**

Cores shall be taken as instructed by the Engineer.

#### **5.21.6 Carting Away of the milling material**

The materials removed shall be placed in an approved disposal area and stockpiled in such a manner to prevent segregation or contamination to the Environment.

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### **Article 5.22 - Grassing, Top soiling and Landscaping**

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5.22.1 After completion of bituminous surfacing, the verges, central median and the slopes of cuttings and embankments shall be planted with indigenous grass suitable for this particular use.

The Contractor shall plant springs of grass at approximately 20 cm centres.

Topsoil shall be obtained from material resulting from site clearance or from spoil tips or from natural ground in close proximity to the works. It shall be lightly compacted.

Planting shall preferably be carried out at the beginning of a rainy season, but where this is not possible; the grass shall be kept watered. Grassing and landscaping shall be paid under the corresponding Items of Bill No.3

5.22.2 Landscaping shall be made by means of loose boulders, decorative bushes and trees, as directed by the Engineer.

The bushes and trees shall be supplied and planted by specialists sub-contractors.

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### **Article 5.23 – Concrete Surfaces of footpaths and sidewalks**

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#### **5.23.1 Strength**

Footpaths shall be of concrete having minimum strength of 25 Mpa, minimum 265 kg cement content, a maximum 0.55 water: cement ratio, 60mm  $\pm$  20 mm initial slump, normal setting plasticizing admixture to a final 110 mm  $\pm$  20 mm slump, 20 mm aggregate. The amount of colour pigments added to a concrete mixture shall not be more than 7 % of the mass of the concrete but 5 % may be needed. The amount required depends on the type of pigment and colour desired. To maintain uniform colour, proportioning of all materials must be carefully controlled by mass.

To prevent streaking, the dry cement and colour pigment must be thoroughly blended before they are added to the mix. Mixing shall be longer than normal to ensure uniformity. Use of admixtures may be required for dispersal of pigment. All admixtures shall be normal setting and non-retarding.

### **5.23.2 Trial mixes**

Trial mixes shall be assessed and refined until the concrete satisfies the requirements for strength, durability, colour and finish ability. These are required to establish the mix proportions for a concrete to satisfy:

- Strength class,
- Maximum water: cement ratio,
- Nominal aggregate size,
- Chloride content class,
- Consistence class,
- Cement type (Ordinary Portland Cement), - Colouring agent to be used (red oxide).

The sources of the constituent materials shall not be changed without further trial mixes and prior to approval of Engineer. All equipment for the manufacture, transport, compaction and finishing shall be cleaned immediately prior to the production of the coloured concrete. The mixing process shall be sufficient to ensure effective dispersal of the pigment.

### **5.23.3 Contraction Joints**

Contraction joints at a spacing to produce approximately square sections shall be provided.

### **5.23.4 Curing**

Curing shall commence as soon as possible. Apply one coat of curing compound evenly across the entire surface at the manufacturer's recommended coverage rate. Curing compound shall be clear, non-yellowing, acrylic sealer with a minimum solids content of 20%. Curing compound shall be submitted for approval of Engineer. Concrete surface finish shall be brush finish to  $\pm 5$  mm tolerances.

## **SECTION 6 - DRAINAGE**

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- 6.1 GENERAL
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- 6.6 LINED TRAPEZOIDAL DITCH
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- 6.11 MASONRY WORKS
- 6.12 RIP RAP
- 6.13 RAINWATER DOWNSPOUTS
- 6.14 WATER PROOFING

## **Article 6.1 - General**

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The present section includes the construction of:

- Drains
- Pipe and box culverts including head works, wing walls and cover slabs
- Gullies and Manholes
- Retaining walls, paving slabs
- Masonry works (including retaining walls, stone facing, rainwater downspout etc)
- Riprap

## **Article 6.2 - Drainage programme**

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The Contractor shall submit to the Engineer for his approval immediately after the signature of the Contract, a carefully prepared programme for the drainage works which shall allow for completion of all drainage systems necessary for drainage during construction, before works are started.

## **Article 6.3 - Drainage Excavation**

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The Contractor shall excavate all drainage systems to the lines, levels, gradients and dimensions shown on the drawings or as directed by the Engineer.

Excavation for drainage systems shall be carried out in accordance with the requirements of the section <earthworks> of these technical specifications.

Should excavations be executed to greater depth or dimensions than necessary through the incidence of boulders or through other causes, the Contractor shall backfill and make good, with approved materials thoroughly compacted, to the correct level and dimensions and to the approval of the Engineer.

The material excavated for drainage systems shall be, if suitable, set aside for use as backfill and if unsuitable or in excess, run to spoil tips.

## **Article 6.4 - Timbering and Shoring of Excavations**

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The sides of excavations such as trenches, holes shall, where required, be timbered and shored to the satisfaction of the Engineer. The Contractor shall remain liable for any damage or injury consequent upon removal of timbering or shoring.

Where directed by the Engineer the timbering and shoring shall be left in excavations and measured and paid for except if, in the Engineer's opinion, the necessity for leaving the timber in has arisen from carelessness or neglect on the part of the Contractor.

## **Article 6.5 - Trenches and Holes Excavation and Backfilling**

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- 6.5.1 The trenches and holes excavations shall be of sizes sufficient to enable the bottom to be compacted as required, the bed to be laid, the pipes and concrete to be placed accurately and proper backfilling and ramming to be carried out.
- 6.5.2 Where required the bottom of such excavations shall be compacted to 95% B.S H.M.D.D.
- 6.5.3 Where rock is met at level of the intended bottom of the trench or hole, it shall be cut to a depth of 20 cm below this level and replaced with sand, granular material or other material to the approval of the Engineer.
- 6.5.4 Trenches and holes shall be kept free from water until any works such as concrete or joints therein are sufficiently set; the Contractor shall construct any temporary drains that the Engineer may deem necessary.
- 6.5.5 Where seepage of water occurs in trenches or holes, bedding and backfilling shall be carried out using sand, granular material or crushed stones or other material as directed by the Engineer.
- 6.5.6 Material for backfilling shall be to the approval of the Engineer and shall be deposited in layers not exceeding 15 cm of loose material, compacted with power rammers, the moisture content of the material being adjusted to facilitate thorough compaction. The density of each compacted layer shall not be less than 95% of B.S H.M.D.D.

## **Article 6.6 - Lined trapezoidal ditch**

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Lined trapezoidal ditches shall be built in masonry to the cross-section as shown in the drawing or as directed by the Engineer, and the invert level shall be finished to a steady longitudinal gradient not less than 0.5% and the fall shall be in all cases towards a culvert.

## **Article 6.7 - Unlined trapezoidal ditch**

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Unlined trapezoidal ditches shall be constructed to the cross section as shown on the drawing or as directed by the Engineer.

The invert level shall be finished to a steady longitudinal gradient of not less than 1% and the full shall be in all cases towards a culvert.

## **Article 6.8 - Pipe Culverts**

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Pipe culverts shall be placed after cleaning their inside. Any damaged pipe shall be rejected.

Pipes shall be embedded in class 15 concrete to the line and level as shown on the drawings or as directed by the Engineer.

The method, tools for placing the pipes, joints to be used shall be to the approval of the Engineer.

A properly fitted plug shall be well secured at the end of each pipe already laid and shall be removed only when the next pipe line is being laid or on completion of the pipe line or culvert.

Where required by the Engineer, bedding shall curve upward along the culvert to correct for expected settlement and to ensure tightness in the lower half of the joints.

The flow line of the pipes shall be within a range of 0.5 cm of the specified level shown on the drawings or as directed by the Engineer.

Backfilling shall be brought up evenly on both sides of the pipe. Special care shall be taken to compact thoroughly the material under the haunches of the pipe and to ensure that backfilling material is in intimate contact with the pipe.

Jointed pipes shall be tested as directed by the Engineer.

Masonry works shall comply with the requirements of Article 6.11 and the end of all pipes shall be neatly built into the walls and finished with cement mortar.

No separate payment shall be made for excavation of pipe culverts and the cost thereof shall be deemed to be included in the rate for provision and laying of the pipe.

### **Article 6.9 - Box Culverts**

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Box culverts shall be built to the lines, levels and dimensions shown on the drawings or as directed by the Engineer. The base shall rest on firm soil and if the nature of the soil encountered requires the foundation to be lowered, the extra depth excavated shall be filled up with class 15 concrete containing 25% of plums.

The bottom of the excavation shall be filled with class 15 blinding concrete.

The top of the base slab shall be finished smooth to a steady gradient and the fall shall be as directed by the Engineer. The base slab and the cut-off walls shall be executed in class 30 concrete.

The supporting walls and the wing walls shall be built with class 30 concrete. All exposed surfaces shall have a smooth off shutter finish and construction joints shall be rubbed down to a smooth finish. The supporting walls and the wing walls may be built in masonry at the option of the contractor.

The top of the supporting walls shall be finished smooth to a perfectly level surface (by a layer of concrete in the case of masonry walls) so that no rocking of the precast apron slabs occurs once the latter is fixed in position.

The apron slabs shall be cast to have a smooth off shutter finish to the dimensions and levels given in the drawings or as directed by the Engineer in class 30 concrete. These slabs may be cast in-situ or precast at the option of the contractor. If they are precast, they shall, in all respects, comply with the requirements for precast concrete given in Article 8.12.



## **Article 6.10 - Gullies and Manholes**

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Gullies and Manholes shall be built to the lines, levels, dimensions, and details given in the drawings or as directed by the Engineer. The bottom of the excavation shall be blinded with class 15 concrete. The base slab and the walls shall be built with class 30 concrete. The internal surfaces shall be of off-shutter finish with the construction joints rubbed down to make a uniform level surface. The top edge of the wall shall be carefully finished smooth and level so that no rocking of the precast cover slabs occurs.

## **Article 6.11 - Masonry Works**

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The stones for masonry works shall be in accordance with the requirements of Article 2.24.

The masonry shall be laid to line and in courses roughly levelled up. The bottom courses shall be composed of large selected stones to be approved by the Engineer and all courses shall be laid with bearing beds parallel to the natural beds of the material.

Each stone shall be cleaned and thoroughly saturated with water before being set and the bed which is to receive it shall be clean and well moistened. All stones shall be well bedded in freshly made mortar. The mortar joints shall be full and the stones carefully settled in place before the mortar has set.

Wherever possible, the face joints shall be properly pointed before the mortar becomes set. Joints which cannot be so pointed shall be prepared for pointing by racking them out to a depth of 5 cm before the mortar has set.

The face surfaces of stones shall not be smeared with the mortar forced of the joints or that used in pointing.

Vertical joints in each course shall break with those adjoining courses at least 15 cm. In no cases shall a vertical joint be so located as to occur directly above or below a header.

In case any stone is moved or the joint broken, the stone shall be taken up, the mortar thoroughly cleaned from bed and joints, and the stone reset in fresh mortar.

Joints not pointed at the time the stone is laid shall be thoroughly wet with clean water and filled with mortar. The mortar shall be well driven into the joints and finished with an approved pointing tool. The wall shall be kept wet while pointing is being done and in hot or dry weather the pointed masonry shall be protected from the sun and kept wet for a period of at least four days after completion. After the pointing is completed and the mortar has set, the wall shall be thoroughly cleaned and left in a neat condition.

## **Article 6.12 - Riprap**

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The stones for riprap shall be as specified in Article 2.24. They shall be laid with closed joints from the bottom of the slope of the embankment or existing ground, upward, the larger stones being laid at the bottom.

## **Article 6.13 - Rainwater Downspouts**

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The stones for rainwater downspouts shall be as specified in Article 2.24. They shall be laid and bedded in class 15 concrete to the lines, levels and dimensions given in drawings or as directed by the Engineer.

## **Article 6.14 Waterproofing**

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### **6.14.1 General**

Proprietary waterproofing systems incorporated in the Permanent Works shall have a current British Board of Agreement Roads and Bridge Certificate or equivalent approved certificate.

The system will be as per the advice of the manufacturer with regard to site conditions including climatic and environmental limitations together with compatibility of materials and details at the interface of the waterproofing system with the drainage outlets and bridge deck movement joints. No departure from the specified constituent materials and methods of installation as stated on the British Board of Agreement Roads and Bridges Certificate will be permitted.

Proprietary waterproofing systems shall be installed only by applicators approved by the manufacturers.

The formation of defects affecting the integrity of the membrane including pinholes (continuous or non-continuous), blowholes and blisters in the waterproofing shall:

- (i) Be made good by repair in accordance with the Waterproofing System Data Sheets and the manufacturer's installation procedure and to the satisfaction of the Engineer before any subsequent layers are applied; or
- (ii) Require the system to be replaced where directed by the Engineer.

For sheet membranes bonded with oxidized bitumen the heating and the temperature of the bitumen shall comply with the manufacturer's requirements within the limits stated in BS 8000. A means of checking the bitumen temperature shall be provided.

Sheet membranes shall wherever possible be laid in the direction that the additional protective layer or surfacing will be laid and compacted by roller.

Unless otherwise specified in the British Board of Agreement Roads and bridges Certificate, joints between sheets shall be lapped with end laps of at least 150mm and side laps of at least 100mm. The joints shall be arranged so that:

- (i) At no point are there more than 3 thicknesses of sheeting and, (ii)  
Water will drain away from the exposed edge.

Proprietary waterproofing systems shall be laid to follow the contours of the concrete surface. Laps, ridges and ripples in waterproofing sheeting, and peaks and steps at butt joint in waterproofing boards, shall not be greater than 10mm in height.

### 6.14.2 Additional Bituminous protection

All proprietary waterproofing systems shall be protected with a bituminous layer of sand asphalt complying with BS594: Part 1 recipe Type F wearing course mixture designation 0/3 thickness 25mm. An additional warning layer of red coloured slurry seal shall be applied to this bituminous protective layer. This slurry seal will comply with the following specification, aggregate shall be light colour.

Aggregate (Sieve)	Grading (% Passing)
6.3	100
5	90-100
2	60-87
1	40-67
424mm	22-38
300	18-30
150	10-20
75	5-15

5% of the total mix is to be unreactive red pigmat and regarded as part of the filler. Cement is to be included as a fluxing agent at minimum 0.75% of the total mix which is also to be regarded as part of the filler content.

The emulsion may be anionic A4 or cationic K3 (depending on reaction with filler) and at a rate of 15-25% of the total mix, additional water up to a maximum of 10% of the mix may be added. Rate of application will be of the order of 250 m<sup>2</sup>/m<sup>3</sup>. Mixing may be by concrete mixer and spreading by hand application using a spreader box, rolling may be required by pneumatic tyred roller after initial curing.

The additional protective layer or surfacing laid on the waterproofing system shall be firmly bonded to the system. Where a tack coat for the additional protective layer or surfacing is not provided as part of the waterproofing system a satisfactory bond to the membrane shall be obtained from:

- (i) A separate compatible tack coat; or
- (ii) The binder within the directly applied additional protective layer or surfacing. Where the tack coat is the type activated by the heat of the succeeding bituminous layer the rolling temperature of this layer shall be sufficient to ensure adhesion.

## **SECTION 7 - ROAD EQUIPMENT AND MISCELLANEOUS**

### **INDEX**

#### ARTICLE NO

- 7.1 ROAD MARKING PAINT
- 7.2 CATS' EYES
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- 7.4 THE MOUNTING AND POSITIONING OF TRAFFIC SIGNS
- 7.5 GUARD RAILS
- 7.6 PEDESTRIAN HAND RAILS
- 7.7 MILESTONES AND BOLLARDS
- 7.8 PRECAST KERBS, CHANNELS, EDGINGS AND QUADRANTS
- 7.9 IN SITU KERBS
- 7.10 REINFORCING GRIDS FOR ASPHALT
- 7.11 JOINT SEALANT

## **Article 7.1 - Road Marking Paint**

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The setting out of lines and symbols shall be made by the Contractor according to Typical Drawings. For junction and roundabout, the contractor shall submit to the agreement of Engineer working drawing at least fifteen days before starting works. The contractor shall also submit a layout of the existing road marking before any works being started and approved by the project manager.

Prior to application, the road surface shall be thoroughly cleaned of dust, dirt and all loose material. Painting on wet surface is forbidden.

The application of paint shall preferably be done by a purpose made machine, but the Engineer may approve brushing. All application shall be strictly adhered.

The spraying rate for cold paint will vary with the roughness of the surface, but shall be such to give continuous coverage. Immediately after application of the cold paint, ballotinis shall be spread on top.

The minimum dry film thickness and the rate of ballotinis shall be in accordance with the manufacturer's instructions. The guarantee period of products shall be at least twelve months.

Warning signs shall be erected when painting is in progress and traffic shall not be allowed to pass over wet paint. Any painting disfigured by traffic or any painting not to the satisfaction of the Engineer, shall be wiped out and repainted at the Contractor's expense.

### **7.1.1 Paint**

The paint to be used for road surface marking shall be specifically manufactured for such purposes. It shall be suitable for applying by brush, low pressure spraying equipment and high pressure spraying equipment to give a chemically stable film of uniform thickness.

It shall be stored and applied in accordance with the manufacturer's instructions. Paint shall be applied without the use of thinners or other additives.

### **Colour**

#### **1. White**

The colour of white markings shall when laid be approximately to BS colour No. 102 of BS 381 C.

The pigment used shall be titanium dioxide type A Anatase or type R (Rutile) complying with BS 239.

#### **2. Yellow**

The colour of yellow markings shall when laid be approximately to BS colour No. 355 of BS 381 C.

### 7.1.1.1 Chlorinated Rubber Paints

1. Maximum % by weight of chlorinated rubber - 20%
2. Maximum % by volume of pigment at 20 degree C - 50%
3. Minimum colouring (prime) pigment content % by weight paint 16 %, yellow paint 10 %
4. Surface drying time determined in accordance with BS 3900 part C2, less than 5 minutes
5. Hard drying time determined in accordance with BS 3900 Part C3, less than 15 minutes
6. Adhesion to concrete or bituminous surfacing must, in the opinion of the Engineer, be good.
7. Reflectorisation shall be surface reflectorisation.

Testing to determine drying times in accordance with BS 3900 parts C2 and C3 shall be carried out on test panels prepared in accordance with BS 3900 part A 3.

## Reflectorisation

### *Internal Reflectorisation*

Internally reflectorised paint shall be specifically manufactured for this purpose and shall contain ballotini to the general requirements of BS 3262 part I with a luminance factor of not less than 7%, skid resistance of not less than 45, and heat stability of not less than 65%. The ballotini shall meet the following grading requirements: -

<u>BS TEST SIEVE</u>	<u>% PASSING</u>
212 micron	100
150 micron	75 - 100
75 micron	0 - 25
65 micron	0 - 10

The quantity of ballotini beads shall be between 18 and 22% by weight of total mix or such other quantity as the Engineer shall direct.

### *Surface Reflectorisation*

Surface reflectorisation shall be by application of ballotini beads to the wet paint film. The ballotini shall comply with the general requirements of BS 3262 part I and shall comply with the following grading requirements:-

<u>BS TEST SIEVE</u>	<u>% PASSING</u>
0.850 mm	100
0.600 mm	80 - 100
0.300 mm	18 - 35
0.150 mm	0 - 10
0.075 mm	0 - 2

The ballotini shall be spread on the wet paint at between 0.7 and 0.9 kg/litre of paint or at such other rate, as the Engineer shall direct.

#### 7.1.1.2 Hot applied thermoplastic road marking materials

The material for hot applied thermoplastic road marking shall be in accordance with BS 3362, and suitable for spraying.

The material shall be of a type approved by the Engineer, and if not on the current approved list, samples and technical data shall be submitted to the Engineer at least four (4) months prior to the proposed use.

### **Colour**

#### 1. White

The colour of white markings shall when laid be approximately to BS colour No. 102 of BS 381 C.

The pigment used shall be titanium dioxide type A Anatase or type R (Rutile) complying with BS 239.

#### 2. Yellow

The colour of yellow markings shall when laid be approximately to BS colour No. 355 of BS 381 C.

### **Composition**

The thermoplastic material shall consist of light coloured aggregate, pigment and extender bound together with resin plasticised with oil as necessary, in approximately the following proportions:

Aggregate 40%, Ballotini 20%, Pigment 10%, Extender 10%, Binder 20%

Glass beads, less than 1.0 mm in diameter, dispersed in the mix (BS EN 1423: 1998, BS EN 1424: 1998)

Pigment used is Titanium Dioxide (Rutile)

Extender used is chalk or Lithopone

Binder softening point shall be 55°C

Reflectorisation shall be Internal Reflectorisation

### **7.1.2 Warranty for Road Marking**

All applications shall be subject to a warranty period as follows:

- (i) 2 years after application of thermoplastic.
- (ii) 1 year after application of chlorinated paint.

During the contract period, the guarantee shall be in the form of the Retention Money. The Retention Money will be substituted by a Bank Guarantee for an equivalent amount after release of the retention money and until the end of the Warranty Period.

Notwithstanding any provisions of the specification of the paints if during the Warranty Period it is found that the road marking have faded or cracked to the extent that in the

opinion of the Project Manager they no longer reasonably serve the purpose for which they were intended then the Guarantee shall be withheld until the contractor shall have at his own costs remedied such defects to the satisfaction of the Project Manager.

In case the Contractor fails to remedy the defects within such period as agreed with the Project Manager the guarantee will be forfeited. It is to be noted that forfeiture of Bank Guarantees will be taken into account in evaluation of future road marking works and may lead to disqualification of such bidders

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## **Article 7.2 - Cats' Eyes**

### **7.2.1 General**

The white lensed road-mounted reflectors used in the Works shall be those known as "Cats' eyes" of the pin-type such as Prismo II or similar, or an alternative complying with BS 873.

Mounting on these reflectors shall comply in all respects with the manufacturer's instructions for use, according to the paint centre line pattern and also with the British Department of the Environment Manual for Road systems.

The Contractor shall take delivery from the stores of LM or from any other place of omni-directional, bi or uni directional reflectors to be fixed on site as directed by the Project Manager.

Cat's eyes using the glued method of fixing will not be accepted.

*Note:*

Bi-directional studs should always be used on a line which separates opposing flows of traffic.

Unidirectional studs are more appropriate on edge lines.

\*The standard 18m spacing should be reduced to 9m on bends with a radius of curvature less than 450m, or on roads particularly prone to fog and mist or where there is a severe dazzle problem caused by glare from the headlamps of oncoming vehicles.

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## **Article 7.3 - Traffic Signs**

### **7.3.1 General**

The sign panels shall be manufactured either from:

- (a) 'steel sheets with zinc-aluminium coating (Galfan)' which is a flat carbon steel product coated on both sides with a zinc-aluminium alloy. Its composition is: 95% zinc and 5% aluminium. The coating is applied by means of a continuous hot dip galvanising process: or



(b) Glass Reinforced Polyester (GRP) sheets as per the following specifications.

### **High impact resistance**

The panel should pass the impact test specified under BS EN 12899-1 for road traffic signs.

### **Minimum surface preparation**

Panels shall only require wiping clean prior to the application of self-adhesive vinyl. The panels shall be grey colour to eliminate the need to surface paint the reverse face, which shall be UV protected.

### **Immune to corrosion**

Panels shall not rust or corrode from road salt or chemically aggressive conditions which otherwise would result in deterioration of the sign.

### **Compatible with industry standard reflective films and fixing systems**

GRP is compatible with 3M, Scotchlite and Nikkalite reflective films and riveting systems.

### **Compliant with regulatory standards**

GRP should comply with all the requirements of BS EN12899-1 following accelerated weathering tests. Regulatory and warning signs up to 2m<sup>2</sup> manufactured in accordance with NCI guidelines from one sheet of GRP are compliant. The signs shall have a minimum thickness of 3.4 mm +/-5% and are to be fixed on 60 mm diameter galvanised steel pipes or 75 x 75 mm galvanised steel tube sections with a minimum thickness of 2.5 mm as directed by the project manager.

### **Signs and Materials for Fixing**

The signs shall have a minimum thickness of 3.4 mm +/-5% and are to be fixed on 60mm diameter galvanized steel pipes and 75 x 75mm galvanized steel tube sections with a minimum thickness of 2.5mm.

The sign plates shall accommodate Aluminium rails (dimensions shall be as per the drawings; any acceptable minor deviations shall be to the Engineer's approval) at the rear side for fixing purposes. The fixing method shall be such that it shall be possible to adjust the direction of the traffic signs at any time on site without having to move the post in its concrete base.

Material for fixing, such as brackets, sockets, caps, clips, screws, bolts, nuts and washers shall be inox (stainless steel) or any steel alloy that does not corrode, rust or stain and to the Engineer's approval. The Anti-Rotational Clip (ARC) complete with bolt assembly shall be of AISI grade 304 stainless steel. Bolt heads shall be square shape and as per the drawings. Brass or copper will not be allowed for use in contact with Aluminium.

**Bidders may check details, materials and shape of the required clips, rails, bolts and nuts at the store of the TMRSU before bidding.**

To prevent peeling of the reflective sheeting a galvanised metal strip must be provided all along the edges of the sign plate

The letters "LM" of height 20 mm should be marked at the back of the signs.

### 7.3.2 Reflective sheeting on road signs (Engineer grade)

The reflective sheeting used on road signs shall consist of spherical lens elements embedded with a transparent plastic having a smooth, flat outer surface with a protected pre-coated adhesive which shall be pressure sensitive for manual application or tack free heat activated for mechanical vacuum-heat application.

The reflective sheeting shall be sufficiently flexible so as to permit application over and conformance to a moderate embossed surface. It shall show no damage when bent 90° over a 50 mm diameter mandrill.

The sheeting shall be solvent resistant so as to be capable of withstanding cleaning with petrol, diesel fuel, mineral spirits, turpentine and methanol.

The sheet shall show no cracking or reduction in reflection after being subjected to the dropping of a 25 mm diameter steel ball from a height of 2 meters onto its surface.

The adhesive shall permit the reflective sheeting to adhere securely within 48 hours after application at temperatures of up to 95° C.

The reflective material shall be weather resistant and, following cleaning, shall show no definite fading, darkening, cracking, blistering or peeling and not less than 75 of the specified wet or dry minimum brightness values when exposed either to an accelerated weathering period of 12 hours or a natural exposure period of 2 years, in accordance with an approved testing procedure.

The minimum reflective brightness values of the retro-reflective sheeting as compared to Magnesium Oxide (MgO) shall be:-

COLOUR	ANGLE OF INCIDENCE	ANGLE OF DIVERGENCE	REFLECTIVE VALUE COMPARED WITH MgO
Red	-4°	0.5°	15
	20°	0.5°	10
	50°	0.5°	3
White	-4°	0.5°	75
	20°	0.5°	70
	50°	0.5°	70
Yellow	-4°	0.5°	45

	20°	0.5°	35
	50°	0.5°	10
Blue	-4°	0.5°	6
	20°	0.5°	4.5
	50°	0.5°	0.5

The brightness of the reflective sheeting when totally wet by rain shall be not less than 90% of the values.

A warranty certificate for the reflective sheeting is to be obtained from the Local Supplier of the road signs and submitted to the Project Manager and should be at least for 5 years.

### 7.3.3 Reflective sheeting on road signs (Diamond grade)

The diamond grade reflective sheeting used on road signs shall consist of super-high efficiency, full cube retro reflective sheeting elements embedded with a transparent plastic having a smooth, flat outer surface with a protected pre-coated adhesive which shall be pressure sensitive for manual application or tack free heat activated for mechanical vacuum-heat application.

The reflective sheeting shall be sufficiently flexible so as to permit application over and conformance to a moderate embossed surface. It shall show no damage when bent 90° over a 50 mm diameter mandrill.

The sheeting shall be solvent resistant so as to be capable of withstanding cleaning with petrol, diesel fuel, mineral spirits, turpentine and methanol.

The sheet shall show no cracking or reduction in reflection after being subjected to the dropping of a 25 mm diameter steel ball from a height of 2 meters onto its surface.

The adhesive shall permit the reflective sheeting to adhere securely within 48 hours after application at temperatures of up to 95° C.

The reflective material shall be weather resistant and, following cleaning, shall show no definite fading, darkening, cracking, blistering or peeling and not less than 75 of the specified wet or dry minimum brightness values when exposed either to an accelerated weathering period of 12 hours or a natural exposure period of 7 years, in accordance with an approved testing procedure.

### Photometrics

The Photometrics of the Diamond Grade retro-reflective sheeting should be as follows.

Daytime Color (x, y, Y %)

The chromaticity coordinates and total luminance factor of the retroreflective sheeting conform to the table below.

### Color Test – Fluorescent Sheatings

Conformance to standard chromaticity (x,y) and luminance factor (Y%) requirements shall be determined by instrumental method in accordance with ASTM E 991 on sheeting applied to smooth aluminum test panels cut from Alloy 6061-T6 or 5052-H38. The values shall be determined on a HunterLab ColorFlex 45/0 spectrophotometer. Computations shall be done for CIE Illuminant D65 and the 2° standard observer.

### Color Test – Ordinary Colored Sheeting

Conformance to standard chromaticity (x,y) and luminance factor (Y%) requirements shall be determined by instrumental method in accordance with ASTM E 1164 on sheeting applied to smooth aluminum test panels cut from Alloy 6061-T6 or 5052-H38. The values shall be determined on a HunterLab ColorFlex 45/0 spectrophotometer. Computations shall be done for CIE Illuminant D65 and the 2° standard observer.

Daytime colour specification limits<sup>1</sup>

Color	x y		x y		x y		x y		Daytime Luminance Limit (Y%)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329	27	
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472	15	45
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346	2.5	15
Blue	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216	1	10
Green	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771	3	12
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390	1	9
FY	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442	40	
FYG	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540	60	
FO	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355	20	

<sup>1</sup> The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 Colorimetric System.

FY : Fluorescent Yellow.

FYG : Fluorescent Yellow Green.

FO : Fluorescent Orange.

The minimum reflective brightness values of the diamond grade retro-reflective sheeting.

- 4° Entrance Angle <sup>2</sup>			
			Observation Angle <sup>1</sup>
			0.2°
			0.5°
			1.0°

<sup>1</sup> Observation Angle - the angle between the illumination axis and the observation axis.

White	580	420	120
Yellow	435	315	90
Red	87	63	18
Green	58	42	12
Blue	26	19	5
Brown	17	13	4
Fluorescent Yellow	350	250	72
Fluorescent Yellow Green	460	340	96
Fluorescent Orange	175	125	36
<b>30° Entrance Angle<sup>2</sup></b>			
	<b>Observation Angle<sup>3</sup></b>		
	<b>0.2°</b>	<b>0.5°</b>	<b>1.0°</b>
White	220	150	45
Yellow	165	110	34
Red	33	23	7
Green	22	15	5
Blue	10	7	2
Brown	7	5	1
Fluorescent Yellow	130	90	27
Fluorescent Yellow Green	180	120	36
Fluorescent Orange	66	45	14

<sup>2</sup> Entrance Angle - the angle from the illumination axis to the retroreflector axis. The retroreflector axis is an axis perpendicular to the retroreflective surface.

The brightness of the reflective sheeting when totally wet by rain shall not be less than 90% of the values.

All diamond grade traffic signs should be provided with protective anti-graffiti sheeting.

A warranty certificate for the reflective sheeting is to be obtained from the Local Supplier of the road signs and submitted to the Project Manager and should be at least for 5 years.

### 7.3.4 Colours for road signs

Standard colours to be used for signs, posts and fittings shall be as described in the relevant BS as follows:-

Red  
Blue

BS 381C No. 537  
BS 4800 No. 0.013

Grey for post fittings and Back of signs	BS 2660 No. 9-101
Cream	BS 381 C No. 352
Black and White	BS 873 CB & 3C

Rust inhibitive paint shall comply with BS 2523: Lead Based Priming Paints.

### 7.3.5 Road Sign Posts and Bases

All posts shall receive on coast of rust protective primer before being erected and fixed in foundations.

When the sign has been assembled the complete sign, including the post, shall receive one coat of rust protective primer as specified followed by two coats of grey paint of an approved manufacture.

The foundation of posts shall be of Class 15 concrete. The volume of foundation shall be not less than 0.25 m<sup>3</sup>. The post shall be surrounded at sides and bottom by a minimum of 150 mm of concrete. The top of the foundation shall be set to the design level with a tolerance of 2 cm.

The dimensions of bases and posts will be:

Panel Area (m <sup>2</sup> )	Diameter of Post (mm)*	Dimensions of Concrete base **
< 0.5	75 (5mm thick)	0.55 x 0.55 x 0.70
0.5 - 1.0	100 (6mm thick)	0.60 x 0.60 x 0.85
1.0 - 2.0	150 (8mm thick)	0.80 x 0.80 x 0.95
> 2.0	2 No.150 (8mm thick)	Ditto -2 bases

\*(1) or near dimension.

\*\* (2) to add 5 cm depth for bituminous concrete on topping

□ For Advance Directional Signs (ADS), the back boarding of the panel shall be with aluminium material. The ADS shall be fixed on only 2 Nos. supports with aluminium I-Sections. Contractor shall design the I-Section, method of fixation and foundation.

### 7.3.6 Rust Inhibitive priming and finishing paint

All galvanised posts, to be painted with two coats of rust inhibitive priming paint one coat of undercoat and one coat of gloss paint as per clients colour. All welded joints to be treated with cold galvanised paint. Back of the traffic panels are to be grey in colour.

## Article 7.4 - The mounting and positioning of traffic signs

### 7.4.1 Introduction

The way signs are arranged and positioned is very important for their effectiveness. There are three things to consider:

- Its position in relation to the edge of the carriageway
- The height of the sign plate and its angle to the road

- Where it is to be sited in relation to the junction, hazard, etc., to which it refers

General advice on sign mounting and positioning is given below. The recommendations should be used as a guide, because the precise positioning can only be determined on site. There are often limitations on where signs can be placed, especially in urban areas.

Always check that:

- the signs are clearly visible from the appropriate distance
- there is no confusion about which road they refer to
- the signs do not obstruct the view of drivers
- the signs are not placed where they could be struck by vehicles

### 7.4.2 Mounting

*Mounting height* - Signs should normally be mounted so that the lower edge of the sign is 1.8 meters above the highest point of the carriageway - see Figure 1. Where the sign is mounted over or alongside a footway (or footpath) the lowest edge should be 2.1 meters above footway level. Signs should never be mounted less than 1 meter above carriageway level, as below this level they will get too dirty from rain splash and vehicle spray.

*Clearance from the edge of the carriageway* - Signs must be set back from the road to reduce the risk of them being hit by passing vehicles. See Figure 1. Avoid siting signs at places where vehicles park on the shoulder.

*Multiple signs* - Two signs can be mounted on the same sign pole. When two warning signs are mounted together the sign at the top should refer to the nearest of the two hazards. When two rectangular signs are being mounted on the same poles it looks neater if the two signs are made the same width.

### 7.4.3 Supplementary plates

*These plates are mounted beneath the primary sign to which they refer and there is normally a gap of 75mm between them.*

*Angle of the sign plate* - Sign plates are normally mounted so that they face the driver. The plate should be angled slightly away from the road to avoid mirror reflection when illuminated by vehicle headlights.

Table 1. Heights and Clearances

	Minimum (mm)	Desirable (mm)	Maximum (mm)
A	600	1000	2500
B	1000	1500	2500
C	300	600	
D	1000	1800	2500
E	2100	2100	2500

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G	750	
H		5000

---



Figure1. Heights and Clearance

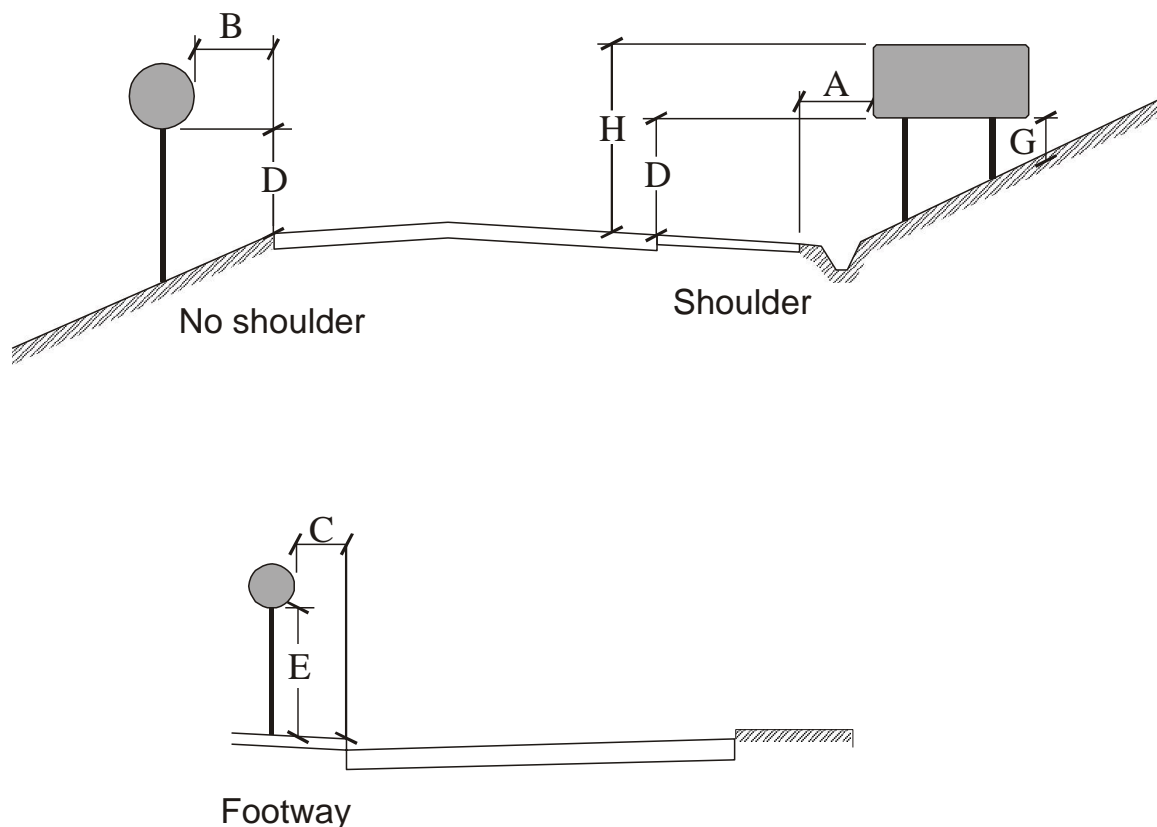


Table 2: Siting details for warning signs

## Article 7.5 – Guard Rails

Guard Rails supplied by the Contractor shall be accompanied by relevant documents including Performance criteria, impact resistance, installation and fixing methods etc; for the proposed guardrails and a Certificate from the manufacturer stating that the materials supplied conform to the following:-

- The steel posts shall conform to the requirements of AASHTO M183 and galvanising shall be in accordance with AASHTO M111. The guard rails shall be galvanised, corrugated sheet steel beams conforming to the requirements of AASHTO M180-78 Class A, with a base metal nominal thickness of 2.67 mm and Type 1, with zinc coated of 550 g/m<sup>2</sup> minimum-spot and of W-Beam shape. The guardrail must have been submitted to official crash test.
- The fittings i.e. bolt and nuts shall conform to or exceed requirement of ASTM A 307 and shall be hot dip zinc coated in accordance with the requirement of AASHTO M232M, Class C. The guardrails shall be supplied and delivered completed with bolted warning reflectors, steel, posts and metallic spacing device and bolts etc.
-

## Posts and Spacers

Structural steel used for these components conforms to ASTM A36 specification, quality S235J, according to EN 10027- 1 standard.

### Base Metal Specification to AASHTO M180-89

Properties	
Tensile strength, minimum	490 N/mm <sup>2</sup>
Yield stress, minimum	345 N/mm <sup>2</sup>
Elongation, % min	15%

### Mass for guardrails and Accessories

The mass per unit shall be 44 kg for guardrails.

Guard rail shall be erected at the location designated by the Project Manager. The Project Manager shall approve the depth and size of holes prior to the fixing of the posts. Posts shall be spaced as shown in the drawings and shall be set plumb and to the established lines and grades. End sections shall be anchored to the ground by means of RCC post as indicated in the Drawings or by the Project Manager. The guard rail as installed and finished shall not deviate in the horizontal direction and in levels from the specified lines and grades by more than 5 mm.

## Article 7.6 - Pedestrian Handrails

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Pedestrian handrails shall be provided as shown on Typical Drawing. Individual panels supplied shall take into account horizontal and vertical alignment of the ground where hand railing is to be located, and the change in direction of the hand railing at road junctions.

Support posts for the panels shall be fixed in the ground as shown on the Drawings. Hand parapets shall comply with BS 4360. Nuts and bolts not designated as high strength shall conform to the requirements of ASTM A307 and steel tubing shall conform to the requirements of ASTM A500, Grade B. Anchor bolts, nuts and all steel portions of railings and gratings shall be galvanised. Galvanising shall conform to the requirements of AASHTO M111 (ASTM A123) and galvanising of nuts and bolts shall conform to the requirements of AASHTO M232 (ASTM A153). Minor abrasions to galvanised surfaces shall be repaired with zinc rich paint.

All exposed welds shall be finished by grinding or filling to give a smooth surface. Metal railings shall be carefully adjusted prior to fixing in place to the approval of the Project Manager. After fixing of hand-rails or metal gratings, all sharp protrusions shall be removed and the railing or grating cleaned of discolouring foreign materials.

## Article 7.7- Bollards

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Bollards shall be precast with Class 25 concrete to the dimensions shown in the Drawings or as directed by the Engineer and shall in all respects comply with the requirements for precast concrete as per Article 8.12. They shall be bedded in Class 15 concrete.

Bollards shall be painted as directed by the Engineer.

## **Article 7.8 - Precast Concrete Kerbs, Channels, Edgings and Quadrants**

---

Precast concrete kerbs, edgings and quadrants shall comply with Article 2.32 of the Technical Specifications and shall be laid and bedded in a layer of mortar not less than 10 mm thick on a Class 15 concrete foundation. Kerbs shall be backed with Class 15 concrete.

All precast kerbs shall be butt jointed and all joints shall be mortared.

For radii of 12 m or less, kerbs of appropriate radius shall be used.

Any unit of kerb, channel edging and quadrant deviating more than 3 mm in 3 m from line and level shall be made good by lifting and relaying.

## **Article 7.9 - In situ kerbs**

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The kerbs shall be compacted with regular sides, edges, arises and chamfers finished to a surface free from blowholes and dragging and shall be impervious.

The surface regularity of the top of the kerbs shall comply with the tolerances for the wearing course as specified in this Specification. The horizontal alignment shall not deviate from that shown on the Drawings by more than 3 mm in 3 m.

The concrete shall comply with relevant clause of section 8 of this specification and shall be Class 30. The exposed surfaces of kerbs shall be cured by treating with an approved aluminised curing compound immediately after laying, unless other methods of curing are approved by the Engineer.

Kerbs shall remain firmly secure on the surface on which they are laid and shall be cast at least one week prior to the laying of the layer they are to contain. They shall be cut and moulded whilst green to form expansion and contraction joints. The joints shall then be filled.

## **Article 7.10 Reinforcing Grids for Asphalt**

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The reinforcing grids for asphalt layers shall have the following characteristics:

Product: Polymer based geogrid

Coating: Bitumen based

Weight of fabric: 250-400 g/m<sup>2</sup>

Mesh size: 20mm x 20mm - 40mm x 40mm

Tensile strength kN/m (length/width): 50-100/50-100 kN/m

Extension at nominal load in % (length/width): <5%

Heat resistance: Up to 200 °C

## Article 7.11 Joint Sealant

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### 7.11.1 Preparation

General: Comply with manufacturer's recommendations and with the following:

- A. Remove all foreign materials from joint substrates which could interfere with adhesion of joint sealer, including oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- B. Clean concrete, masonry, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, acid washing, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers.
- C. Remove laitance and form release agents from concrete prior to installation of sealants.
- D. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.
- E. Prime or seal joint surfaces where recommended by the sealant manufacturer. Confine primer/sealer to areas of sealant bond, do not allow spillage or migration onto adjoining surfaces.

### 7.11.2 Installation of joint sealers

- A. General: Comply with joint sealer manufacturer's printed installation instructions applicable to products and applications indicated, and with ASTM C1193 and ASTM C919.
- B. Backing: Provide backing material in the joint recess whenever necessary to control the depth of the sealant. One backer rod shall be a minimum of 33% oversized for closed cell and a minimum of 50% oversized for open cell backer rod.
- C. Set joint filler units at depth or position in joint as indicated to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.
- D. Install sealant backer rod for liquid-applied sealants, except where shown to be omitted by the sealant manufacturer for application indicated.
- E. Install bond breaker tape where indicated or where required by manufacturer's recommendations to ensure that liquid-applied sealants will perform as intended.
- F. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete 'wetting' of joint bond surfaces equally on opposite sides. Fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surfaces, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
- G. Install liquid-applied sealant to depths shown or, if not shown, as recommended by the sealant manufacturer but within the following general limitations, measured at center (thin) section of beads (not applicable to sealants in lapped joints):
  - 1 For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 % of joint width, but neither more than ½ inch (12.7 mm) deep nor less than ¼ inch (6.35 mm) deep.

2 For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in range of 75% to 125% of joint width.

- H. Spillage: Do not allow sealants to overflow from confines of joints, or to spill onto adjoining work. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- I. Do not overheat or reheat hot-applied sealants; discard and do not use this material.
- J. Recess exposed edges of gaskets and exposed joint fillers slightly behind adjoining surfaces except as otherwise shown or specified so that compressed units will not protrude from joints.

**7.11.3 Curing and protection** Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, interval cohesive strength and surface durability. Cure and protect sealants in a manner which will minimize increases in modulus of elasticity and other accelerated aging effects. Replace or restore sealants which are damaged or deteriorated during the construction period.

## **SECTION 8 – STRUCTURAL CONCRETE**

### **INDEX**

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- 8.2 MIXING OF CONCRETE
- 8.3 HANDLING AND PLACING OF CONCRETE
- 8.4 CONSTRUCTION JOINTS
- 8.5 CURING CONCRETE
- 8.6 TOLERANCES
- 8.7 LOADING CONCRETE STRUCTURES
- 8.8 FORMS, FALSEWORK OR CENTERING
- 8.9 CONCRETE SURFACE FINISH
- 8.10 STEEL REINFORCEMENT
- 8.11 MORTAR
- 8.12 PRECAST CONCRETE
- 8.13 MEASUREMENT AND PAYMENT FOR CONCRETE WORKS

## Article 8.1 - Structural Concrete

### 8.1.1 Material

Structural concrete shall consist of Portland cement, aggregate and water which shall conform to the requirements of Part 2 of these Technical Specifications.

### 8.1.2 Concrete Mix Design

At least 30 days before commencing any concrete construction, the Contractor shall carry out trial mixes to determine the grading of aggregates, the relative proportion of fine and coarse aggregates, water and cement in order to produce a concrete of satisfactory strength and workability in accordance with these Technical Specifications.

The trial mixes shall be mixed in an approved type of concrete mixer similar to that which the Contractor proposes to use on site.

For each class of concrete the Contractor shall prepare 2 sets of 18 cubes (for compressive strength) and 2 sets of 18 cylinders (for indirect tensile strength). One set shall be tested at 7 days and the other set at 28 days. The results of these tests, called "preliminary tests" shall comply with the requirements of Table 2 in article 8.1.3 hereafter.

Should one cube crushed at 7 days or at 28 days fall below the specified requirements, the Contractor shall carry out further trial mixes altering the mix design and/or the source of aggregate, gradation, preparations of aggregate, cement, water until a satisfactory standard of concrete for each grade is attained.

The results of the concrete mix design shall be submitted to the Engineer for his approval.

The cost of such trials and tests shall be deemed to be included in the tendered rates and prices.

### 8.1.3 Classes of Concrete

Various classes of concrete are provided for in these Technical Specifications. Each class of concrete shall be used in that part of the structure where called for in Table 1 hereafter, on the Drawings or as directed by the Engineer.

TABLE 1

CLASS	GRADATION OF AGGREGATE mm	PART OF THE WORKS
40	0 - 20	Slab deck of bridges, Parapets
35	0-20	Abutments,walls,footings and foundation of bridges
30	0 - 20	Wing walls of bridges, box culverts

25	0 - 20	Precast or in situ kerbs Precast or in situ channels Precast or in situ cover slabs Precast or in situ footpath slabs Drains
20	0 - 20	Mass concrete filling, Benching
15	0 - 40	Blinding Bedding Base for masonry wall



**TABLE 2**

	CLASS 40		CLASS 30		CLASS 25		CLASS 15	
	Preliminar Test	Work Test	Preliminary Test	Work Test	Preliminar Test	Work Test	Preliminar Test	Work Test
Minimum weight of cement per cubic metre of concrete - Kg	425	425	400	400	350	350	250	250
Minimum cube compressive strength at 28 days - N/mm <sup>2</sup>	50	40	40	30	30	25	17.8	15
Slump	←-----5cm-----→							

Max Free water cement ratio shall be 0.45 or as instructed by the Engineer.



## **Article 8.2 - Mixing of Concrete**

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### **8.2.1 General**

Concrete shall be mixed in an approved batch type machine at the Site. No hand mixing shall be allowed. Aggregates and water shall be cooled as necessary to produce concrete within the placing temperature limits stated hereinafter.

### **8.2.2 Mixing at Site**

Concrete shall be thoroughly mixed in a batch mixer of an approved size and type manufactured in accordance with B.S. 1305 and having a mixing performance within the limits specified therein and which will ensure a uniform distribution of the materials throughout the mass.

The mixer shall be equipped with adequate water storage and a device for accurately measuring and automatically controlling the amount of water used in each batch. Their accuracy shall be maintained within the tolerances described in B.S. 1305 and checked against accurate weights and volumes. Preferably, mechanical means shall be provided for recording the number of revolutions for each batch and automatically preventing the discharge of the mixer until the materials have been mixed in the specified minimum time.

The entire contents of the mixer shall be removed from the drum before materials for a succeeding batch are placed therein. No mixer having a rated capacity of less than a 1bag batch shall be used nor shall a mixer be charged in excess of its rated capacity.

All concrete shall be mixed for a period of not less than 1 1/2 minutes after all materials, including water, are in the mixer. During the period of mixing, the mixer shall operate at a speed for which it has been designed, but this speed shall be not less than 14 nor more than 20 revolutions per minute.

The first batch of concrete materials placed in the mixer shall contain a sufficient excess of cement, sand and water to coat the inside of the drum without reducing the required mortar content of the mix. Upon the cessation of mixing for a considerable period, the mixer shall be thoroughly cleaned before a fresh batch of concrete is made in it.

### **8.2.3 Ready-Mixed Concrete**

Ready-mixed concrete as defined in B.S. 1926, batched off the Site, may be used only with the agreement of the Engineer and shall comply with all requirements of the Contract. Mixing at a central plant shall conform to the requirements for mixing at the site. The organisation supplying concrete shall have sufficient plant capacity and transporting apparatus to ensure continuous delivery at the rate required.

The concrete shall be carried in purpose made agitators, operating continuously, or truck mixers. The concrete shall be compacted in its final position within 60 minutes of the introduction of cement to aggregates unless a longer time is agreed by the Engineer. The time of such introduction shall be recorded on the Delivery Note together with the weight of the constituents of each mix. When truck mixed concrete is used, water shall be added under supervision either at the site or at the central batching plant as agreed

by the Engineer but in no circumstances shall water be added in transit. Unless otherwise agreed by the Engineer, truck mixer units and their mixing and discharge performance shall comply with the requirements of BS 4251. Mixing shall continue for the number and rate of revolutions recommended in accordance with BS 4251.

Each mixer, agitator and truck shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of volume of the mixed concrete, and the speed of the rotation of mixing drum or blades.

### **8.2.4 Weather Precautions**

If the weather forecast normally available is neither sufficient nor frequent enough, the Contractor shall at his own expense arrange for special detailed forecasts from the nearest meteorological authorities.

## **Article 8.3 - Handling and Placing of Concrete**

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### **8.3.1 General**

In preparation for the placing of concrete all sawdust, chips and other construction debris and extraneous matter shall be removed from the interior of forms. Struts, stays and braces, serving temporarily to hold the placing of concrete at their locations, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. These temporary members shall be entirely removed from the forms and not buried in the concrete.

No concrete shall be placed until the Engineer's approval has been given.

The Contractor shall give at least 48 hours' notice to the Engineer of the times he proposes to concrete and the Engineer may order that no concreting shall take place until either he or his representative and laboratory staff are present.

Concrete shall be transported in water-tight containers in such a manner that will avoid the segregation of the constituent materials. The time elapsing between the initial mixing of the concrete and finally placing in the work shall not exceed 30 minutes. Concrete remaining unplaced at the end of this period shall not be placed in the work but shall be removed from the Site and disposed of at the Contractor's expense. The temperature of mixed concrete immediately before placing shall not be more than 32°C or not less than 5°C.

Concrete shall not be dropped through a height exceeding 1.2 metres.

For lowering concrete through heights in excess of 1.2 metres special methods shall be used, such as chutes, tremies, bottom dumping hoppers, or bagged placing and then only with the approval of the Engineer. All containers, troughs and chutes and apparatus through and in which the concrete is passed shall be kept clean and entirely free from hardened concrete or cement and free from contamination by extraneous material, and where there is an interruption of concreting exceeding 20 minutes, these shall be cleaned and bored down with water.

Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. Concrete shall be placed in horizontal layers not more than 20 cm thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding batch has taken initial set to prevent injury to the green concrete and avoid surfaces of separation between the batches. Each layer shall be compacted so as to avoid the formation of a construction joint with a preceding layer which has not taken initial set.

A competent steel fixer shall be in attendance the whole time concrete is being cast around reinforcement.

Immediately following the discontinuance of placing concrete, all accumulations of mortar splashed upon the reinforcement steel and the surfaces of forms shall be removed. Dried mortar chips and dust shall not be puddled into the unset concrete. If the accumulations are not removed prior to the concrete becoming set, care shall be exercised not to injure or break the concrete steel bond at and near the surface of the concrete, while cleaning the reinforcement steel.

#### **8.3.1.1 Pumping**

The placing of concrete by pumping will be permitted only if authorised by the Engineer. The Contractor shall submit fill design mix for the Engineer's approval. The equipment shall be so arranged that no vibration will occur that might damage freshly placed concrete.

Where concrete is conveyed and placed by mechanically applied pressure the equipment shall be suitable in kind and adequate in capacity for the Work. The operation of the pump shall be such that a continuous stream of concrete without air pockets is obtained. When pumping has been completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients. After this operation, the entire equipment shall be thoroughly cleaned. The placing of concrete by pumping method shall allow the Contractor no claim for extra cost in any way. This method shall be deemed to be included in the prices in the Bill of Quantities or elsewhere.

#### **8.3.2 Placing of Concrete in Foundations**

Before placing concrete in foundations the bottom shall be thoroughly rammed and cleaned up to a neat horizontal plane, or such profile as is shown on the Drawings or as directed by the Engineer. No steps on batters shall be permitted unless shown on the Drawings or approved by the Engineer.

Where shown on the Drawings or ordered by the Engineer that the sides of the concrete shall be cast against the existing ground without using shuttering, the faces of the earth shall be trimmed neat and true to line. Where such a hole is over-excavated due to the Contractor's method of working, the void shall be filled with concrete of the same class as specified for the foundation at the Contractor's expense.

### **8.3.3 Placing of Concrete in Culverts**

The base slab or footings of box culverts shall be placed and allowed to set before the remainder of the culvert is constructed.

Before concrete is placed in the sidewalls, the culvert footings shall be thoroughly cleaned of all shavings, sticks, sawdust, or other extraneous material and the surface carefully chipped and roughened in accordance with the method of bonding construction joints as specified in article 8.4.2 hereinafter.

The concrete in the walls shall be placed and allowed to set before the top slab is placed.

Each wing wall shall be constructed as a monolith. Construction joints, where unavoidable, shall be horizontal and so located that no joint will be visible in the exposed face of the wing wall above the ground line.

### **8.3.4 Placing of concrete in Bridge decks**

It shall be as per general requirements but it shall also include the following: The concrete shall be uniformly levelled and screeded to produce a plain surface. When the concrete has sufficiently hardened to prevent laitance being worked, it shall be floated to produce a uniform surface free from screed marks and exposed aggregate. Finally the surface shall be textured by brushing or otherwise to the waterproofing manufacturer's requirements as agreed by the Engineer. The accuracy of the finished surface shall be such that it does not deviate from the required profile by more than 10mm over a 3m gauge length or have any abrupt irregularities more than 3 mm.

### **8.3.5 Compaction of Concrete**

Concrete, during and immediately after depositing, shall be thoroughly compacted. The compaction shall be done by mechanical vibration subject to the following provisions:

- (a) The vibration shall be internal unless special authorisation of other methods is given by the Engineer.
- (b) Vibrators shall be of a type and design approved by the Engineer. They shall be capable of transmitting vibration to the concrete at frequencies within the range of 9000 to 20000 impulses per minute.
- (c) The intensity of vibration shall be such as to visibly affect a mass of concrete of 2.5 cm slump over a radius of at least 30 cm.
- (d) The Contractor shall provide a sufficient number of vibrators to properly compact each batch immediately after it is placed in the forms.
- (e) Vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcement and embedded fixtures, and into the corners and angles of the forms. Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrators shall be inserted and withdrawn out of the concrete slowly. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point to the extent that localised areas of grout are formed.

Application of vibrators shall be at points uniformly spaced and not further apart than twice the radius over which the vibration is visibly effective.

- (f) Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.
- (g) Vibration shall be supplemented by such spading as is necessary to ensure smooth surfaces and dense concrete along form surfaces and in corners and locations impossible to reach with the vibrators.
- (h) Sufficient numbers of vibrators in usable condition shall be on site so that in the event of breakdowns spare equipment is available.

### **8.3.6 Faulty Concrete work**

The Contractor shall on the order of the Engineer remove and reconstruct any such portion of the work which, in the opinion of the Engineer, is unsatisfactory as regards quality of concrete incorrect dimensions of the cast portion, badly placed or insufficient reinforcement, honey-combing or other such cause as shall render the construction not up to the standard required and which, in the opinion of the Engineer, may prejudicially affect the strength or durability of the construction.

## **Article 8.4 - Construction Joints**

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### **8.4.1 General**

Construction joints shall be made only where located on the plans, or shown in the pouring schedule, unless otherwise approved by the Engineer.

If not detailed on the plans, or in the case of emergency, construction joints shall be placed as directed by the Engineer. Shear keys or inclined reinforcement shall be used where necessary to transmit shear or to bond the two sections together.

### **8.4.2 Bonding**

Before depositing new concrete on or against concrete which has hardened, the forms shall be re-tightened. The surface of the hardened concrete shall be roughened as required by the Engineer, in a manner that shall not leave loosened particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned of foreign matter and laitance, and saturated with water.

The placing of concrete shall be carried continuously from joint to joint. The face edges of all joints which are exposed to view shall be carefully finished true to line and elevation.

When the placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete.

To avoid visible joints as far as possible upon exposed faces, the top surface of the concrete adjacent to the forms shall be smoothed with a trowel. Where a "feather edge" might be produced at a construction joint, an inset form shall be used to produce a blocked out portion in the preceding layer which shall produce an edge thickness of not less than 15 cm in the succeeding layer. Work shall not be discontinued within 45 cm of the top of any face.

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### **Article 8.5 - Curing Concrete**

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Concrete surfaces exposed to conditions causing premature drying shall be protected by covering as soon as possible with canvas, straw, burlap, sand or other satisfactory material and kept moist. Curing shall continue for a period of not less than seven days after placing the concrete. Details of the method to be used shall be subject to the approval of the Engineer. The formwork shall also be kept damp, and if struck earlier than seven days, shall be replaced for the remaining period with other approved damp material.

Concrete surfaces of structures which are to be buried in the ground shall be cured as specified above, but care shall be taken to avoid excessive water from curing running into the foundation of the footings.

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### **Article 8.6 - Tolerances**

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The concrete work shall be constructed as accurately as possible with the following tolerances:

- (a) In the cross-sectional dimensions not more than 3 mm
- (b) In dimensions, other than cross-sectional dimensions, not more than 6mm
- (c) In any surface, the irregularity shall not exceed 5 mm measured from a 3 metre long straight edge
- (d) No member shall be out of line by more than 5 mm
- (e) No wall shall be out of plumb by more than 5 mm or if battered, out of batter by more than 5 mm.

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### **Article 8.7 - Loading Concrete Structures**

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No concrete structure shall be loaded until the concrete is at least 28 days old and has achieved the specified cube strength and only then with the approval of the Engineer, and subject to such conditions as he may lay down.



## **Article 8.8 - Forms, Falsework or Centering**

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### **8.8.1 Forms**

All forms shall be built mortar tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incident to the construction operations. Forms shall be constructed and maintained so as to prevent warping and the opening of joints due to shrinkage of the lumber.

The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours. The design of the forms shall take into account the effect of vibration of concrete as it is placed. They shall be so constructed that they can be removed from the moulds before any concrete is deposited in them.

Form clamps, bolts and anchors shall be used to fasten forms. The use of wire ties to hold forms in position during placing of concrete shall not be permitted. Bolts and clamps shall be of such type that they can be entirely removed or cut back to a depth of at least 2 cm from the finished surface of the concrete without injury to the concrete. The cavities shall be filled with grout and the surface left sound, smooth, even and uniform in colour. All forms for the outside surfaces shall be constructed with stiff wailers at right angles to the studs and all form clamps shall extend through and fasten such wailers.

All forms shall be treated with approved mould or similar oil or be soaked with water immediately before placing concrete to prevent adherence of concrete. Any material, which will adhere to or discolour concrete, shall not be used.

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall remain in place for periods, which shall be as specified in Article 8.8.4 hereinafter. When forms appear to be unsatisfactory in any way, either before or during the placing of concrete, the Engineer shall order the work stopped until the defects have been corrected.

All formwork shall be approved by the Engineer before concrete is placed within it. The Contractor shall provide the Engineer with copies of his calculations of the strength and stability of the formwork or falsework, but notwithstanding the Engineer's approval of these calculations, nothing shall relieve the Contractor of his responsibility for the safety or adequacy of the formwork.

### **8.8.2 Falsework and Centering**

Detailed plans for falsework or centering shall be supplied by the Contractor for the Engineer's consent at least 45 working days in advance of the time the Contractor begins construction of the falsework.

All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads from the weight of green concrete and shuttering and incidental construction loads.

Notwithstanding the approval by the Engineer of any designs for falsework submitted by the Contractor, the Contractor shall be solely responsible for the strength, safety and adequacy of the falsework or centering.

Falsework or centering shall be founded upon a solid footing safe against undermining and protected from softening. The Engineer may require the Contractor to employ screw jacks, or hard wood wedges to take up any settlement in the formwork either before or during the placing of concrete.

Falsework shall be set to give the finished structure the required grade. The Contractor shall submit to the Engineer all camber details / calculations which are required for the construction of the post tensioned decks, parapets, etc...

The Contractor shall make available to the Engineer a copy of the latest edition of the following British standards within 4 weeks from the issue of the order to start the works:  
BS 5268: Structural use of timber, part 2: Code of practice for permissible stress, design, materials and workmanship

BS 5973: Code of practice for access and working scaffolds and special scaffold structures in steel.

BS 5974: Code of practice for temporarily installed suspended scaffolds and access equipment.

BS 5975: Code of practice for falsework.

### **8.8.3 Forms for construction joints**

Where permanent or temporary joints are to be made in horizontal or inclined members, stout stopping off boards shall be securely fixed across the mould to form a watertight joint. The form of the permanent construction joint shall be as shown on the Drawings. Temporary construction joints shall have blocks of timber at least 8 cm thick, slightly tapered to facilitate withdrawal and securely fixed to the face of these stopping off board. The areas of the key or keys so formed shall be at least 30% of the area of the member. The blocks shall be kept back at least 5 cm from the exposed face of the concrete.

Where reinforcement passes through the face of a construction joint the stopping off board shall be drilled so that the bars can pass through, or the board shall be made in sections with a half round indentation in the joint faces for each bar so that when placed the board is a neat and accurate fit and no ground leaks from the concrete through the bar holes or joints.

### **8.8.4 Removal of Forms and Falsework**

In the determination of the time for the removal of forms, falsework and housing, consideration shall be given to the location and character of the structure, the weather and other conditions influencing the setting of the concrete and the materials used in the mix.

Forms shall be removed in such a manner as will not injure the concrete and no formwork shall be removed before the concrete has sufficiently set and hardened.

The minimum periods which shall elapse between the placing and compacting of normal Portland cement concrete for the various parts of the structure are given in the following table, but compliance with these requirements shall not relieve the Contractor of obligation to delay the removal of the forms if the concrete has not set sufficiently hard:

PARTS OF WORK	DELAY
Sides of walls and footings	1 day
Soffits of beams and slabs (props left in)	7 days
Removal of props (beams and main slabs)	16 days

Concrete shall not be subject to disturbance / vibration between 4 hours and 36 hours after compaction except with the agreement of the Engineer.

### **8.8.5 Verifying of Reinforcement and Tendons concrete covers**

The Contractor shall provide an electromagnetic cover measuring devices to verify the depths of the reinforcement and Tendons after concreting and removing of forms. The Contractor shall carryout this work under the Engineer's supervision and shall produce and submit all necessary reports. BS 4408: Part 1 shall be consulted for this purpose.

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## **Article 8.9 - Concrete Surface Finish**

### **8.9.1 Unexposed Surface Finish**

Unexposed surface finish, unless otherwise specified, shall be considered as a final surface finish on the surfaces which are buried in the ground, or covered with embankment or surfaces which are to be enclosed. The removal of fins and form marks and the rubbing of mortared surfaces to a uniform colour will not be required for unexposed surface finish.

All formwork bolts or other devices shall be removed to a depth of 3 cm from the surface, and all holes, cavities and honey-combing in the surface shall be cleaned out and roughened to form a good key. These holes shall then be filled with cementitious (Non shrinkable) grout and approved by the Engineer

The irregularities in the finish shall be no greater than those obtained from the use of wrought thickness tongue and grooved boards arranged in uniform pattern.

### **8.9.2 Exposed Surface Finish**

Exposed surface finish shall be considered as final surface finish on all surfaces of the retaining walls.

The formwork shall be lined with a material approved by the Engineer to provide a smooth finish of uniform texture and appearance. This material shall leave no stain on the concrete and shall be so joined and fixed to its backing that it imparts no blemishes.

It shall be of the same type and obtained from one source as far as possible. The Contractor shall make good any imperfections in the resulting finish as required by the Engineer. Internal ties and embedded metal part will be allowed only with the Engineer's specific approval. The Contractor shall ensure that permanently exposed concrete surfaces are protected from rust marks, spillage and stains of all kinds.

## **Article 8.10 - Steel Reinforcement**

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### **8.10.1 Bar Bending Schedule**

Bar bending schedules are incorporated in the Drawings but the Contractor shall be responsible for their accuracy and shall satisfy himself as to errors or omissions and all other things regarding their suitability for the work. When new bar bending schedules are required or the existing ones required to be amended the Contractor shall prepare such lists and submit them to the Engineer for his approval.

### **8.10.2 Fabrication**

Bar reinforcement shall be bent to shapes shown on the Drawings and bending schedules. All bars shall be bent cold, unless otherwise permitted by the Engineer. All hooks, bends, etc., unless otherwise shown on the Drawings, shall be to BS EN ISO 3766:2003. Bar reinforcement shall be bundled and each bundle of steel shall be tagged with identifying tags, showing the size and mark of the bar.

### **8.10.3 Placing and Fastening**

The reinforcement shall be accurately placed and held in the positions as shown on Drawings and subject to the approval of the Engineer.

The minimum spacing centre to centre of parallel bars shall be 2 1/2 times the size of the bar, but in no case shall the clear distance between bars be less than 1 1/2 times the maximum size of coarse aggregate in the concrete.

Distances from the forms shall be maintained by means of blocks or plastic spacers or other approved supports. Blocks for holding reinforcement from contact with the forms shall be precast mortar blocks of approved shape and quality and dimensions or approved metal chairs.

Layers of bars shall be separated by metal chairs or stirrups or other approved supports.

### **8.10.4 Splicing and Lapping**

All reinforcement shall be provided in full lengths as indicated on the drawings and bending schedule. splicing of bars, except where shown on the Drawings, shall not be permitted without the written approval of the Engineer. Splices shall be staggered, as directed by the Engineer.

In lapped splices, the bars shall be placed in contact and wired together in such a manner as to maintain a clearance specified in the code of practice for reinforced concrete BS 8110.

Sheets of mesh or bar mat reinforcement shall overlap each other sufficiently to maintain a uniform strength and shall be securely fastened at ends and edges. The edge lap shall not be less than 40 diameters of the mesh reinforcement bar or two meshes in width whichever is the greater or as directed by the Engineer.

### **8.10.5 Approval before concreting**

The Contractor shall in all cases request the approval of the steel work by the Engineer in sufficient time to allow an inspection to be made and shall not commence concreting until such approval and his intention to commence concreting shall not be less than one clear normal working day and the Engineer may require a longer period if, in his opinion, the reinforcement is of such complexity as to require it.

Such approval shall not relieve the Contractor of his responsibilities under the contract.

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## **Article 8.11 - Mortar**

The mortar for jointing masonry works shall be a mix of

- 1,000 litres of sand passing the 5 mm B.S. Sieve - 450 kilograms of Portland Cement
- sufficient water to obtain a workable mix.

The mortar shall be mixed using concrete mixers. Hand mixing will not be allowed.

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## **Article 8.12 - Precast Concrete**

Precast concrete members, kerbs, channels, cover slabs, paving slabs, etc., shall generally comply with the requirements of British Standard Code of Practice BS 8110, except where varied by the requirements of this specification or the drawings.

The Contractor shall set up an adequate precasting yard undercover, capable of handling all the precast concrete works and shall provide a suitable qualified Engineer to supervise the working of the yard all to the satisfaction of the Engineer. The Contractor shall provide full details and drawings showing his proposals for the precasting yard and until approval is given in writing no work on erection of the yard or producing precast concrete shall commence.

### **8.12.1 Concrete Mixes**

Concrete mixes shall be as shown on the drawings and in accordance with the Specifications.

### **8.12.2 Formwork**

The precast units shall each be cast complete in one operation, on suitable and sufficient platforms and moulds, all to the satisfaction of the Engineer. Before casting is commenced the Contractor shall submit, for the approval of the Engineer fully detailed drawings showing the proposed layout of casting beds, together with the details of the method of assembling and dismantling of the moulds. In cases where the finished thickness of the concrete is small, and compaction by internal or surface

vibration will be difficult, the mould may be constructed so that external vibration of the shutter will satisfactorily compact the concrete, or vibrating tables may be used. The soffit shutter shall be adequately supported to prevent any settlement which might cause cracking of the concrete.

Provision shall be made to hold firmly and maintain in position all projecting reinforcement, bolts, screwed sockets, etc., so that they are correctly located in the completed unit or member concerned.

### **8.12.3 Weather Protection and Curing**

The precast units shall at all times be cast under suitable covering to provide complete protection from the sun, rain and drying winds. They shall remain under the cover for at least four days or until the units are strong enough to be lifted from the casting beds, whichever is the longer period. During this period, all exposed concrete shall be protected and cured as described in article 8.5. Thereafter, the units may be transferred to a storage area or be erected in their final position.

### **8.12.4 Surface finishes generally**

The methods used for compacting the concrete must be such that pinholes or airholes on the surface are avoided. Upon removal of the formwork, any units having a concrete face with rough, uneven, honeycombed or imperfect finish, or which shall be permanently discoloured, will be rejected at the Engineer's discretion. Where carrying out of remedial work is approved by the Engineer, irregularities shall be eliminated by grinding, or where an area shows air holes, these shall be filled and thoroughly rubbed over to leave the desired surface.

Unsightly encrustations and stains shall be removed from all exposed surfaces. Remedial work of all kinds must be carried out strictly in accordance with the Specification and any further instructions which may be given by the Engineer. Any units which are rejected shall be disposed of away from the Site at the Contractor's expense.

### **8.12.5 Lifting and Handling of Units**

No items may be lifted from the casting beds until they have gained sufficient strength to avoid damage through lifting, handling, erection or stacking. Notwithstanding any guidance given by the Engineer on the concrete strength necessary to prevent damage, the Contractor shall be entirely responsible and any items so damaged or cracked will be rejected by the Engineer. They may not be included in the works and must be disposed of, to the approval of the Engineer, at the Contractor's expense.

Before casting, the Contractor shall submit to the Engineer, for his approval, full details of the proposed method of hoisting precast units including the location of proposed lifting points. The Contractor shall be responsible for the design and provision of extra reinforcement that may be required to facilitate the handling of the precast units and his price for precast units should include for this.

The edges of precast units shall be protected by fenders of timber or other approved material during the lifting, handling and erection stages.

### **8.12.6 Stacking of precast units**

Where members are stored, they shall be firmly supported at such bearing positions that will ensure that the stresses induced in them are always less than the permissible design stresses.

Ample space is to be provided for the storage and stacking of the units. Units shall not be walked on or come into contact with the ground or with dirty or greasy hands or with ropes and cables. Nor shall wet slabs come into contact with dirty packs or pieces of timber which will discolour them.

The units shall be stacked in such a way that the faces are protected both from damage and from staining.

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## **Article 8.13 - Measurement and payment for concrete works**

### **8.13.1 In situ Concrete**

The unit of measurement for in-situ concrete shall be per cubic metre, measured in place in the work, as set forth in the Bill of Quantities, and shall distinguish between the various classes of concrete and position in the work.

The rate for in-situ concrete shall include for complying with the provisions of the Specification herein described. Reinforcement and shuttering will be paid for separately.

### **8.13.2 Precast Concrete Units**

Precast concrete units will be measured either by number, or in linear metre as indicated in the Bill of Quantities. The rate for precast concrete shall include for complying with the provisions of the specifications herein described and in addition any shuttering and reinforcement, unless specifically shown separately in the Bill of Quantities.

### **8.13.3 Measurement and Payment for Formwork**

Formwork shall be measured as the area of concrete actually in contact with the mould, except that in the case of small fillets and chambers of size 30mm x 30mm and less, the overall area of the concrete shall be taken as though the fillets and chambers had been omitted. Formwork for temporary construction joints will not be paid for and will be deemed to be included in the Contractor's rates for concreting.

The formwork for in-situ concrete will be paid for separately according to the type of finish and according to whether it is vertical, horizontal and/or inclined as set out in the Bill of Quantities.

Formwork will not be measured and paid for to blinding concrete.

### **8.13.4 Measurement and payment for Reinforcement**

Reinforcement shall be paid for the net calculated weight of reinforcement shown on the Drawings or ordered by the Engineer, and no allowance will be made for waste, rolling margins, binder wire, or spacer bars.

When laps are made for splices for the convenience of the Contractor other than those shown on the Drawings, the extra steel shall not be measured.

### **8.13.5 Joints**

Items for joint surfaces are measured where joints are expressly itemised in the Bill of Quantities, with or without formwork and with or without filler material.

The unit of measurement shall be per linear metre or per square metre as set forth in the Bill of Quantities.

### **8.13.6 Waterproofing/Impregnation**

The unit of measurement for waterproofing/impregnation shall be per square metre, measured in place in the work, as set forth in the Bill of Quantities.

The measured area shall be that of the covered surface, without deduction for holes and openings each less than 0.5 m<sup>2</sup>.



## **SECTION 9 - ROAD LIGHTING**

### **INDEX ARTICLE**

NO.

9.1	ROAD LIGHTING COLUMNS
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9.3	LAMPS AND CONTROL GEAR
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9.8	CABLES AND WIRES
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9.14	LED SOLAR STREET LIGHTING

## Article 9.1 - Road Lighting Columns

---

The road lighting columns shall be of the octagonal tapered type and be manufactured from only one piece of sheet steel of appropriate thickness. The columns and single and twin brackets shall have a high quality hot dipped galvanised finish with the zinc coating being at least 550 g/m<sup>2</sup>, and giving protection both inside and outside the columns.

The galvanising process shall comply to the relevant British Standard, namely BS EN ISO 1461:2009 or equivalent Mauritius Standard, if any.

An **original certificate** from the manufacturer with regards to the galvanisation of the columns shall be submitted while tendering.

The columns shall comply with BS EN 40-3-3:2013.

The columns with single or double outreach shall be a nominal height of 10m. Columns will be generally located at 30metre intervals except where otherwise specified in the tender documents. All columns shall be provided with a flanged base plate surface mounted on a concrete column base using galvanised anchored bolts.

An access opening/inspection door complete with a cover plate and when open must be attached in such a way that it cannot be removed from the column. It shall be situated at a height of about 2m along the column.

The columns and brackets including anchor bolts shall be capable of supporting single or twin side entry luminaires with integral control gear in a wind velocity of 83.33m/s (300 km/hr). **A written guarantee shall be submitted while tendering.**

The single and twin brackets shall be securely fixed to the column to prevent rotation. The brackets shall give a maximum outreach to the centre of Lantern not exceeding 1.5 m and shall give a Lantern inclination of 5 to 15 degrees above the horizontal to the Lantern manufacturer's recommendation in order to achieve the best utilisation and uniformity of light in relation to road widths.

Anchor bolts and two nuts per bolt (both bolts and nuts being hot dipped galvanised) are to be supplied and cast in the column foundation. The poles will be erected on these foundations, and after plumbing dry pack mortar under the base plate is to be rammed to s into the foundation.

## Article 9.2 - Road Lighting Luminaires

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The luminaires shall be to IP65 or better and be of Class II.

**Original catalogue to be supplied to show compliance with specifications.**

The luminaire shall be to BS EN 60598-2-5:2015 or IEC 598 - 2-3 No. 2 (1987) or equivalent.

The luminaires shall be of the totally enclosed type of sound and robust construction weatherproof and dustproof manufactured from cast aluminium and tempered glass.

The luminaires shall be of neat appearance presenting minimum windage area, designed of side entry mounting. The spigot mounting shall incorporate a substantial locking device to prevent rotation or displacement under the wind velocity of 83.33 m/s (300 Km/hr).

The luminaries shall comprise of an optic compartment to SABS 1277 - Amendment No. 1987 protection or equivalent and an auxiliary gear compartment to at least IP 44 or better. The lanterns are to have a Mechanical Index Factor of minimum 6 joules.

The luminaries to be used on 10m high columns shall be of the ‘**cut off**’ type and suitable for 230 volt 250 watt high pressure sodium discharge lamps and associated auxiliary control gear. The gear compartment of certain luminaires shall be suitable to accommodate an appropriate ballast to work with an energy saving device.

The bowl or outer component giving access to the lantern floodlight interior for replacing lamp and maintenance must be firmly attached to the fixed part of the lantern when closed, and when open must be attached in such a way that there is no likelihood of its becoming accidentally detached or blown against any part of the lantern or column bracket.

All luminaires shall be supplied with lamp holder with adjustable focusing device, lamp control gear, and ready wired with silicon or other high resisting single or multi core.

The lamp shall be supported in its lantern floodlight so as to maintain its correct relationship to the optical surfaces of the lantern and minimise the effect of traffic vibration.

### **Article 9.3 - Lamps and Control Gear**

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Sodium discharge type Lamps shall comply with BS EN 62035:2014 and shall have a normal rating of 250 watts or as specified on the approved drawings and of the tubular or elliptical shape to give the most efficient luminaire / lumen output and control.

The lamp auxiliary control gear shall be housed in a separate compartment of the lantern. The control gear shall be suitable for operation at 230 volts and the ambient temperatures prevailing at Mauritius.

Ballast chokes shall comply with the BS EN 55015:2006 + A2:2009 (Radio Interference Suppression) and the ballast chokes shall not give rise to interference with radio or television reception.

The ballast chokes shall be totally enclosed and moisture proof against condensation and provided with safety leaks and either sealed-in heat resisting cable tails or a terminal block suitably shrouded to prevent live parts being exposed during operation. They shall be suitable for working with the lamp specified. The capacitance shall be sufficient to produce a power factor of 0.84 lagging or better. Capacitors shall comply with BS EN 61048 and BS EN 61049. Separate ignitors shall be provided. Lamps and control gear which become faulty during the

defects liability period shall be replaced by the successful tenderer within 48 hours at no extra cost.

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### **Article 9.4 - Fused Cut Out Units**

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A totally enclosed insulated 10A SP & N MCB (Type C, 4.5 KA) + RCD 30mA shall be provided in the base compartment of each 10m single arm column and two 5/6 amp SP + N MCB for twin arm 10m columns to BS EN 60947-3:2009 + A2:2015.

The Contractor shall provide all internal column wiring between luminaire control gear and fused cut out with 4 mm<sup>2</sup> twin core flexible cable to IEC 227 - (1979)

The column earth conductor shall be efficiently bonded to the armouring of the incoming cable and to the main earth conductor via the column earth stud.

All wiring connections with columns shall be made inside the column and not underground.

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### **Article 9.5 - Numbering of Columns**

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For identification and maintenance purposes all masts and columns shall be numbered using black figures 70mm high on a white background minimum 30mm all-round the number on an aluminium plate. Numbering to be instructed by the Engineer. Note that same numbering may also be engraved on the top part of the concrete base after proper finishing.

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### **Article 9.6 - Column Foundation**

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The concrete foundation shall be constructed by the main contractor with a box out for insertion and final concreting of anchor bolts.

After the pole has been plumbed, all the space below the base and bolts is to grouted with cement mortar. PVC sleeves 110 mm diameter slow bends shall be embedded into the stub for the cable entrance into column.

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### **Article 9.7 - Main Distribution Cables and Wires**

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Subject to final measurement and adjustment, all cables and wires shall be installed, connected up complete, tested and commissioned under this Contract in accordance with the drawings and Specification. All cables shall be equal sized copper conductors PVC or XLPE insulated and sheathed with steel wire armouring to BS 6346 or BS 5467.

Due consideration shall be given to the ambient temperature and the Contractor shall ensure that the materials he is required to supply are suitable to withstand the ambient conditions.

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### **Article 9.8 - Cables and Wires**

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(1) *Laying*

The final routing of all cables shall be approved by the ESD Engineer prior to installation.

(2) *Cable Lengths*

The cables shall run in the longest practical lengths without joints. No joints shall be allowed between columns or between columns and control cabinet.

The radius of the bends shall be not less than twelve times the overall cable diameter unless otherwise stated. Cables shall loop in / loop out of all columns and cabinets.

(3) *Cables laid direct in ducts*

The cables running underground entering feeder pillars or passing underground and structures shall be laid in high pressure type pvc pipes with minimum diameter of 110 mm and yellow coloured. After cables have been drawn through these ducts, a vermin – proof and waterproof plug shall be provided and fitted by the electrical sub-contractor at each end, sealed with an epoxy resin compound.

(4) *Cables laid direct in the grounds*

The cables running underground where entering feeder pillars, column bases and structures shall be laid in high pressure type pvc pipes with minimum diameter of 110 mm and yellow coloured. Supply from the distribution cables to the luminaries shall be made with separate wiring connected underground by means of water proof connection without making a joint in the main distribution cable.

Note that:

- (a) The pvc pipes shall be laid at a minimum depth of 800 mm and blinded with a radial thickness of at least 100 mm of fine coral sand or rock sand.
- (b) The presence of underground cables shall be indicated by laying a plastic warning tape above the cables / pipes after the trenches have been partially backfilled, the tapes being approximately 300 mm below surface level. The tape shall be manufactured from high grade polythene 150 mm wide and at least 0.3mm thick, coloured yellow with the words “electric Cable” or equivalent printed along its whole length.
- (c) A sample of the high pressure type pvc pipe and plastic warning tape shall be submitted together with the tender.

(5) *Supply by CEB*

At some places, there will be a need for the new CEB supplies. Accordingly, as part of this contract, the tenderer shall undertake all necessary arrangements with the CEB for the supply of same.

The tenderer shall undertake all necessary arrangements with CEB, the Municipality, the District Council and Police Department as and when necessary.

The Contractor will be held responsible for any damage to underground services caused during or in consequence of excavation or erection.

The employer will bear the cost of electricity supply directly with CEB.

## **Article 9.9 - Earthing**

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The whole of the installation covered by this Specification shall be efficiently bonded back to the Feeder Pillars through the metal sheathing of cables and earth wires all in accordance with the I.E.E. Regulations British Code of Practice and Mauritian Code of Practice if applicable. All prices shall be inclusive of the cost of this bonding.

The tenderer shall note that the armouring of the underground cables shall not be used as the sole means of bonding / earthing.

Accordingly, an earth conductor (colour green of appropriate size and according to IEE regulations) shall be provided with each underground cable for bonding / earthing purposes in addition to the armouring.

All earthing installations, size of earth wires and bonding shall be in accordance with IEE 3645-54 (1982).

The earthing continuity of each metal sheathed cable shall be maintained by efficient bonding between the cable sheath, the gland and the metal case of switchgear or other metal - clad accessory or appliance at which the cable terminates.

All wires and cables shall be protected against mechanical stresses and corrosion.

All joints between wires and earthing metal - work shall be mechanically sound before soldering.

The earth stud or terminal of all columns shall be bonded to the armouring of the incoming cable and earth conductor in an approved method. A copper clad steel type earth electrode shall be provided **at each column**.

The armouring of the circuit cabling and earth conductor shall be used to earth each section of the installation back to the feeder pillar earth bar.

The frame and earth of feeder pillar and columns shall be connected to its adjacent electrode to ensure that the earth loop impedance is in accordance with the I.E.E. Regulations.

The minimum size of the earthing rods shall be 2 m long and of 20 mm diameter and the rate shall include for extra 2 m lengths if required. Connection from each feeder pillar frame and earth bar shall be by means of single core stranded copper cable green PVC covered IEE Regulations.

The Contractor shall be responsible for taking necessary earth readings and providing a satisfactory earth to meet the IEE wiring Regulations or Mauritian Code of Practice requirements but same valve shall however not be more than 5 ohms.

All final circuits shall be protected by the use of ELCB 300 mA of the type “Bloc differentiel” + DP MCB. Note that ELCB of the type “Disjoncteur differentiel” will not be accepted as an equivalent.

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### **Article 9.10 - Electrical Controls**

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A light sensitive switch/Photocell shall be connected, to the electrical supply cable feeding the streetlights. These switches shall be of appropriate ratings and shall be contactor operated and shall be securely fixed on the poles as necessary. The photocell shall be capable of being adjusted over a range of 5 to 25 lux. The photocell shall be mounted with weatherproof enclosure to IP 65 which shall be securely fixed on the poles as necessary at a height of about 5.0m; they shall comply to BS 5972.

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### **Article 9.11 - Control Cabinet and equipment**

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All control equipment / control cabinet / dimming equipment shall be enclosed within reinforced concrete chambers of appropriate dimensions and of appropriate design.

These chambers shall be complete with base and chamber for cable access and heavy duty hot dip galvanised door of appropriate size and non-corrosive hinges.

All control cabinet enclosures and any other enclosures shall be to IP 65 and be complete with key and lock.

Upon completion of works, the tenderer shall submit 3 copies of the door keys of each enclosure and of the chamber's door.

The chamber's door shall be solidly earthed.

When tendering, the tenderer is requested to give in addition details on the following:-

- (i) The type of equipment (transformer regulator protective device) he is proposing together with all relevant technical details.
- (ii) The enclosure
- (iii) The reinforced concrete chamber.

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### **Article 9.12 - Term**

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The term “lantern” or “luminaire” shall be taken to mean the same. The lamp shall be taken as the light source fitted in the lantern or luminaire.

### **Article 9.13 - Energy Saving Device**

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As an energy saving measure, the tenderer shall supply and install for each luminary an equipment of appropriate rating and complete with all necessary protective devices (including lightning protective devices) whereby it shall be possible to dim automatically the street light, for a certain period at night every day. The said period may range between 0 hours to 12 hours and same shall be of such type as to be easily adjustable.

### **Article 9.14 – LED Solar street lighting**

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<i>Items</i>	<i>Unit</i>	<i>Allowable Range</i>
Led Lamp Power	Max Power	80W
	Lumen (lm)	85 – 90 lm/w
	Life time	50,000 hours
Solar Panel	Mono	18V/100W - 36V/100W
Battery Type	Type	Lithium
	Lifetime	6 Years
Charge Time	by sun	6 hours
Discharge Time	full power	≥ 10 hours
	saving mode	≥ 20 hours
Working Temperature	range (°C)	-30°C ~ + 80°C
Working Time		Bright mode ≥ 8hrs / Dim mode ≥ 40 hrs
Installation height		10 – 12 m
Colour Temperature		3500 – 6500K
Installation distance		25 – 50 m
Lamp material of main		hot dip galvanized
Height of column		Min 9 m



**ARTICLE NO SECTION 10 – BRIDGE WORKS**

**INDEX**

- 10.1 GENERAL
- 10.2 WELDING
- 10.3 INSPECTION AND TESTING OF WELDING
- 10.4 ERECTION OF PARAPETS
- 10.5 ALIGNMENT
- 10.6 BRIDGE EXPANSION JOINTS

### **Article 10.1 - General**

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Proprietary vehicle parapets shall be of a design acceptable to the Engineer and complying with the requirement of BS 6779. Metal parapets shall be provided with the name, trade mark or other means of identification of the proprietary parapet system, group designation and type or mark number. The metal parapets shall be designed by the Contractor for the folio-wing criteria:

1. Level of containment: High; to resist penetration from a 4 axle heavy goods vehicle of mass 30 tons with its centre of gravity at a height or 1.6i m impacting at an angle of 20° at a speed of 64 KM/hr.
2. Overall height: 1.25 m height
3. Infill to fill height

### **Article 10.2 - Welding**

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In the case of steel parapets, welding shall comply with the qualification and testing of welders.

In the case of aluminium and aluminium alloy parapets, welding shall comply with the requirements of either BS 3019: Part 1 or BS 3571: Part 1

### **Article 10.3 - Inspection and Testing of Welding**

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When directed by the Engineer and before fabrication is commenced, welding procedure trials shall be carried out using representative samples of materials to be used in the work.

A penetrant dye or other non-destructive method of testing agreed with the Engineer shall be used to examine the welds selected by the Engineer.

### **Article 10.4 - Erection of Parapets**

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When parapets are erected they shall be securely held in their correct position until all connections and fastenings are complete and the post fixings have gamed sufficient strength to withstand the design holding - down moment. The assessment of the strength of the post fixing shall be subject to the Engineer's agreement.

### **Article 10.5 - Alignment**

The finished parapets shall be true to line throughout their length.

## **Article 10.6 – Bridge Expansion Joints**

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### **10.6.1 - General**

- The size of the gap shall be compatible with the mean bridge temperature at the time of installation. This temperature shall be determined in accordance with arrangements agreed with the Engineer.
- The position of all bolts cast into concrete and holes drilled in plates shall be accurately determined from templates.
- The mixing, application and curing of all proprietary materials shall comply with the manufacturer's requirements.

### **10.6.2 – Prevention of Damage**

- During the placing and hardening of concrete or mortar under expansion joint components, relative movements shall be prevented between them and the supports to which they are fixed.
- When one half of the joint is being set, the other half shall be completely free from longitudinal restraint. In particular where strongbacks or templates are used to locate the two sides of a joint, they shall not be fixed simultaneously to both sides.
- Screw threads shall be kept clean and free from rust. Ramps shall be provided and maintained to protect all expansion joints from vehicular loading.

Vehicles shall cross the joints only by means of the ramps until the Engineer permits their removal.

### **10.6.3 - Epoxy Mortar Nosings**

- Epoxy mortar nosings shall be formed under the direction of a competent supervisor experienced in the use of the material. The work shall be carried out preferably in warm dry weather. The air temperature around the joint shall be not less than 1 0°C which shall be achieved artificially if necessary.
- Concrete surfaces to which the nosings are applied shall be dry, sound and free from laitance. Before application of the priming coat, loose material and dust shall be removed by an air jet tested to ensure that no oil is carried over from the compressor.
- Unless otherwise described in the Contract, surfacing shall be carried across the joint and then cut back to accommodate the nosing. The cutting shall be done with a diamond saw to give a clean edge throughout the depth of the material to be removed.

Masking materials provided to prevent surfacing materials adhering to the deck where nosings are to be formed shall be adequately located to prevent displacement by the paving machine.

- A priming coat of unfilled epoxy resin composition shall be well worked in by brush to all surfaces with which the nosings will be permanently in contact at a uniform rate of not less than 300 g/m<sup>2</sup>. The mortar shall then be applied as quickly as possible while the priming coat is still tacky.
- Aggregate shall be either silica sand, calcined bauxite or other approved synthetic or natural aggregate of suitable grading. The particle size distribution shall be that which produces a mortar with adequate workability and minimum void volume. Aggregate shall be clean and completely dry.
- Whichever type of aggregate is used, the epoxy mortar components shall be thoroughly mixed in a suitable mechanical mixer. The sequence, duration and temperature of mixing shall be in accordance with the Compounder's instructions.
- The mortar shall be placed in position within the time recommended by the Compounder. It shall be well worked against the primed surfaces and trowelled flush with the adjacent road surface to form a dense mortar to the profiles described in the Contract.
- Epoxy mortar shall generally be compacted in courses of thickness not exceeding 50mm. Where an underlying course is more than 1 hour old it shall, unless otherwise agreed by the Engineer, be primed with an unfilled epoxy resin priming coat before placing the next course.
- Traffic shall not be permitted to run on the mortar until the Engineer's agreement has been obtained.

#### **10.6.4 – Sealing**

1. A poured sealant shall only be placed when the mean bridge temperature is between 10°C and 16°C, unless otherwise agreed in writing by the Engineer.
2. Joints shall be clean and dry before sealing.

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## **SPECIFICATIONS FOR STRUCTURAL WORKMANSHIP BLOCKWORKS**

- 1.1.1. Concrete Blocks  
Concrete Blocks  
Concrete Blocks  
Concrete blocks for walling shall comply with B.S 2028 Type A for load bearing walls and of compressive strength not less than;  
Lowest individual block strength 375 lbs/sq. in Gross Area  
Blocks for non load bearing walls are to be Class B Blocks  
Blocks shall be hollow two-hole type and shall be cured for not less than 28 days before they are used in the works. The Contractor shall supply a certificate from the supplier for each consignment of block received to the effect that the blocks meet the requirements and strength of the latest relevant B.S. Any block for which a certificate cannot be produced will be condemned and must be removed from site. All blocks supplied shall be of the same height and blocks of dissimilar dimensions will not be accepted. Half-length blocks and specials shall also be provided as specified or required to break bond.
- 1.1.2. Mortar  
Mortar  
Mortar to be used for all Type A block wall shall be composed for 1 part of cement to 3 parts of sand Mortar for Type B block work shall be composed of one part of Portland Cement, one-part lime, and five parts of sand. All mortar shall be measured in specially prepared gauge boxes and thoroughly mixed dry or clean and water tight mixing platform with water added from a fine rose until all part are completed incorporated and brought to a proper consistency.  
All mortar must be used within thirty minutes of mixing. No partially or wholly set mortar will be allowed to be used or re-mixed.
- 1.1.3. Setting and Jointing  
Setting and Jointing  
All blocks shall be lightly wetted immediately before being bedded and jointed to minimize absorption of water from the mortar.  
Blocks are to be well buttered with mortar as previously specified. The blocks shall be laid fair-faces on the outside face, in stretcher bond with 10mm thick, full flushed up and grouted solid joints. The joints shall not vary by more than 3mm and four consecutive joints shall not exceed 30mm. Joints shall be raked out where surfaces and walling are to be plastered.
- 1.1.4. Laying of Blocks  
Laying of Blocks  
All walls throughout the work shall be carried up evenly in courses, no part being allowed to be carried up more than 900mm. higher at one time than any other part and in such cases the joining shall be made in long steps so as to prevent cracks arising and all walls shall be levelled round at each floor.  
All putlog holes shall be carefully, properly and completely filled up on completion of walling work.  
All walling shall be properly protected while mortar is setting.  
Walls shall be kept thoroughly wet for at least three days or for such longer period of time as the Architect/Engineer may direct. Walls exposed to the sun shall be kept wet.
- 1.1.5. Fair face Blocks  
Fair face Blocks  
Where walling is to be finished fair-faced, the blocks are to be selected free from defects. Joints shall be raked out as works proceed and pointed with a neat flush joint.  
The work shall be carried out regularly with all horizontal joints truly horizontal and no part shall be more than 900mm above adjacent work during construction.
- 1.1.6. Sample Panel  
Sample Panel  
The Contractor shall include in his tender for erecting a sample panel on the site of 200mm block work not less than 1 square metre in area and built off a suitable concrete foundation. The sample, when approved, to form the standard for all concrete block work in the contract. The sample area and concrete foundation to be removed when ordered and the surface of the ground made good. Horizontal and vertical joints shall be 10mm finished thickness, and raked out 12mm deep where

face of wall is to be rendered and in other cases to be left finished flush or as otherwise instructed. The joint grooves between blocks shall be completely filled with cement, lime mortar. No portion of the wall during construction to be more than 900mm above adjoining work. All work to be executed truly level, perpendicular and properly bonded together without continuous upright joints.

- 1.1.7. Cement, sand and lime  
Cement and Aggregates for this trade except where separately specified for precast concrete blocks shall be as specified for 'Concrete' and lime shall be dry hydrated lime to B.S. 890 Class B.
- 1.1.8. Air Bricks  
Form and leave neat holes in walls and supply and build in approved louvered pattern concrete air bricks where shown. The opening shall be rendered on all sides, the bottom sloped towards external face.
- 1.1.9. Bedding and Pointing  
Bedding and pointing of timber door and window frames shall be in cement mortar. Where frames are in metal they shall be bedded and pointed in mastic. Lugs or ties shall be built into walls as described.
- 1.1.10. Fixing blocks  
Provide and build into walls all necessary fixing blocks and leave out or cut away as necessary holes for pipes, conduits and the like and make good after fixing by other trades and specialists.  
leaving holes  
When building up the walls the openings shall be made about 200mm wide and the external dimensions of the doors frames, and when the latter are placed, complete with lugs, the walling completed in concrete mix type C.
- 1.1.11. Damp-proof course  
Where indicated on drawings provide 2-ply felt damp-proof course. Felt to be of a manufacture approved by the Architect/Engineer and to be laid on a 25mm thick bed of cement: mortar (1:3) on walls.  
The damp-proof courses to stand the full thickness of walls, partitions and beams in one width and to be overlapped at all jointings and corners.
- 1.1.12. Measurements  
The Contractor must allow in his prices for block-walling for plumbing angles, all straight and raking cuttings, cutting under soffits, ware split courses necessary for bond, bonding at angles, intersections and junctions of walling of different thickness, cutting and fitting to columns, cutting and pinning to beam, cutting and fitting and pinning ends of structural timber.  
The rates of block work must also include for fixing all door, window and like openings, forming reveals to same and for cutting and waste to walling in short lengths to mullions and jamb of openings.  
The rates of block work must also include for hoisting and building off beams and slab at any level, all necessary scaffolding and for work built overhead.

## MASON

- 1.2.1. Cement and Sand  
Cement and sand for this trade shall be as specified for Contractor.
- 1.2.2. Mortar for Masonry Work  
Mortar for bedding and jointing of stonework shall comprise 1 part of cement to 3 parts of sand by volume.
- 1.2.3. Stonework in walls  
All stones for use in walling shall be blue basalt stone carefully selected according to the type of walling required. Walls to be built to the thickness shown on the drawings and the stones shall be well bonded and all voids filled in solid with mortar, bond stones to be used one every 1200mm vertically and 2700mm horizontally.

Mortar joints shall be raked to depth of 12mm from face of stonework ready for painting. Walls exposed to sun shall be protected with sacking which shall be kept thoroughly wet for at least three days or for such longer period of time as the Engineer may direct.

- 1.2.4. Pointing All joints shall be raked out as described in Clause 8.2.3 and pointed with cement and sand (1:3) with approved pigment added. The pointing will either be recessed, weather struck or flush.
- 1.2.5. Cleaning of stonework The Contractor shall protect the stone work from mortar droppings and wire brush and wash down all walls on completion

#### CARPENTER AND JOINER

- 1.3.1. Timber generally All timbers used in the works unless otherwise specified shall be one of the following;  
 a) For constructional work keruing, Kempas, Balau or approved imported treated pine.  
 b) For joinery work, Meranti, Teak, Sapele  
 The timber shall be sound, selected, well seasoned vacuum impregnated with Tanalith Salts type C at the rate of 64 kgs per cu.m. of timber, free from all defects and shall be worked to the full sizes indicated on the drawings.  
 In all cases samples of the timber for use in the building shall be submitted to the Architect/Engineer for approval prior to use.
- 1.3.2. Treatment of Timber The ends and backs of all doors, frames of all timbers built in, resting or indirect contact with walling or concrete where not exposed to view, shall be coated with two cents of concrete, colignum or other approved preservative.
- 1.3.3. Replacement of defective timber Should any of the timber wavy, shrink, wind or fly to any appreciable extent within 6 months of completion of the works, the same shall be removed and now fixed in its place at the Contractor's sole expense together with all other work that may be affected.
- 1.3.4. Preparation of timber The preparation of the timber shall commence simultaneously with the beginning of the work generally and shall proceed continuously until the whole of the woodwork is prepared and stacked on the site, and properly protected from the weather.
- 1.3.5. Constructional timber All constructional timber shall be properly jointed and framed together with dowels, bolts or spiked as indicated on the drawings.
- 1.3.6. Workmanship All carpentry shall be executed with workmanship of the best quality. All carpenter's work shall be left with sawn surface except where specified to be wrote.  
 All carpenter's work shall be accurately set out and in strict accordance with the drawings and shall be framed together and securely fixed in the best; possible manner with properly made joints, Provide all brads, nails, screws, etc. as necessary and as directed and approved.  
 All timber shall be as long as possible and practicable in order to eliminate joints.



Actual dimensions of scantlings for carpentry shall not vary from the specified dimensions by more than 3mm in deficiency or excess

- 1.3.7. All timber boarded floors to be protected with sawdust after laying. The sawdust to be cleared away on completion.  
Protect floors
- 1.3.8. All joiners' work generally to be cast and framed together as soon as is practicable after the commencement of the building, but shall not be wedged or glued until the building is ready for fixing same.  
Joinery work generally  
All work to be properly tenoned, shouldered, wedged, pinned, bradded etc. as directed by and to the satisfaction of the Architect/Engineer and all properly glued up with best quality approved glue.  
Oval or round brads or nails shall be used for fixing on free work, heads properly punched in and the holes filled with putty or as otherwise described.
- 1.3.9. All exposed faces of woodwork shall be wrot, which shall mean bringing up the surface after planing with sand paper to a smooth satin-like finish.  
Finish to woodwork
- 1.3.10. All joinery work shall be executed with workmanship of the best quality in strict accordance with the detailed drawings.  
Workmanship  
All joiners' work shall be accurately set out on boards to full size for information and guidance of artisans before commencing the respective work. All joints, ironwork and other work connected therewith fully delineated which said setting out will be required to be submitted to the Architect/Engineer and approved before such respective works are commenced.  
All mouldings shall be accurately and truly run and all work planned and finished to the approval of the Architect/Engineer. All arises to be slightly rounded.  
Should any of the joinery work shrink, warp, wind or develop other defects within six months after the completion of the works, the same will be removed and new fixed in its place, together with all other work which may be affected thereby, at the contractor's cost and expense.  
All plugs described as fixing for joinery etc, unless otherwise stated shall be formed by Rawlplastic Philplug screwfix or other approved patent material. No woodplugs shall be used.  
Any fixed joiner; which in the opinion of the Architect/Engineer is liable to become bruised or damaged in any way shall be properly cased and protected by the Contractor until the completion of the works.
- 1.3.11. Doorframes and linings shall be constructed to the sizes and details shown on the drawings. Doorframes shall be fitted with three fixing irons to each side of the frame and one at the head. Frames for double doors shall have two fixing at the head. The fixing irons shall consist of 300 mm long heep iron not less than 3mm thick bent up 75mm at one end and twice screwed to the frame and the other and built into walls or cast into the lintels to a depth of 225mm (where lintels are less than 225 mm deep the straps shall be cut off to the full depth of the lintel). 6mm diameter metal dowels shall be fixed to each end of the frame and let into the floor concrete to a depth of at least 50mm.  
Door linings shall be screwed to wooden fixing slips let into the walls and lintels.
- 1.3.12. Doors shall be provided and fixed to the sizes and details shown on the drawings. Doors shall be free from all blemishes and shall be rubbed down to a satin-like finish. Frames, ledged and braced or ledged and brewed doors shall be made to the sizes shown on the drawings and the nailing in construction shall be driven

from the face and clenched at the back. The heads of nails shall be punched and the holes filled with petty.

The flash doors are to be equal in all respects to the samples of each type to be submitted to the Architect/Engineer for approval. The coves of all doors shall be ressure bonded and stacked for inspection before the faces are fixed. The plywood facings shall be of the same species on both sides of each door unless otherwise stated.

Facings shall be free from lifting at edges, plisterings or sinking or raising of the surface due to defects in the base of materials.

- 1.3.13. Hardboard Hardboard for linings, ceilings and joinery shall be of approved manufacture.
- 1.3.14. Veneered Plywood All veneered plywood or block board is to be counter-veneered on the reverse side. Plastic faced materials shall also be counter-veneered if and where necessary.
- 1.3.15. Formica Formica shall be as supplied by Messrs. Formica Ltd. de La Rue House, 84 Regent Street, London W.1., England or similar approved or approved colour and pattern and fixed with an approved adhesive in accordance with the manufacturer's instructions.
- 1.3.16. Ironmongery Butts and hinges shall be of sizes and types specified and fixed with the full number of screws and on no account shall nails be used. All locks and ironmongery shall be fixed before the woodwork or metalwork is painted. Handles shall be removed carefully stored and re-fixed after the completion of painting. Locks shall be oiled and left in prefect working order. All locks to include two keys and all keys shall be labelled with door references marked on plastic labels before handing to the Architect/Engineer on completion.
- 1.3.17. Plugging and Screwing Where items are described as plugged or plugged and screwed this shall mean plugging, plugging and screwing to concrete block walling, concrete walling. Stone walling to the approval of the Architect/Engineer.
- 1.3.18. Prices of timber work The Contractor is to include in his prices of all members for fitted ends, metres, housings, returned ends, etc., and for short-lengths not exceeding 300 mm. The prices for all joinery items are to include for slightly rounding all arises and extra cost of labours cross grain. Where hardwood is described as screwed, priced are to include for pellating with a patching hardwood. Allowances are to be made in the prices for angles, ramps, metres, ends, etc. on timber worked on solid and shall include for all necessary nonferrous metal screws. The prices for all timber described as select quality are to allow for keeping clean for light coloured finishes, polishing, etc.

#### IRONMONGERY, SMITH AND METALWORKER

- 1.4.1. Ironmongery All ironmongery and furniture to be approved by the Architect/Engineer as to quality and type and locks to be fixed to the correct hand.
- 1.4.2. Oiling of Locks, etc. All locks, ironmongery and hinges including the moving parts of metal doors and windows to be well oiled, and all necessary adjustment made before handing over the works.

- 1.8.3. Metal windows and doors shall be hot dipped galvanized after manufacture and shall be from a manufacturer approved by the Architect/Engineer.  
They shall be if sizes and types shown on the drawings and shall be ordered by the Contractor at the commencement of the contract. The doors and windows shall have bronze fittings with projecting hinges unless otherwise specified complete with building in lugs and glazing pins. Metal doors and windows bent or damaged during construction of the building shall be replaced at the contractor's expense.
- 1.4.4. Cyclone Bolts All openings sashes of metal windows shall be fitted with two cyclone bolts consisting of an extruded brass case with stamped brass sheet 115mm long complete with socket or wedge.
- 1.4.5. Louver Windows Louver frames to be anodised aluminium with slips of the size specified suitable for taking 6mm thick glass blades screwed to concrete jambs with 38 mm screws.  
Mullions to be formed by coupling 56mm x 6mm thick anodised aluminium mullion strips bolted through to the box mullions, and fix to lintel and cill by means of retaining brackets screwed to raw plugs in concrete with No. 4.38 mm screws.  
Weather strips to be in anodised aluminium and to be screwed to raw plugs in concrete at head and cill with 38mm screws.
- 1.4.6. Workmanship Workmanship and materials shall be of the best quality.  
Prices of all doors, windows and louvers shall also include for all necessary cutting and pinning, plugging and screwing to concrete or block openings and for making good of finishes.

## PAVIOR

- 1.5.1. Cement, Sand and Aggregate Cement, sand and aggregates for this trade shall be as specified for "Concrete".  
Coral and shall have three washings.
- 1.5.2. Preparation of surface to receive screedings and pavings The surface of the concrete shall be hacked to form a good key, well washed and brushed perfectly cleaned with a wire brush to remove all impurities, dust etc., damped and grouted with a mixture of cement and water in the form of slurry, using 2.75 kgs of cement per sq.m. of surface area, before screeds are laid.
- 1.5.3. Plain Screeded Pavings Floors to have plain screeded finish shall be laid in areas not exceeding 10 sq.m. at one time using teak 6mm x 19mm stop fillets. Screeds to be minimum of 19mm and to be composed of one part of cement to 3 parts of sand. The surface to be finished to a polished surface with a steel trowel. The screeds or pavings shall be kept wet with sand, sacking or similar for at least seven days after completion.
- 1.5.4. Expansion Joints At the entrance of each room directly under the door fix a teak strip 6mm x 19mm deep for full width of opening to form an expansion joint between adjoining screeds.
- 1.5.5. Granolithic Paving Shall be laid in areas not greater than 10 sq.m. at one time using teak 6mm x 19mm fillets. Granolithic paving shall be composed of two parts by volume of cement to five of blue basalt chippings to pass a 6mm square mesh free from dust and containing not more than 10% frit. Granolithic paving to be well watered and kept damp for seven days after laying.

- 1.5.6. Polishing of Granolithic Pavings When laid the Granolithic paving shall be rubbed down with a carborundum stone to give polished surface.
- 1.5.7. Non-slip surfaces to pavings Surfaces of internal pavings and steps where required to be made non-slippery shall be created with coarse Carborundum average 11.4 kgs per m<sup>2</sup> lightly trowelled in while the paving is still green.  
Surfaces of external pavings or steps where required to be made non slippery shall have parallel lines 12mm deep and 9mm wide in the surfaces of the paving or concrete.
- 1.5.8. Quarry Tiling Quarry tiles shall be to the quality, sizes and colour as selected by the Architect/Engineer, laid to areas indicated on the drawings. The tiles shall be set square jointed bedded and pointed in cement mortar (1 part of cement to 3 parts of sand).  
Tiles shall be soaked in water 24 hours before laying and shall be thoroughly scrubbed to remove all traces of cement after laying and protected with sawdust or sacking and not used for at least 10 to 14 days.  
The surface shall be polished on completion of the contract.
- 1.5.9. Polishing paved surfaces Types of floors described in Clauses 1.5.3 and 1.5.6 shall be cleaned on completion of the works and treated with two coats of floor polish each coat rubbed well in and polished.
- 1.5.10. Roof Screed Roof slabs shall be finished with a cement/sand screed 1:3 mix laid to falls and cross falls and minimum thickness 19mm to which shall be added an approved waterproofing liquid used in strict accordance with the manufacturers' written instructions. Screeds shall be carried down rainwater outlets and finished neatly against the down pipe. The screed shall be kept wet for at least seven days after completion.
- 1.5.11. Prices of pavings and screeds tiles etc. Prices for pavings or screeds are to include for preparation of the concrete base, all necessary hacking, grouting with cement grout, any extra thickness consequent upon the concrete surfaces not being finished to true and level, laying in bays and all necessary formwork and dividing strips, and curing the finished screed or passing for at least seven days.  
Prices for tiling shall also include for all straight and raking outting, fair edges and fair joint, prices for tile skirting shall further include for angles, ends, mitres and for short lengths not exceeding 300mm.

#### PLASTERER AND WALL TILER

- 1.6.1. Generally The renderings are to be carried out so that the finished surfaces appear without visible joints or patches. The rendering of wall surfaces, reveals of openings and cills are to be carried out in one operation and each day's work stopped at a suitable point where it can be picked up again on the following day without noticeable joints. The quality and mixing of the materials are to be constant throughout so that there is no variation in colour or texture. The finished coat to be brushed down and left clean of a wall the rendering shall be carried out continuously and day to day breaks made to coincide with architectural breaks in order to avoid unsightly junctions.
- 1.6.2. Preparation All faces of concrete work shall be well hacked to form a good key and in the case of block or stonewalls the joints shall be raked out. All surfaces for rendering shall be well wetted with a hose before rendering is applied.

of surfaces  
for rendering

- 1.6.3. Cement shall be as specified in section 6.
- 1.6.4. Sand Cement Sand shall be as specified for Fine Aggregates in section 6 but in addition shall be in accordance with B.S. 1199 and shall if CORAL SAND have three washing in lieu of 2 for internal work.
- 1.6.5. Lime Lime shall be either in the form of quick lime and obtained from an approved course and properly stacked on site or in the form of hydrated lime and conform to the requirements of B.S. 890 Class B “Quick lime or Hydrated Lime for Coarse Stuff and Building Mortar”.
- 1.6.6. Mix for rendering The mix for rendering both internally and externally shall be 1 part of cement to 1 part of lime to 5 parts of sand plus an approved mortar plasticiser used strictly in accordance with the manufacturers’ written instructions.
- 1.6.7. Application of rendering All external surfaces shall be rendered in two coats unless otherwise instructed. The first coat of rendering shall be applied with wooden float to an even thickness of not less than 10mm and not more than 15mm. As soon as the first coat starts to set it shall be closely combed to a depth of 3mm to 6mm and kept damp for at least two days after which time the final coat shall be applied to an even thickness of not less than 6mm and not more than 10mm. For one-coat work internally the surfaces to be rendered shall be prepared as described and the rendering applied to an even thickness of not less than 19mm and not more than 25mm. All rendered surfaces shall be kept damp for at least two days after the final coat has been applied.
- 1.6.8. Finishes to renderings Rendered surfaces shall be finished as directed by the Architect/Engineer in the following manner:  
(a) Wood float finish: Finish surfaces with a wood float to an even and slightly/rough textured finish.  
(b) Sponge finish: Finish rendered surfaces with a steel trowel and while the rendering is still green dab the surfaces with a damp sponge until they present a fairly sanded textured finish.  
(c) Trowel finish: Finish rendered surfaces with a steel trowel to a smooth and even surface, free from trowel marks.
- 1.6.9. Tyrolean Finish Tyrolean rendering shall consist of a 12mm backing coat of one part of cement with 10% of lime by volume added to four parts of sand, trowelled up to a true surface left as open as possible ( no combing or scratching required).
- 1.6.10. Sample Panel The contractor shall prepare samples of plastering tyrolean finish, bush-hammered finish as directed until the quality texture and finish as directed until the quality texture and finish required is obtained and approved by the Architect/Engineer, after which all plastering, tyrolean and bush hammered finish expected in the work shall conform to the respective approved samples.
- 1.6.11. Arises Vertical and horizontal arises shall be formed to beams, columns, openings and the like and shall be pencil rounded. Particular care shall be taken to ensure that the rendering is strong and sound at the corners.
- 1.6.12. Cracks, blisters, etc. The Contractor shall make good all cracks, blisters and other defects and leave the whole of the plaster, tyrolean, bush-hammered finish perfect at completion. When making good defects the plaster shall be cut out to a rectangular shape with edges undercut to form dove-tailed key and all finish flush with face of surrounding plaster all at the contractor’s own expense.

- 1.6.13. Form plinths are external rendering as shown on drawings.
- Plinths
- 1.6.14. Wall Tiling Wall tiling unless otherwise stated shall be coloured glazed ceramic tiles of the dimensions and colours specified and shall conform to EN 177 or latest and shall be of approved manufacture true to shape and free from blemishes. The backing coat for wall tiling shall be in cement: sand mortar (1:2 mix), not less than 9 mm and not more than 15 mm thick, the surface of which shall be closely combed while the mortar is still green and left for a period of 24 hours. The tiles shall be soaked in water for 30 minutes and bedded with an adhesive of the approved manufacture. All tiles shall be laid perfectly level, the joints to run straight horizontally and vertically and to be pointed in neat cement to an approved colour. Internal and external angles and rounded edges tiles are to be of the same manufacture, colour and thickness as the foregoing
- 1.6.15. Prices of Plasters, tiling, etc. Prices of plastering are to include for preparation of the surface, hacking of concrete, raking out joints of block work, grouting, forming temporary rules, fair edges and arises, rounded external angles, Vee joints, working to debates making good to window or door frames, around pipes, holderbats, sanitary fittings, narrow widths and small quantities. Prices for wall tiling shall include for all operations required in proper execution of the work out and waste and fixing as described.

#### GLAZIER

- 1.7.1. Quality of Glass All the glass to be of the best quality obtained free from all defects and imperfections and shall be to the approval of the Architect/Engineer.
- 1.7.2. Windows and Doors Glaze all windows and doors in 4 mm thick clear sheet glass unless specified otherwise.
- 1.7.3. Translucent glass Windows requiring obscure vision shall be glazed with translucent glass of an approved texture or pattern, the thickness to be not less than that mentioned above unless specified otherwise.
- 1.7.4. Putty Putty for glazing to wood shall be made of pure whiting and raw linseed oil and to be used fresh. Putty for glazing to metal shall be steel sash putty of approved manufacture. All putty shall be delivered on site in the original manufacturer's sealed cans or drums and used direct there from, with the addition only of pure linseed oil if necessary. No mineral or other oils shall be used in the putties except genuine linseed oil. The rebates of metal window shall be painted one coat before puttying.
- 1.7.5. Glazing All glass to be cut accurately in one piece, to fit easily into their rebates and to be well puttied, back puttied and secured with springs in the case of fixing to wood or with metal clips in the case of metal. Care must be taken to ensure that the putty does not show beyond the sight lines of panes and that the putty is neatly cut off internally and neatly splayed off externally all metres and angles left clear and sharp.
- 1.7.6. Glass blades for Louver Window Blades for louver windows shall be 6 mm thick glass of selected glazing quality Grade 'A' to B.S. 952 and of approved manufacture. The two long edges of the blades shall be flat smooth polished with no sharp arises and the two others clean cut. The contractor shall, when requested to do so, produce certificates of proof of manufacture and quality of the glass blades be proposed to use.

- 1.7.7. Glazing work at completion All glass broken, cracked or scratched during the progress of the works to be reinstated at the sole cost of the contractor and all glazing to be left clean and perfect at the completion of the contract

#### PAINTER AND DECORATOR

- 1.8.1. Generally All work shall be carried out in strict accordance with schedule of colours to be obtained from the Architect/Engineer. Samples of colours if requested by the Architect/Engineer shall be painted on the walls 1.00m x 1.00m square and approval obtained from the Architect/Engineer before proceeding with the work.
- 1.8.2. Materials, Paint, Varnishes, etc. All oil paints, emulsion paints, varnish and other materials shall be of an approved manufacture and shall be used strictly in accordance with the manufacturers' printed instructions, the Contractor will only be allowed to use materials which are brought to the site in sealed cans not exceeding one gallon capacity, bearing the name of the manufacturer and properly labelled as to quality. Exterior quality paints only shall be used, both internally and externally. All cans of paint must be kept well stirred before and during use. The only addition to the paint that will be allowed shall be approved pure turpentine and this shall be added only in accordance with the Architect's instructions. All coats of paint applied over each other shall be from the same manufacturer and the type recommended by the manufacture. Well before commencing the painting work the contractor shall submit to the Architect/Engineer for approval a list of all the brands of paint and finishings including the necessary primers and undercoats he intends to use and immediately upon being so approved orders shall be placed and total requirements obtained for the works. Once approved no other brand of materials shall be used without the express permission of the Architect/Engineer in writing.
- 1.8.3. Preparation of surfaces All surfaces to be painted shall be thoroughly cleaned down and surfaces of wood to be sandpapered and to be twice knotted and stopped before applying the priming coat which shall be regarded as additional to the undercoat. All surfaces of ironwork to be thoroughly cleaned of all scale, and every particle of rust, dirt or grease removed by scrapers' and wire brushes, or other approved method. Galvanized, sheradised or zinc sprayed metal to be painted shall be treated with mordant solution. Copper pipes specified to be painted shall be rubbed down with coarse emery, cleaned with a solution of one part acetone to two parts of benzene and left to dry.
- 1.8.4. Wood Preservative Treat all timber built in or in contact with walling and concrete with 2 coats of approved wood preservative.
- 1.8.5. Galvanised metal surfaces Clean down, treat with degreasing solution, prime with yellow chromate or other approved primer, and paint one undercoat and two gloss finishing coat oil paint.
- 1.8.6. Ironwork Clean down, removing every trace of rust and paint 1 coat of red lead primer, 1 coat of undercoat and two gloss finished coat.
- 1.8.7. Rendered Surfaces Brush down to remove dirt and dust, prime with alkali resistant primer as specified by the suppliers of the emulsion paint to be used and paint three coats of approved plastic emulsion paint (external quality) both internally and externally strictly in accordance with the manufacturers' instructions. The walls are not to be pumiced down.

- 1.8.8. All floors to be twice washed, all marks of paint to be sponged off, windows cleaned on completion the work generally to be touched up after all the other trades are finished and the whole of the building left clean and perfect on completion to the satisfaction of the Architect/Engineer.

#### PLUMBER

- 1.9.1. All materials and workmanship shall comply with the latest editions of the British/European/South African or other approved Standard's Specification, Codes of Practice, By laws and regulations of all Statutory Authorities concerned.

The Contractor shall include for producing all working drawings, details, builder's work and holes drawings necessary to carry out the work and as required by the Architect/Engineer. The drawings shall be based upon the Architects diagrammatic drawings and shall be submitted, in duplicate progressively at least two months prior to the programmed commencement of work coordination and approval of the Architect/Engineer. All alterations to drawings, whether due to co-ordinations or otherwise, shall be carried out by the contractor. The contractor shall provide the Architect/Engineer with four copies of each approved drawings in addition to those required for his own use.

At completions of the Contract, the Contractor shall provide the Architect/Engineer with one complete set of negatives indicating the "As installed" installation and three prints of the said drawings complete with all operational and maintenance instructions value charts, and test certificates. These drawings shall be provided to the Architect/Engineer at practical completion of the works, failing which the Architect/Engineer reserves the right to withhold an appropriate portion of the first retention money.

All work shall be tested in sections as required and before being covered up, for the Architect/Engineer and statutory authorities. Before any test is carried out, a minimum of seven days notice shall be given to the Architect/Engineer.

Where access is indicated to soil, waste and rainwater pipe fittings, the Contractor shall ensure that all accessible. Before testing, all access doors shall be removed, inspected, the washer greased and then reassembled by the Contractor.

- 1.9.2. The lead used shall be best milled sheet lead of approved manufacture. No Lead in flats flashings, aprons etc. solder to be used in laying of lead except where quite unavoidable and no continuous strip of lead to be more than 2.00mlong. Overlaps to be not less than 75 mm. Lead flashings, aprons, soakers and other lead work where required to be fixed shall be secured with copper nails. Lead work shall comply with the following weights:

	Per sq. ft.
Lead gutters & Flats	29.3 kgs
Flashings and aprons	24.4 kgs
Soakers	19.5 kgs

- 1.9.3. Soil ventilating pipes shall be not less than 63 mm internal diameter cast iron pipes conforming to B.S. and fitted with the necessary junctions and bends. All joints shall be made with a gasket of tarred hemp and caulked with a mixture of neat cement just moist. The pipes shall be secured to the wall with approved holderbats which shall be securely fixed to the wall with rawbolts.

Ventilating pipes shall be carried at least 900 mm above caves level and shall be fitted with approved coated wire balloon.



- 1.9.4. Rising Main The Contractor shall include for all charges for tapping and connection to public water main, including all necessary excavations and reinstatement of public roads.
- 1.9.5. Galvanised pipes and fittings for water services All internal and external water services, fittings, wastes, overflows and the like shall be in screwed and socketted galvanised wrought iron or steel tubes and tubulars; the former complying with BS 788 for water (medium) and the latter with BS 1387 for B class. Pipes above ground level shall be fixed to walls with approved type galvanised malleable iron built in clips, brackets, holderbats or pipe clips, the spacing of which shall not exceed 900 mm.  
The jointing of galvanised piping and fittings shall be made with proprietary brands of jointing paste or compound complying with BS 1260 and if these are not obtainable by a method to be approved by the Architect/Engineer.  
Unless otherwise specified or detailed on drawings the internal diameter of service pipe shall comply with the following:
- | Diameter of supply or feed pipe | No. of Tappings shall not exceed                  |
|---------------------------------|---|
| 13 mm                           | 2 - 13 mm   |
| 19 mm                           | 4 - 13 mm   |
| 25 mm                           | 13 mm or 2 - 19 mm                                |
| 25 mm                           | 11-13mm or 2-25 mm                                |
| 31 mm                           | 16 - 13 mm or 6 - 19 mm<br>3 - 25 mm or 2 - 31 mm |
- 1.9.6. Water taps All bib, pillar, globe and stop taps shall be of the screw down pattern and comply in every respect with BS 1010. The size specified or shown on the drawing shall mean the maximum bore of the seating.
- 1.9.7. Stopcocks and Boxes Brass stopcocks shall be provided at the immediate entry of the water services into the building and at the other points as indicated on the drawings and shall be of a pattern approved by the Architect/Engineer.  
Stopcock boxes where required externally shall be constructed of 150 mm earthenware pipe cut to the required length and fixed vertically over the stopcock on two concrete blocks and the earth wall consolidated round the sides. Top of pipe to be fitted with 225mm x 225 mm x 25 mm, thick precast concrete cover reinforced with 13 mm chicken wire netting and fitted with a lifting ring.
- 1.9.8. Testing of water services The whole of the water services laid or fixed by the expense in the presence of the Architect/Engineer and shall comply with his requirements and any defects made good to his satisfaction. In the absence of instructions regarding the test it shall be an air pump and pressure gauge test the pressure applied at 35 to 53 grms per cm<sup>2</sup> for one hour at the end of which period the loss in pressure shall not be greater than 1/50th of lb. per 225 mm<sup>2</sup>.
- 1.9.9. Waste pipes Waste from sinks and shower to be in 38mm bore pipe and from lavatory basins to be 31 mm. All wastes to be fitted with C.P. bottle traps. All waste to be carried through external walls to discharge over gully gratings. All wastes pipes shall be at each change of direction of pipe fitted with a tee, and at one end with screwed plug for cleaning purposes. The external gully to be connected to the nearest manhole. Wastes from urinals to be taken in 50mm diameter cast iron pipe with trap at urinal end and connected by 50mm pipe externally to the nearest manhole. All laid to fall.

- 1.9.10. Overflow pipes are to be fitted to all W.C. cisterns, tanks and baths and in each case the overflow pipe shall be 6 mm. larger in diameter than the water supply pipes to the unit. Overflow pipes to W.C. cisterns shall be taken through an external wall to finish 150mm beyond the face of the wall.
- 1.9.11. Baths, W.C's. basins, sinks and other sanitary units shall be of approved manufacture, and shall comply with the relevant B.S, SABS or equivalent. They shall be of the type and designs shown on the drawings or to the Architect's/Engineer's instructions. The whole of the units shall be properly fixed and connected to the water service complete with wastes and overflows as described.
- 1.9.12. Rainwater pipes shall be approved rigid P.V.C. rainwater unless otherwise described. Pipes shall be properly fixed to walls with approved clips at distance to be directed by the Architect/Engineer.
- 1.9.13. All pipes for soil drainage which include the conveyance of discharges from Drain, WCs, basins, sinks, urinals, baths and showers shall be salt glazed earthenware Pipes for pipes, bends, junctions and tapers complying in all respects with B.S. No. 65 for Soil "British Standard Pipes" and must be stencilled with the registered mark of the drainage B.S.I. Other fittings shall comply with the dimensions laid down in B.S. 539. If the above type of pipe is unobtainable then best Commercial Quality may be used on conditions prior approval of the Architect/Engineer is obtained.
- 1.9.14. Pipes conveying storm or surface water shall be second quality distinguished by Drain pipes for a black band. water drainage
- 1.9.15. The pipes to be laid in straight runs to even and regular falls, and put together with great care, the spigot of one pipe shall have one lap of tarred gaskin Laying of drain pipes wrapped round it and then placed into the socket of the pipe previously laid. After adjustment the gaskin shall be caulked lightly home but not so as to occupy more than one quarter of the socket depth. The socket shall then be completely filled with cement mortar (1:1) and a fillet shall be formed round the joint, with a trowel forming an angle of 45 degrees with the barrel of the pipe. The joint inside to be struck with a scraper, so as to give a perfectly clear and unobstructed waterway.
- 1.9.16. All pipes except where otherwise shown shall be 125mm internal diameter laid Fall in drains to a fall of 1:50.
- 1.9.17. Concrete (1:3:6) shall be laid 150mm thick to form bed for drains where the soil Concrete bed to drains is found to be soft. After the pipes have been tested, it shall be haunched up on both sides to a height of 3/4th of the internal diameter of the pipe.
- 1.9.18. All pipes passing under buildings or under roadways shall, in addition to a Concrete cover to drains 150mm concrete bed under, be completely surrounded in concrete of the same thickness of (1:3:6) mix.
- 1.9.19. Provide trapped gullies, complete with gratings in positions shown on drawings, Gully traps set on concrete and surrounded in concrete, and jointed to drain as described.

1.9.20. Manholes are to be constructed in the positions shown on the drawings. The Manholes internal dimensions of the manholes shall vary according to their depth and shall be as follows:

Depth of manhole from top of invert to finished ground level	Internal dimensions of manhole shall not be less than
Up to 600mm	600 x 450mm
Up to 900mm	750 x 600mm
Up to 1200mm	825 x 675mm
Up to 1500mm	900 x 750mm

Exceeding 1500mm in depth the Contractor shall apply to the Architect/Engineer for details.

Manholes shall be constructed in concrete (1:3:6) cast in-situ hacked for key and finished above the benching with 6mm thick rendering of cement and sand mixed in the proportions of 1 to 2. The thickness of the concrete walls shall vary according to the depth and shall be as follows:

Depth of manhole from top of invert to finished ground level	Thickness of concrete to manhole walls shall not be less than
Up to 600mm deep	100mm thick
Exceeding 600mm but not exceeding 1500mm	150mm thick

Exceeding 1500mm in depth the Contractor shall apply to the Architect/Engineer for details.,

The floor of manholes shall be 150mm thick and the channels and benching shall be formed above the level of the floor in fine concrete (1:2:4) average 225mm thick with a polished fall and carried up 450mm above invert level and finished off at an angle of 45o rounded off and dished to main and branch channels. The cement for benching to be sulphate-resisting cement. Step irons shall comply with B.S. 1247 and shall be placed at intervals of 450mm vertically with 300mm offset between alternate steps.

Manhole covers other than those in roadways shall be 600 x 450mm cast iron medium weight with frame set flush in 125mm concrete cover slab Mix C, reinforced in cases where the internal size of the manhole situated inside the building shall be bedded in grease and shall be of an approved type fixed with bolts and screws. Manhole covers for manholes in roads or drives shall be of an approved heavy iron pattern and the contractor shall apply to the Architect/Engineer for details including the construction of the manhole.

## **SPECIFICATIONS OF THE WATERPROOFING SYSTEM**

The Subcontractor for waterproofing works must be registered as specialist waterproofing contractor with the Ministry of National Infrastructure and Community Development.

### **1.0 The waterproofing system**

The waterproofing system, unless otherwise specified, shall meet the following performance specifications:

Either

a SBS elastomeric bitumen system in double layers, torched bonded, and of total minimum thickness of 4.2mm with a granular finish

Or

any other alternative system or concrete waterproofing method, provided it is duly supported with all technical specifications and backup information and literature to allow a proper assessment of the treatment proposed and its suitability for tropical climates and subject to approval.

### **2.0 Performance Specifications of the waterproofing system**

2.1 The system shall, unless specified otherwise, be resistant to foot traffic and light concentrated loads associated with installation and maintenance operations.

2.2 The system shall comply with European, South African or American standards.

2.3 The system and its installation shall conform strictly to the Manufacturer's specifications.

2.4 The system should be able to withstand and resist suction pressure created from cyclonic winds of up to 280km/h.

### **3.0 Preparation of surface to receive Waterproofing treatment**

3.1 The waterproofing Contractor shall ensure that the slope of the substrate is adequate to prevent water-ponding and is according to Manufacturer's specifications.

3.2 All concrete surfaces to be waterproofed shall be reasonably smooth and free from holes and projections, which might puncture or otherwise damage the waterproofing treatment to be applied.

3.3 The surface of the substrate shall also be dry and shall be thoroughly cleaned of dust and loose materials prior to the laying of the waterproofing system

3.4 Prior to the application of the new treatment, the waterproofing Contractor shall be required to issue a certificate stating that the surface is ready to receive the new waterproofing treatment and is according to the Manufacturer's Specifications.

It is hereby made clear that, should the waterproofing system fails to perform as required, no discharge of responsibilities shall be allowed on the grounds of the existing conditions prior to the application of the waterproofing system.

### **4.0 Inspection of Waterproofing Treatment**

4.1 The waterproofing treatment shall be carried out in the presence of the Engineer's representative between 9.00 a.m to 4.00 p.m and to the satisfaction of the Engineer.

4.2 The Contractor shall ensure that the waterproofing treatment is free from wrinkles, buckles, blisters (trapped air) and other damage. Any damaged or defects to the waterproofing system shall be corrected at the Contractor's cost, and to the Engineer's approval

4.3 The Contractor shall carry out a water test on the finished work, and seek the Engineer's approval for the same. The test shall consist in filling the whole treated area with water (after plugging the rain water pipes outlets) and retaining the water on the treated

surface for 24 hours, or as directed by the Engineer. Any leak / defect found shall be repaired at the Contractor's cost and another water test carried out to confirm the same, the whole to the Engineer's satisfaction.

4.4 The Contractor shall clean adjacent surfaces of spillage and spattering of any adhesive materials used in the works

5.0 Water Test

5.1 The Contractor shall allow in his rates for a water test to be carried out after laying the screed to fall, to confirm the absence of any water-ponding. The Test shall be verified and approved by the Engineer.

5.2 The contractor shall allow in his rates for a 24-hour water test to be carried out after laying of new waterproofing membrane to verify for any leakage. The Test shall be verified and approved by the Engineer.

6.0 Guarantee Certificate

6.1 On satisfactory completion of the waterproofing works, the Contractor shall submit a certificate of guarantee against leakage, defective materials and defective installation of the completed waterproofing system. Any such defects or leakage occurring during the guarantee period shall be promptly and completely attended to, including all affected work, at no additional cost to the Employer

6.2 The said guarantee shall be in effect for a period of ten (10) years from the date of the Practical Completion Certificate. The guarantee shall be signed by the Contractor and shall be submitted to the Engineer with a copy to the Employer.

## **SPECIFICATIONS FOR ALUMINIUM OPENINGS**

### **1.0 GENERAL**

#### **SUBMISSION**

A certificate from a Registered Professional Engineer certifying that:  
the Aluminium openings fixed in place shall withstand cyclonic winds of not less than 280 km/hr;

The design has been made based on sections with thickness not less than 25 microns coating.

This certificate shall in no way waive or diminish the contractor's liability towards the Employer. The Engineer reserves the right to request for detailed calculations for any opening.

#### **DELIVERY AND STORAGE**

Adequately protect aluminium and aluminium finishes to prevent damage thereto during fabrication, storage, shipping, handling and installation.

Deliver, handle and store units by methods approved by manufacturer. Protect from damage and staining.

Protect sills and stools after installation with boards of heavy paper or other suitable protection, secured in place, to prevent staining or scratching. Do not remove protection before final cleaning.

#### **WARRANTY**

The Contractor shall submit a written warranty of five years for any defects in manufacturing.

In addition to the above, insulating glass units shall carry manufacturer's standard warranty of minimum five years for defective materials and ten years for seals.

The Warranty shall include a statement that the openings shall resist cyclonic winds of not less than 280 km/hr and shall be water tight.

## 2.0 PRODUCTS

### MATERIALS

Aluminium extrusions shall be of Aluminium equivalent of minimum 25 microns.

Finish clean anodised natural finish.

Bolts, screws and fasteners: Hot dipped galvanised or cadmium plated steel or 302 stainless steel.

Glass: 6 mm clear glass or Georgian wired glass or tinted glass, as directed by the Engineer.

Glazing tape: Vulcanised butyl tape with continuous neoprene spacer, colour as selected by Engineer.

Setting Block: Neoprene 10 mm long, 80A durometer.

Steel: Brake formed, galvanised sheet steel.

## 3.0 EXECUTION

### DESIGN

Allow full expansion and contraction of window framing members without causing stress within the window assembly as result of such expansion and contraction.

Tolerate structural deflection and distortion structure, under design criteria conditions, without load on window assembly.

### FABRICATION

Make profiles of framing members as shown on drawings.

Entire assembly shall be watertight throughout.

Fabricate complete units in shop to provide minimum tolerance and hairline joints throughout.

Assemble members by stainless steel screws. All connections shall be internally sealed in factory with approved sealing compound. Exposed frame sealants are not acceptable.

Aluminium extrusions shall be designed to provide sufficient section modules to safely resist imposed loads but minimum thickness of any part of the load bearing extrusion shall be 3 mm. Glazing stops may be 6 mm. Be prepared to submit design data as requested by the Engineer.

Conceal interconnecting members and fasteners in completed assembly.

Do not place manufacturer's name plates, labels or any other finished means of identification on exposed finished parts.

Provide weep holes in tubular members to drain and condensation.

Glass stops shall provide edge margins recommended by glass manufacturer.

Paint all metal surfaces in contact with concrete or masonry, plastic, mortar or dissimilar metals with protective lacquer or bituminous coating.

Mitre and full length vulcanise joints in weather stripping.

### INSTALLATION

Provide all fastenings or anchors required to be built in under work of other sections.

Use only concealed fastenings.

Securely install components so that they line up square in true, straight flat and/or flush plated, plumb and level free from distortion.

Make joints neat and fine as practicable. Allow for full expansion and contraction and take into consideration climatic conditions prevailing at time of installation.

Fasten galvanised steel supports and slips with galvanised bolts and fasten aluminium members with stainless steel screws and bolts.

Ensure that corner joints of frames are watertight.

Clean aluminium and glass surfaces that are to receive glazing materials with an oil removing solvent and wipe dry.

Glaze windows with factory-glazed wrap around vinyl glazing channels.

Place setting blocks at quarter points for each type of glass.

Comply with tape manufacturer's recommendations regarding use of spacers for certain glass sizes.

Install glass with clean-cut edges, leaving spaces to expansion and contraction between edge of glass and inside of frame as recommended by glass manufacturer.

Finish tape and glazing with straight unwavering sight lines.

Conform to sealant manufacturer's written recommendations for cleaning, priming, backing and joint design to suit type and location of joint and temperature conditions at time of application.

Mask adjacent surface likely to become marred with sealant or primer, using non-thermosetting easily removed masking.

Apply sealant using pressure-operated gun fitted with suitable nozzles approved by the sealant manufactures. Apply in accordance with manufacturer's directions and recommendations.

Apply sealant in such a manner as to assure good adhesion to sides of joints and to completely fill voids in joints. Form surfaces of sealant smooth, concave, free from ridges, wrinkles, sags, air pockets and imbedded impurities.

Remove masking tape, soils and sealant which may have been deposited on surfaces near joints.

Seal all window frames to adjacent materials both sides.

#### CLEANING

When directed, inspect work and remove protective wrappings, coatings and devices and clean glass and aluminium surfaces. Use methods which will not scratch or damage glass, paint or coatings.

#### SPECIFICATIONS FOR HEAVY DUTY VINYL FLOORING

The vinyl flooring shall be coloured heavy duty, homogeneous with a minimum thickness of 2.5 mm specially made for use in Hospitals. The vinyl shall be in sheets (rolls) with smooth surface finish.

The vinyl flooring shall also be scratchproof, abrasion resistant, slip resistant, fire resistant, stain proof, wheel chair resistant, indentation resistant, acid resistant, fungi & bacterial resistant and easily cleaned with liquid detergents.

The vinyl flooring shall be laid with a continuous riser on the wall to give a skirting of 125 mm height to avoid joints between the walls and the floor and ended with rounded PVC strips.

All corners that is between floor and walls shall have a fillet to be either in concrete or any other approved material.

All joints shall be seam welded with appropriate rod for a continuous finish and of same colour to match the vinyl flooring.

The vinyl flooring shall be laid as per Manufacturer's Specifications with approved adhesives.

#### SPECIFICATIONS FOR FILL MATERIALS

##### Fill material

Fill material shall consist of naturally occurring or processed material, or inert construction and demolition material, which at the time of deposition is capable of being compacted in accordance with the specified requirements to form stable areas of fill.

Fill material shall not contain any of the following:

Material susceptible to volume change, including marine mud, soil with a liquid limit exceeding 65% or a plasticity index exceeding 35%, swelling clays and collapsible soils, Peat, vegetation, timber, organic, soluble or perishable material, Dangerous or toxic material or material susceptible to combustion, and Metal, rubber, plastic or synthetic material.

The different types of fill material shall have the particle size distributions within the ranges stated in Table 6.1.

Special fill material shall consist of material which has a liquid limit not exceeding 45%, a plasticity index not exceeding 20% and a coefficient of uniformity exceeding 50.

Granular fill material shall consist of clean, hard and durable material including recycled aggregates, rock and concrete.

Rock fill material shall consist of pieces of concrete or hard and durable rock of which the maximum size shall not be greater than three times the minimum dimension of individual pieces and in the opinion of the Engineer not more than 30% by mass is discoloured or shows evidence of decomposition.

The soluble sulphate content of fill material placed within 500 mm of concrete, cement bound material or cementitious material shall not exceed 1.9 grams of sulphate, expressed as SO<sub>3</sub> , per litre.

The total sulphate content, expressed as SO<sub>3</sub> , of fill material placed within 500 mm of metalwork shall not exceed 0.5% by mass.

Well-graded material shall consist of material that has a coefficient of uniformity exceeding 10.



Uniform-graded material shall consist of material that has a coefficient of uniformity of 10 or less.

Table 6.1: Particle size distributions of fill material

Type of Fill material	Percentage by Mass passing					
	Size		BS test sieve			
	400mm	200mm	75mm	20mm	600Mm	63Mm
Fine fill material	-	-	100	-	-	-
General fill Materials	-	100	75-100	-	-	-
Special fill materials	-	-	100	-	-	0-4.5
Granular Fill materials	-	-	100	-	0-5	-
Rock fill material (Grade 200)		100	20-75	0-50		
Rock fill material (Grade 400)	100	20-75	10-30	0-25		

## **SPECIFICATIONS FOR ALUCOBOND MATERIAL**

General

SCOPE

SECTION INCLUDES

The extent of panel system work is indicated in these specifications.

Panel system requirements include the following components:

Aluminum faced composite panels with mounting system. Panel mounting system including anchorages, shims, furring, fasteners, gaskets and sealants, related flashing adapters, and masking (as required) for a complete watertight installation.

Parapet coping, column covers, soffits, sills, border, and filler items indicated as integral components of the panel system or as designed.

Interior panel system work that basically matches exterior panel system work.

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Particular Conditions, Specification Sections, and Technical Specification.

RELATED WORK SPECIFIED ELSEWHERE

Structural steel

QUALITY ASSURANCE

Composite Panel Manufacturer shall have a minimum of 5 years experience in the manufacturing of this product.

Composite Panel Manufacturer shall be solely responsible for panel manufacture and application of the finish.

Fabricator/installer shall be acceptable to the composite panel manufacturer.

Fabricator/Installer shall have a minimum 5 years experience of metal panel work similar in scope and size to this project.

Field measurements should be taken prior to the completion of shop fabrication whenever possible. However, coordinate fabrication schedule with construction progress as directed by the Contractor to avoid delay of work. Field fabrication may be allowed to ensure proper fit. However, field fabrication shall be kept to an absolute minimum with the majority of the fabrication being done under controlled shop conditions.

Shop drawings shall show the preferred joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on the inside face of the panel system as determined by BS STANDARD. Systems not utilizing a construction sealant at the panel joints (i.e. Rout and Return Dry and Rear Ventilated System) shall provide a means of concealed drainage with baffles and weeps for water which may accumulate in members of the system.

Maximum deviation from vertical and horizontal alignment of erected panels: 6mm in 6m non-accumulative.

Panel fabricator/installer shall assume undivided responsibility for all components of the exterior panel system including, but not limited to attachment to sub-construction, panel to panel joinery, panel to dissimilar material joinery, and joint seal associated with the panel system.

Composite panel manufacturer shall have established a Certification Program acceptable to the local Code Authorities.

#### SUBMITTALS

##### Samples

Panel System Assembly: Two samples of each type of assembly.

Two samples of each color or finish selected.

##### Shop Drawings

Submit, upon request, design calculations from a registered professional engineer and shop drawings showing project layout and elevations; fastening and anchoring methods; detail and location of joints, sealants, and gaskets, including joints necessary to accommodate thermal movement; trim; flashing; and accessories.

Proof certifying material meets requirements specified, upon request.

Two copies of manufacturer's literature for panel material, upon request.

Alternate materials must be approved by the Engineer.

#### DELIVERY, STORAGE AND HANDLING

Protect finish and edges in accordance with panel manufacturer's recommendations.

Store material in accordance with panel manufacturer's recommendations.

#### WARRANTY

1. The contractor shall submit a warranty of five years.

The warranty shall include resistance to cyclonic winds of not less than 280 km/hr and watertightness.

The contractor shall submit a certificate from a registered professional engineer certifying that the claddings fixed in place shall withstand wind speed of not less than 280 km/hr. This certificate shall in no way waive or diminish the contractor's liability towards the employer.

#### Products

#### PANELS

##### Composite Panels

Items of the same function and performance, which have received prior approval from the engineer, shall be allowed for this project. Approval shall be based on documentation submitted showing the adequacy of the material.

Thickness: 4 mm

##### Product Performance:

Should be watertight

Should resist peeling off

Should be fire resistant: 1 to 2 hours

##### Finishes

Coil coated based Polyvinylidene Fluoride (PVDF) or Fluoro Ethylene – Alkyl Vinyl Ether (FEVE) resin in conformance with the following general requirements.

Color: Standard color as selected by the engineer from manufacturer's standard color palette.

Hard

Humidity Resistant

Salt Spray Resistant

Weather Exposure: Minimum color change, No checking, crazing, adhesion loss

Chemical Resistance

#### PANEL FABRICATION

##### System Characteristics

Plans, elevations, details, characteristics, and other requirements indicated are based upon standards by one manufacturer. It is intended that other manufacturers, receiving prior approval, may be acceptable, provided their details and characteristics comply with size and profile requirements, and material/performance standards.

System must not generally have any visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.

Fabricate panel system to dimension, size, and profile indicated based on a design temperature of 70°F.

Fabricate panel system so that no restraints can be placed on the panel, which might result in compressive skin stresses. The installation detailing shall be such that the panels remain flat regardless of temperature change and at all times remain air and water tight.

The finish side of the panel shall have a removable plastic film applied prior to fabrication, which shall remain on the panel during fabrication, shipping, and erection to protect the surface from damage.

##### System Type

Pressure Equalized Rain Screen System

System must provide air/vapor barrier

### System Performance

Composite panels shall be capable of withstanding building movements and weather exposures based on the following test standards required by the Engineer.

#### Wind Load

Panels shall be designed to withstand the Design Wind Load based upon cyclonic winds of the order of 280 Km/h.

#### Air/Water System Test

If system tests are not available, mock-ups shall be constructed and tests performed.

### ACCESSORIES

Extrusions, formed members, sheet, and plate shall conform to the recommendations of the manufacturer.

Panel stiffeners, if required, shall be structurally fastened or restrained at the ends and shall be secured to the rear face of the composite panel with silicone of sufficient size and strength to maintain panel flatness. Stiffener material and/or finish shall be compatible with the silicone.

Sealants and gaskets within the panel system shall be as per manufacturer's standards to meet performance requirements.

Fabricate flashing materials from 0.030" minimum thickness aluminum sheet painted to match the adjacent curtain wall / panel system where exposed. Provide a lap strap under the flashing at abutted conditions and seal lapped surfaces with a full bed of non-hardening sealant.

Fasteners (concealed/exposed/non-corrosive): Fasteners as recommended by panel manufacturer. Do not expose fasteners except where unavoidable and then match finish of adjoining metal.

### EXECUTION

#### INSPECTION

Surfaces to receive panels shall be even, smooth, sound, clean, dry and free from defects detrimental to work. Notify contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with erection until unsatisfactory conditions have been corrected.

Surfaces to receive panels shall be structurally sound as determined by a registered Engineer.

### INSTALLATION

Erect panels plumb, level, and true.

Attachment system shall allow for the free and noiseless vertical and horizontal thermal movement due to expansion and contraction for a material temperature range of -20°F to +180°F. Buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement will not be permitted. Fabrication, assembly, and erection procedure shall account for the ambient temperature at the time of the respective operation.

Panels shall be erected in accordance with an approved set of shop drawings.

Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.

Conform to panel fabricator's instructions for installation of concealed fasteners.

Do not install component parts that are observed to be defective, including warped, bowed, dented, abraded, and broken members.

Do not cut, trim, weld, or braze component parts during erection in a manner which would damage the finish, decrease strength, or result in visual imperfection or a failure in

performance. Return component parts which require alteration to shop for refabrication, if possible, or for replacement with new parts.

Separate dissimilar metals and use gasketed fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals.

#### ADJUSTING AND CLEANING

Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.

Repair panels with minor damage.

Remove masking (if used) as soon as possible after installation. Masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor.

Any additional protection, after installation, shall be the responsibility of the General Contractor.

Make sure weep holes and drainage channels are unobstructed and free of dirt and sealants. Final cleaning.

### **SPECIFICATIONS FOR PLATE LOADING TEST**

#### Plate Load Test

Plate Load Test is a field test for determining the ultimate bearing capacity of soil and the likely settlement under a given load. The Plate Load Test basically consists of loading a steel plate placed at the foundation level and recording the settlements corresponding to each load increment. The test load is gradually increased till the plate starts to sink at a rapid rate. The total value of load on the plate in such a stage divided by the area of the steel plate gives the value of the ultimate bearing capacity of soil. The ultimate bearing capacity of soil is divided by suitable factor of safety (which varies from 2 to 3) to arrive at the value of safe bearing capacity of soil. For better understanding, this Plate Load Test can be sub-divided into the following heads,

#### Test Setup:

A test pit is dug at site up to the depth at which the foundation is proposed to be laid. The width of the pit should be at least 5 times the width of the test plate. At the centre of the pit a small square depression or hole is made whose size is equal to the size of the test plate and bottom level of which corresponds to the level of actual foundation. The depth of the hole should be such that the ratio of depth to width of the loaded area is approximately the same as the ratio of the actual depth to width of the foundation.

The mild steel plate (also known as bearing plate) used in the test should not be less than 25 mm in thickness and its size may vary from 300 to 750 mm. The plate could be square or circular in shape. Circular plate is adopted in case of circular footing and square plate is used in all other types of footings. The plate is machined on side and edges.

#### Testing Procedure:

The load is applied to the test plate through a centrally placed column. The test load is transmitted to the column by gravity loading or reaction loading method.

#### Gravity loading or reaction loading method:

In case of gravity loading method, a loading platform is constructed over the column placed on the test plate and test load is applied by placing dead weight in the form of sand bags, pig iron, concrete blocks, lead bars etc. on the platform. Many a times a hydraulic jack is placed between the loading platform and the column top for applying the load to the test

plate – the reaction of the hydraulic jack being borne by the loaded platform. This form of loading is termed as reaction loading



## Drawings

### LIST OF DRAWINGS

Standard Chain Link Fencing Details	LM-FM-SD-CLF-01
Sliding Folding Door	LM-FM-SD-SDF-01
Concrete Work Top Details	LM-FM-SD-CWD-01
Type Flush Door Details	LM-FM-SD-FDD-01
Typical Light Partitions (Timber)	LM-FM-SD-TLP-01
Timber Balustade Details	LM-FM-SD-TBD-01
Entrance Gate (Type 1)	LM-FM-SD-EG-01
False Ceiling Standard Details	LM-FM-SD-FCD-01
Type Grease Trap	LM-FM-SD-TGT-01
High Level Glazed Cupboard Details	LM-FM-SD--GCD-01
High Level Glazed Cupboard Details	LM-FM-SD--GCD-02
Expansion Joint Details	LM-FM-SD-EJD-01
Expansion Joint Details	LM-FM-SD-EJD-02
Light Partition (Gypsum)	LM-FM-SD-LPG-01
Tropical Door (R.H.S Frame 50x25mm)	LM-FM-SD-TD-01
Podium Section & Details	LM-FM-SD-PSD-01
False Ceiling Details	LM-FM-SD-FCD-02
Handrail (Tubular) Details	LM-FM-SD-HTD-01
Metal Grating (light Duty) details	LM-FM-SD-MGD-01
Details of Boundary Wall 3.0m High	LM-FM-SD-DBW-01
Catch Pit & Soakaway	LM-FM-SD-CPS-01
Details of Tarmac	LM-FM-SD-DOT-01
Wall with High Level Fencing (5.75 m High) Details of Fencing, Post and Bracings (sheet 1)	LM-FM-SD-FEN-01
Wall With High Level Fencing (5.75 m High) Details of Fencing, Post and Bracings (sheet 2)	LM-FM-SD-FEN-02
RC Details of Drains (Type 1,11,111,1V,V & V1)	LM-FM-SD-DRA-01
Concrete Bench	LM-FM-SD-CON-01
RC Details of High-Level Fencing on Boundary Wall 1.8 m High Sheet 1	LM-FM-SD-FEN-03



RC Details of High-Level Fencing on Boundary Wall 1.8 m High Sheet 2	LM-FM-SD-FEN-04
Stainless Steel Handrail Grade 316	LM-FM-SD-SSH-01
Burglar proofing Details	LM-FM-SD-BPP-01
Typical Concrete Repair Details For Damaged Columns	LM-FM-SD-CON-02
Typical Concrete Repair Details For Damaged Beams	LM-FM-SD-CON-03
Typical Slab Repairs Detail (Replacement of Corroded / Rusted Reinforcement Bars	LM-FM-SD-CON-04
Typical Slab Repairs Detail (No Replacement of Corroded / Rusted Reinforcement Bars	LM-FM-SD-CON-05
General Notes for Repair Works	LM-FM-SD-CON-06
Details of French Drains	LM-FM-SD-DRA-02
Masonry Retaining Wall on RC Base	LM-FM-SD-CON-07
Car Shed (Metal Roofing Sheet)	LM-FM-SD-CSM-01
Access road Kerb and Drain	LM-FM-SD-DRA-03
False Ceiling without catwalk	LM-FM-SD-FCC-01
Access road Kerb and Drain	LM-FM-SD-DRA-04
Kerb, Pre cost Concrete, Slab and interlocking for paving block details	LM-FM-SD-DRA-05
RC Details of Heavy Dirty Main Holes	LM-FM-SD-SEW-01
Details of Canopy	LM-FM-SD-COP-01
Boundary Wall Entrance Gate (up to 7000m Wider and Pedestrian Cycle on Tract)	LM-FM-SD-DBW-02
The Boundary Wall detail	LM-FM-SD-DBW-03
Details of Car Shed (module of 2 Parking) Sheet 1 of 2	LM-FM-SD-CSM-02
Details of Car Shed (module of 2 Parking) Sheet 2 of 2	LM-FM-SD-CSM-03

## Description of Works

The works have been labelled as follows:

DEM	Demolition Works
CON	Concrete Works
REI	Reinforcement
FOR	Formworks
BLO	Block Works
FEN	Fencing Works
GAT	Gate
REP	Repair Works
TIL	Tiling Works
WAT	Waterproofing Works
PAT	Painting Works
TIM	Timber Works
ROO	Roofing Works
OPE	Opening works
PRO	Protective Works
STE	Steel Works
ALU	Aluminum Works
SIT	Site Works
MIS	Miscellaneous works
PLA	Plant/Equipment
LAB	Labour
MAT	Materials

## **DEMOLITION WORKS**

### **ITEM DEM 1**

#### **DEMOLITION OF MASONRY & CONCRETE STRUCTURES**

The price quoted for this item shall include:-

- \* Demolition of reinforced or unreinforced concrete or masonry structures including blockwall, masonry walls, concrete drains, kerbs, hydraulic structures, etc.;
- \* Removal and transport of materials to any distance to spoil tips as located by Contractor and approved by Engineer;
- \* Possible recuperation and reuse of demolished materials, including transport to Landscape Mauritius Ltd store, according to Engineer's instructions
- \* Costs associated with measures for the prevention of any damage to other structures and;
- \* Any miscellaneous cost which may arise.

The unit of measurement for item DEM 1 shall be volume of existing concrete or masonry members/components measured on site, prior to demolition, in **CUBIC METRES (m<sup>3</sup>)**.

### **ITEM DEM 2**

#### **CAREFUL DEMOLITION OF MASONRY & CONCRETE STRUCTURES**

The price quoted for this item shall include:-

- \* Careful demolition of reinforced or unreinforced concrete or masonry structures including blockwall, masonry walls, concrete drains, kerbs, hydraulic structures, etc. in situations where there is need to avoid damage to existing structures, e.g. forming an opening in an existing blockwall partition;
- \* Removal and transport of materials to any distance to spoil tips as located by Contractor and approved by Engineer;
- \* Possible recuperation and reuse of demolished materials, including transport to Landscape Mauritius Ltd store, according to Engineer's instructions
- \* Costs associated with measures for the prevention of any damage to other structures;
- \* Provision of scaffolding as required and;
- \* Any miscellaneous cost which may arise.

The unit of measurement for item DEM 2 shall be the volume of existing concrete or masonry members/components measured on site, prior to demolition, in **CUBIC METRES (m<sup>3</sup>)**.

### **ITEM DEM 3**

#### **CAREFUL DEMOLITION OF METALIC STRUCTURE**

The price quoted for this item shall include: -

- \* Careful demolition of metallic structures including poles hinges and metal supports and hooks trays, etc. in situations where there is need to avoid damage to existing structures.
- \* Removal and transport of materials to any distance to spoil tips as located by Contractor and approved by Engineer;
- \* Possible recuperation and reuse of removed materials, including transport to Landscape Mauritius Ltd store, according to Engineer's instructions

- \* Costs associated with measures for the prevention of any damage to other structures;
- \* Provision of scaffolding as required and;
- \* Any miscellaneous cost which may arise.

The unit of measurement for item DEM 2 shall be the volume of existing concrete or masonry members/components measured on site, prior to demolition, in **CUBIC METRES (m<sup>3</sup>)**.

## **CONCRETE WORKS**

### **ITEM CON 1**

#### **REINFORCED CONCRETE STRUCTURES**

The price quoted for this item shall include:-

- Preparatory works including trimming and levelling of foundation, hacking;
- Supply of all necessary plant and materials as per requirements and specifications;
- Provision of scaffolding as required;
- Erection of necessary formwork (where appropriate, to be measured and paid under item FOR 1);
- Provision of props as and where required;
- Supply, cutting, bending and placing into position of reinforcement as per specifications (where appropriate, to be measured and paid under item FOR 1);
- Supply and placing epoxy grouting compound epidermix or equivalent to Engineer's approval, (where appropriate, to be measured and paid under item REI 1);
- Mixing, placing and curing of concrete as per specifications;
- Striking of formwork;
- Testing at MNICD, MSB, University of Mauritius or other approved laboratory and submission of test results (including concrete cubes, slump, sieve analysis, test certificates of materials, etc) upon request of the Engineer and as per paragraph 1.10 of the General Specifications; and
- Any miscellaneous costs arising.

### **ITEM CON 1A**

#### **BLINDING LAYER CONCRETE GRADE 15**

The Unit of measurement for Item CON 1A shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of blinding concrete placed.

### **ITEM CON 1B**

#### **CONCRETE GRADE 25**

The Unit of measurement for Item CON 1B shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of concrete placed.

### **ITEM CON 1C**

#### **CONCRETE GRADE 30**

The Unit of measurement for Item CON 1C shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of concrete placed.

### **ITEM CON 2**

#### **RENDERING**

The price quoted for this item shall include:-

- Preparation of the surface, hacking of concrete, raking out joints of blockwork;

- Wetting of surface before applying rendering;
- Supply of all necessary materials and plant;
- Provision of scaffolding as required;
- Mixing and placing of rendering mix (1:3) of 20 mm minimum, in two layers;
- Finish to be as specified by the Engineer, wood float finish/sponge finish/trowel finish/tyrolean finish;
- Carting away excess materials and cleaning; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item CON 2 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of rendering completed.

## **FORMWORK**

The price quoted for this item shall include:-

- Preparatory works including trimming and levelling, etc;
- Supply of all necessary plant and materials as per requirements and specifications;
- Provision of scaffolding as required;
- Erection of necessary formwork (where appropriate, to be measured and paid under item FOR 1);
- Provision of props as and where required;
- Striking of formwork and ;
- Any miscellaneous costs arising.

### **ITEM FOR 1**

#### **FORMWORK (Wrot formwork)**

The Unit of measurement for Item FOR 1 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of formwork fixed.

## **REINFORCEMENT**

The price quoted for this item shall include:-

- Supply of all necessary plant and materials as per requirements and specifications;
- Supply, cutting, bending and placing into position of reinforcement as per specifications (where appropriate, to be measured and paid under item REI 1 );
- Supply and placing epoxy grouting compound epidermix or equivalent to Engineer's approval, (where appropriate, to be measured and paid under item MIS 1);
- Testing at MPI, MSB, University of Mauritius or other approved laboratory and submission of test results ( test certificates of reinforcement) upon request of the Engineer and as per paragraph 1.10 of the General Specifications; and
- Any miscellaneous costs arising

### **ITEM REI 1**

#### **REINFORCEMENT (MILD STEEL OR HIGH TENSILE STEEL)**

The Unit of measurement for Item REI 1 shall be the mass in **KILOGRAMME (kg)** of steel reinforcement used in the works.

## **BLOCK WORKS**

### **ITEM BLO 1**

#### **BLOCK WALL COMPLETE WITH R.C. COLUMNS**

The price quoted for this item shall include: -

- Excavation in any material including rock and removal of water for dry work;
- Supply of all necessary materials and plant;
- Provision of scaffolding as required;
- Mixing and placing of mortar and concrete;
- Supply and placing of 150 mm concrete blocks;
- Placing blinding concrete, strip footing, R.C. column (detachable where applicable) and foundations at 3m spacing, concrete copping;
- Rendering of all surfaces;
- Finish to be as specified by the Engineer, wood float finish/sponge finish/trowel finish/tyrolean finish;
- Testing at MNICD, MSB, University of Mauritius or other approved laboratory and submission of test results (including concrete cubes, slump, sieve analysis, test certificates of materials, etc) upon request of the Engineer and as per paragraph 1.10 of the General Specifications;
- Backfilling, carting away excess materials and cleaning; and
- Any miscellaneous costs which may arise.

The unit of measurement for Item BLO 1 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of block wall constructed.

### **ITEM BLO 2**

#### **REINFORCED BLOCK WALL COMPLETE WITH R.C.COLUMNS**

The price quoted for this item shall include:-

- Excavation in any material including rock and removal of water for dry work;
- Supply of all necessary materials and plant;
- Provision of scaffolding as required;
- Mixing and placing of mortar and concrete;
- Supply and placing of 200 mm concrete blocks;
- Supply and placing of infilled concrete Grade 25 and reinforcement bars(3Y8/block) in blocks;
- Placing blinding concrete, strip footing, R.C. column (detachable where applicable) and foundations at 3 m spacing, concrete copping;
- Rendering of all surfaces;
- Finish to be as specified by the Engineer, wood float finish/sponge finish/trowel finish/tyrolean finish;
- Testing at MNICD, MSB, University of Mauritius or other approved laboratory and submission of test results (including concrete cubes, slump, sieve analysis, test certificates of materials, etc) upon request of the Engineer and as per paragraph 1.10 of the General Specifications;
- Backfilling, carting away excess materials and cleaning; and
- Any miscellaneous costs which may arise.

The unit of measurement for Item BLO 2 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of reinforced block wall constructed.

**ITEM BLO 3**  
**BLOCKWORK**

The price quoted for this item shall include:-

- Supply and laying of blockwork; with a view to forming a wall or part thereof or constructing a row of blocks on an existing base, slab or wall. Rate to include for coping, for items BLO 3D, BLO 3E and BLO 3F;
- Supply of all necessary materials and plant;
- Provision of scaffolding as required;
- Carting away excess materials and cleaning; and
- Any miscellaneous costs which may arise.

**ITEM BLO 3A**  
**BLOCKWORK 100 mm**

The Unit of measurement for Item BLO 3A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of blockwork constructed.

**ITEM BLO 3B**  
**BLOCKWORK 150 mm**

The Unit of measurement for Item BLO 3B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of blockwork constructed.

**ITEM BLO 3C**  
**BLOCKWORK 200 mm**

The Unit of measurement for Item BLO 3C shall be the area in **SQUARE METRE (m<sup>2</sup>)** of blockwork constructed.

**ITEM BLO 3D**  
**BLOCKWORK 100 mm WITH COPING**

The Unit of measurement for Item BLO 3D shall be the area in **SQUARE METRE (m<sup>2</sup>)** of blockwork constructed.

**ITEM BLO 3E**  
**BLOCKWORK 150 mm WITH COPING**

The Unit of measurement for Item BLO 3E shall be the area in **SQUARE METRE (m<sup>2</sup>)** of blockwork constructed.

**ITEM BLO 3F**  
**BLOCKWORK 200 mm WITH COPING**

The Unit of measurement for Item BLO 3F shall be the area in **SQUARE METRE (m<sup>2</sup>)** of blockwork constructed.

**ITEM BLO 4**  
**BOUNDARY WALL (Drawings No (LM-FM-SD-FEN-03, LM-FM-SD-FEN-04, LM-FM-SD-DBW-01, LM-FM-SD-FEN-01, LM-FM-SD-FEN-02 & LM-FM-SD-DBW-03)**

The price quoted for this item shall include:-

- Excavation in any material including rock and removal of water for dry work;
- Supply of all necessary materials and plant;

- Provision of scaffolding as required;
- Mixing and placing of mortar and concrete;
  - Supply and placing of 150 mm or 200 mm concrete blocks as indicated on drawing, except that the effective height of the walls shall be measured on the external side, unless directed otherwise by the Engineer;
  - Supply and fixing of galvanised CHS, galvanised chain link (not plastic coated) fencing, barbed wire, razor blades, metal grating;
  - Placing blinding concrete, strip footing, R.C. column and foundations at 2.4m, 2.5m, 3m or 3.1 m spacing as indicated on drawing, concrete copping;
- Rendering of all surfaces;
- Construction of expansion joints;
  - Testing at MNICD, MSB, University of Mauritius or other approved laboratory and submission of test results (including concrete cubes, slump, sieve analysis, test certificates of materials, etc) upon request of the Engineer and as per paragraph 1.10 of the General Specifications;
- Backfilling, carting away excess materials and cleaning; and
- Any miscellaneous costs which may arise.

**ITEM BLO 4A****BOUNDARY WALL TYPE A – A1(With Barbed Wire)**

The unit of measurement for Item BLO 4A shall be the length in **LINEAR METRE (m)** of boundary wall constructed as per drawing No LM-FM-SD-DBW-03.

**ITEM BLO 4B****BOUNDARY WALL TYPE A – A2(With Razor Blade)**

The unit of measurement for Item BLO 4B shall be the length in **LINEAR METRE (m)** of boundary wall constructed as per drawing No LM-FM-SD-DBW-03.

**ITEM BLO 4C****BOUNDARY WALL TYPE A – A3(With Metal Grill)**

The unit of measurement for Item BLO 4C shall be the length in **LINEAR METRE (m)** of boundary wall constructed as per drawing No LM-FM-SD-DBW-03.

**ITEM BLO 4D****BOUNDARY WALL TYPE B**

The unit of measurement for Item BLO 4D shall be the length in **LINEAR METRE (m)** of boundary wall constructed as per drawing No LM-FM-SD-DBW-03.

**ITEM BLO 4E****BOUNDARY WALL TYPE C**

The unit of measurement for Item BLO 4E shall be the length in **LINEAR METRE (m)** of boundary wall constructed as per drawing No LM-FM-SD-DBW-03.

**ITEM BLO 4F****BOUNDARY WALL TYPE D**

The unit of measurement for Item BLO 4F shall be the length in **LINEAR METRE (m)** of boundary wall constructed as per drawing No LM-FM-SD-DBW-03.

**ITEM BLO 4G****BOUNDARY WALL TYPE E**



The unit of measurement for Item BLO 4G shall be the length in **LINEAR METRE (m)** of boundary wall constructed as per drawing No LM-FM-SD-DBW-03.

**ITEM BLO 4H**  
**BOUNDARY WALL 3 M HIGH**

The unit of measurement for Item BLO 4H shall be the length in **LINEAR METRE (m)** of boundary wall constructed as per drawing No LM-FM-SD-DBW-01.

**FENCING WORKS**

**FENCING WORKS FEN 1**

The price quoted for this item shall include:-

- Excavation in any material including rock and removal of water for dry work;
- Supply of all necessary materials and plant;
- Provision of scaffolding as required;
- Mixing and placing of mortar and concrete;
  - Supply and placing of 150 mm or 200 mm concrete blocks as indicated on drawing, except that the effective height of the walls shall be measured on the external side, unless directed otherwise by the Engineer;
  - Supply and fixing of galvanised CHS, galvanised chain link (not plastic coated) fencing, barbed wire, razor blades, metal grating;
  - Placing blinding concrete, strip footing, R.C. column and foundations at 2.4m, 2.5m, 3m or 3.1 m spacing as indicated on drawing, concrete copping;
- Rendering of all surfaces;
- Construction of expansion joints;
  - Testing at MNICD, MSB, University of Mauritius or other approved laboratory and submission of test results (including concrete cubes, slump, sieve analysis, test certificates of materials, etc) upon request of the Engineer and as per paragraph 1.10 of the General Specifications;
- Backfilling, carting away excess materials and cleaning; and
- Any miscellaneous costs which may arise.

**ITEM FEN 1A**  
**HIGH LEVEL FENCING**

The unit of measurement for Item FEN 1A shall be the length in **LINEAR METRE (m)** of high level fencing constructed as per drawings No G490/FA/24 & No G490/FA/25.

**ITEM FEN 1B**  
**HIGH LEVEL FENCING ON BOUNDARY WALL 1.8 M HIGH**

The unit of measurement for Item FEN 1B shall be the length in **LINEAR METRE (m)** of high level fencing constructed as per drawings No G490/FA/03 & No G490/FA/04.

**ITEM FEN 2**  
**GALVANISED CHAIN LINK (NOT PLASTIC COATED) FENCING ON EXISTING WALL OR BASE**

The price quoted for this item shall include:-

- \* Supply, assemble, erect galvanised chain link (not plastic coated) fencing, as per specifications, on an existing wall or base inclusive of all necessary fittings for fixing and assembly, breaking of concrete, supply and fixing of galvanised CHS and barbed wire, casting of concrete and rendering of new surfaces;

- \* Provision of scaffolding as required and;
- \* Any miscellaneous costs which may arise.

The Unit for Item 6 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of galvanised chain link (not plastic coated) fencing constructed as per drawing No LM-FM-SD-DBW-03 (top part of type D).

### **ITEM FEN 2A**

#### **HIGH LEVEL FENCING ON EXISTING WALL**

The price quoted for this item shall include:-

- Supply, assemble, erect high level fencing, as per drawing and specifications on drawing No LM-FM-SD-FEN-04, on an existing wall inclusive of all necessary fittings for fixing and assembly, breaking of concrete, supply and fixing of galvanised CHS and straining wire; casting of concrete and rendering of new surfaces;
- Provision of scaffolding as required and;
- Any miscellaneous costs which may arise.

The Unit for Item FEN 2A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of high level fencing constructed as per drawing No LM-FM-SD-FEN-04 (top part).

### **ITEM FEN 3**

#### **METAL GRILL ON EXISTING WALL**

The price quoted for this item shall include:-

- \* Supply, assemble, erect metal grill, as per specifications, on an existing wall inclusive of all necessary fittings for fixing and assembly, breaking of concrete, supply and fixing of galvanised solid metal and metal plates; casting of concrete and rendering of new surfaces;
- \* Prepare surface as required prior to painting works;
- \* Supply of paint as per specification;
- \* Apply one coat of primer, undercoat and two coats hard gloss paint to internal and external surfaces;
- \* Provision of scaffolding as required and;
- \* Any miscellaneous costs which may arise.

The Unit for Item FEN 3 shall be the length in **LINEAR METRE (m)** of metal grill constructed as per drawing No LM-FM-SD-DBW-03 (type A3).

### **ITEM FEN 4**

#### **BARBED WIRE ON EXISTING WALL**

The price quoted for this item shall include:-

- \* Supply, assemble, erect barbed wire, as per specifications, on an existing wall inclusive of all necessary fittings for fixing and assembly, breaking of concrete, supply and fixing of galvanised CHS; casting of concrete and rendering of new surfaces;
- \* Provision of scaffolding as required and;
- \* Any miscellaneous costs which may arise.

The Unit for Item FEN 4 shall be the length in **LINEAR METRE (m)** of barbed wire constructed as per drawing No LM-FM-SD-DBW-03 (type A1).

**ITEM FEN 4A**  
**RAZOR BLADE ON EXISTING WALL**

The price quoted for this item shall include:-

- \* Supply, assemble, erect razor blade & barbed wire, as per specifications, on an existing wall inclusive of all necessary fittings for fixing and assembly, breaking of concrete, supply and fixing of galvanised CHS; casting of concrete and rendering of new surfaces;
- \* Provision of scaffolding as required and;
- \* Any miscellaneous costs which may arise.

The Unit for Item FEN 4A shall be the length in **LINEAR METRE (m)** of wall provided with razor blades & barbed wire as per drawing No LM-FM-SD-DBW-03 (type A2).

**ITEM FEN 5**  
**REMOVE CHAIN LINK FENCING/BARBED WIRE/RAZOR BLADE**

The price quoted for this item shall include:-

- \* Removal of existing chain link fencing/barbed wire/razor blade and galvanised tubes;
  - \* Carting away of materials to any distance to approved spoil tips as located by contractor;
- \* Any miscellaneous costs which may arise.

The Unit for Item FEN 5 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of chain link fencing/barbed wire/razor blade removed.

**ITEM FEN 6**  
**GALVANISED CHAIN LINK (NOT PLASTIC COATED) FENCING (Standard Sheet LM-FM-SD-CLF-01)**

The price quoted for this item shall include:-

- \* Trimming ground on the line of fence, including excavation and backfilling;
  - \* Foundation works, including excavation, concreting (concrete grade 15), backfilling and compaction;
  - \* Disposal of surplus material;
  - \* Supply, assemble, erect galvanised chain link (not plastic coated) fencing as per drawing and specifications and inclusive of all necessary fittings for fixing and assembly;
  - \* Provision of scaffolding as required;
  - \* Carting away excess materials and cleaning; and
  - \* Any miscellaneous costs which may arise.

The Unit for Item FEN 6 shall be the length in **LINEAR METRE (m)** of fence constructed as per standard sheet LM-FM-SD-CLF-01.

**ITEM FEN 6A**  
**SUPPLY AND FIXING GALVANISED CHAIN LINK FENCING (NOT PLASTIC COATED)**

The price quoted for this item shall include:-

- Supply and fixing of galvanized chain link (not plastic coated) fencing for replacement of damaged fencing by new, as per drawing and specifications on Standard Sheet LM-FM-SD-CLF-01, inclusive of all necessary fittings for fixing and assembly;
- Provision of scaffolding as required;

- Carting away excess materials and cleaning; and
- Any miscellaneous costs which may arise.

The Unit for Item FEN 6A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of chain link fencing replaced.

#### **ITEM FEN 7**

##### **RAZOR BLADES SECURITY ON EXISTING WALL OR FENCING**

The price quoted for this item shall include:-

- \* Supply, assemble, erect galvanised steel helicoidal razor blades security, diameter 450 mm - 500 mm, 250 mm spacing, on an existing wall or fencing inclusive of all necessary galvanised pipes and fittings for fixing and assembly, breaking of concrete, casting of concrete and rendering of new surfaces;
- \* Provision of scaffolding as required and;
- \* Any miscellaneous costs which may arise.

The Unit for Item FEN 7 shall be the length in **LINEAR METRE (m)** of wall provided with razor blades.

#### **GATE**

##### **ITEM GAT 1**

##### **ENTRANCE GATE**

The price quoted for this item shall include:-

- Supply of all necessary materials and plant;
- Supply of hot-dipped galvanised metal entrance gate;
- Fixing of gate to columns (R.C.columns to be paid separately under relevant items of the schedule of rates);
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat of primer, undercoat and two coats hard gloss paint to internal and external surfaces;
- Provision of scaffolding as required;
- Any miscellaneous cost which may arise.

The unit of measurement for Item GET 1 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of gate constructed as per drawing No LM-FM-SD-DBW-02.

##### **ITEM GAT 2**

##### **ENTRANCE GATE (Standard sheet LM-FM-SD-EG-01)**

The price quoted for this item shall include:-

- Supply of all necessary materials and plant;
- Supply of hot-dipped galvanised metal entrance gate;
- Fixing of gate to columns (R.C.columns to be paid separately under relevant items of the schedule of rates);
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat of primer, undercoat and two coats hard gloss paint to internal and external surfaces;
- Provision of scaffolding as required;
- Any miscellaneous cost which may arise.

The unit of measurement for Item GAT 2 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of gate constructed as per standard sheet LM-FM-SD-EG-01.

**ITEM GAT 3**  
**PEDESTRIAN GATE**

The price quoted for this item shall include:-

- Supply of all necessary materials and plant;
- Supply of hot-dipped galvanised metal pedestrian gate;
- Fixing of gate to columns (R.C. columns to be paid separately under relevant items of the schedule of rates);
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat of primer, undercoat and two coats hard gloss paint to internal and external surfaces;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item GAT 3 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of gate constructed as per drawing No LM-FM-SD-DBW-02.

**ITEM GAT 4**  
**PEDESTRIAN GATE (Standard sheet LM-FM-SD-EG-01)**

The price quoted for this item shall include:-

- Supply of all necessary materials and plant;
- Supply of hot-dipped galvanised metal pedestrian gate;
- Fixing of gate to columns (R.C. columns to be paid separately under relevant items of the schedule of rates);
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat of primer, undercoat and two coats hard gloss paint to internal and external surfaces;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item GAT 4 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of gate constructed as per standard sheet LM-FM-SD-EG-01.

**ITEM GAT 5**  
**REMOVE GATE**

The price quoted for this item shall include:-

- \* Removal of existing gate and handing over to Client or carting away to approved spoil tips as located by contractor;
- \* Any miscellaneous costs which may arise.

The Unit for Item GAT 5 shall be per **UNIT** of gate removed.

**REPAIRS WORKS**

**ITEM REP 1**  
**REPAIRS TO SPALLING CONCRETE (Drawings No LM-FM-SD-CON-02, LM-FM-SD-CON-03, LM-FM-SD-CON-04, LM-FM-SD-CON-05, LM-FM-SD-CON-06)**

The price quoted for this item shall include: -

- Repairs to spalling concrete as per drawings;
- Supply of all necessary materials and plant;
- Cleaning and washing of existing concrete surface and treatment with epidermix 344 or equivalent to Engineer's approval;
- Apply, to existing reinforcement bars, epoxy zinc rich primer e.g Nitoprime Zincrich or equivalent strictly as per Manufacturer's specification and to Engineer's approval;
- Apply, at spalled location of slab, one coat of Nitobond HAR primer, or equivalent followed by Renderoc HB or equivalent well compacted to full thickness and levelled to existing concrete;
- Provision of scaffolding as required;
- Carting away excess materials and cleaning; and
- Any miscellaneous cost which may arise.

#### **ITEM REP 1A**

##### **REPAIRS TO COLUMNS**

The unit of measurement for Item REP 1A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of repaired area as per drawing No LM-FM-SD-CON-02 & LM-FM-SD-CON-06.

#### **ITEM REP 1B**

##### **REPAIRS TO BEAMS**

The unit of measurement for Item REP 1B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of repaired area as per drawing No LM-FM-SD-CON-03 & LM-FM-SD-CON-06.

#### **ITEM REP 1C**

##### **REPAIRS TO SLAB (REPLACEMENT OF REINFORCEMENT BARS)**

The unit of measurement for Item REP 1C shall be the area in **SQUARE METRE (m<sup>2</sup>)** of repaired area as per drawing No LM-FM-SD-CON-04 & LM-FM-SD-CON-06.

#### **ITEM REP 1D**

##### **REPAIRS TO SLAB (NO REPLACEMENT OF REINFORCEMENT BARS)**

The unit of measurement for Item REP 1D shall be the area in **SQUARE METRE (m<sup>2</sup>)** of repaired area as per drawing No LM-FM-SD-CON-05 & LM-FM-SD-CON-06.

#### **ITEM REP 2**

##### **REPAIR OF CRACKS**

The price quoted for this item shall include:-

- Identify and mark areas needing crack repairs in presence of the Engineer or his representative;
- Prepare surface prior to repair works according to Manufacturer's specifications;
  - Supply and apply approved product according to manufacturer's specifications. The product for the repair of cracks should be elastic, highly adhesive, non-flowing, non-shrinkable, non-corrosive and resistant to ageing and bad weather, of type Sikaflex Pro 11FC or Sikacryl S-A or equivalent to Engineer's approval;
- Painting of repaired areas as required;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The Unit of measurement for Item REP 2 shall be the length in **LINEAR METRE (m)** of crack sealed.

## **TILING WORKS**

### **ITEM TIL 1**

#### **REMOVAL OF EXISTING TILES**

The price quoted for this item shall include:-

- Removal of existing ceramic tiles including loose/damaged screed and cart away, Cleaning;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item TIL 1 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tiles removed.

### **ITEM TIL 2**

#### **REMOVAL OF EXISTING VINYL FLOORING**

The price quoted for this item shall include:-

- Removal of existing vinyl flooring and cart away;
- Cleaning and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item TIL 2 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of vinyl removed.

### **ITEM TIL 3**

#### **HEAVY DUTY HOMOGENEOUS VINYL IN ROLLS, MINIMUM 2.0 MM THICK**

The price quoted for this item shall include:-

- Preparation of the surface to receive new vinyl flooring;
- Removal of furniture and re-placing;
- Supply of all necessary materials and plant;
- Laying of coloured heavy duty, homogeneous vinyl flooring 2.0 mm thick specially made for use in Hospital, as per Manufacturer's Specifications with approved adhesives, colour to Engineer's approval;
- Vinyl flooring to be laid with a continuous riser on the wall to give a skirting of 125 mm height ended with rounded PVC strips;
- All joints to be seam welded with appropriate rod for a continuous finish; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item TIL 3 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of vinyl laid.

### **ITEM TIL 4**

#### **TILING (WALLS/CONCRETE WORKTOP)**

The price quoted for this item shall include:-

- Preparation of the surface to receive new ceramic tiles;
- Supply of all necessary materials and plant including tilefix cement;
- Laying of coloured glazed ceramic tiles to EN177 (200x200x6mm) (sample to be submitted for approval – refer paragraph 1.10 of the General Specifications), pvc corner strips to be provided to all vertical & horizontal edges;
- Filling of joints with cement based grout to Engineer's approval;

- Provision of scaffolding as required;
- Carting away excess materials and cleaning; and
- Any miscellaneous cost which may arise.

NOTE: Other dimensions of tiles may be used subject to approval.

The unit of measurement for Item TIL 4 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tiles laid.

#### **ITEM TIL 5**

##### **GRANITE TILES (Floor/Walls/Worktop)**

The price quoted for this item shall include:-

- Preparation of the surface to receive the tiles;
- Supply of all necessary materials and plant including pointing with coloured cement and joints filled with cement based grout of approved make and colour;
- Laying of granite tiles 10mm thick (sample to be submitted for approval – refer paragraph 1.10 of the General Specifications) on floor/walls/worktops;
- Laying of granite tiles on borders, cornices and inlays;
- Provision of scaffolding as required;
- Carting away excess materials and cleaning; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item TIL 5 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tiles laid.

#### **ITEM TIL 6**

##### **GRANITE SLAB**

The price quoted for this item shall include:-

- Preparation of the surface to receive the slab;
- Supply of all necessary materials and plant including pointing with coloured cement and joints filled with cement based grout of approved make and colour;
- Laying of polished granite slab 20 mm thick (sample to be submitted for approval – refer paragraph 1.10 of the General Specifications) on floor/walls/worktops;
- Cut outs to any shape to accommodate wash hand basins or any accessories;
- Rounding/chamfering and polishing of edges;
- Provision of scaffolding as required;
- Carting away excess materials and cleaning; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item TIL 6 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of slab laid.

#### **ITEM TIL 7**

##### **TILING (FLOOR)**

The price quoted for this item shall include:-

- Preparation of the surface to receive new tiles including levelling;
- Removal of furniture and re-placing;
- Removal of flush doors, raising as required and re-fixing;



- Supply of all necessary materials and plant including tilefix cement;
  - Laying of tiles 300x300 or 400x400 or 600x600 of thickness 8mm or 10mm as specified (sample to be submitted for approval – refer paragraph 1.10 of the General Specifications);
- Filling of joints with cement based grout to Engineer's approval;
- Carting away excess materials and cleaning; and
- Any miscellaneous cost which may arise.

NOTE: Other dimensions of tiles may be used subject to approval.

#### **ITEM TIL 7A**

#### **HOMOGENEOUS NON-SKID CERAMIC TILES 8 MM THICK TO EN 176 OR LATEST**

The unit of measurement for Item TIL 7A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tiles laid.

#### **ITEM TIL 7B**

#### **HOMOGENEOUS NON-SKID CERAMIC TILES 10 MM THICK TO EN 176 OR LATEST**

The unit of measurement for Item TIL 7B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tiles laid.

#### **ITEM TIL 7C**

#### **ANTI-SKID PORCELAIN POLISHED FINISHED TILES 8 MM THICK TO EN 176 OR LATEST**

The Unit of measurement for Item TIL 7C shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tiles laid.

#### **ITEM TIL 7D**

#### **ANTI-SKID PORCELAIN POLISHED FINISHED TILES 10 MM THICK TO EN 176 OR LATEST**

The Unit of measurement for Item TIL 7D shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tiles laid.

### **WATERPROOFING WORKS**

#### **ITEM WAT 1**

#### **REMOVAL OF EXISTING WATERPROOFING MEMBRANE**

The price quoted for this item shall include:-

- Removal of existing waterproofing membrane and cart away;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item WAT 1 shall be the area in **SQUARE METRE**

(m<sup>2</sup>) of waterproofing membrane removed.

### **ITEM WAT 2**

#### **REMOVAL OF EXISTING PLASTERING/SCREED**

The price quoted for this item shall include :-

- Removal of existing plastering/screed to ceiling/roof/wall/floor and cart away;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item WAT 2 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of plastering/screed removed.

### **ITEM WAT 3**

#### **TREATMENT OF JOINTS**

The price quoted for this item shall include:-

- Treatment of expansion joints as per Standard Sheet LM-FM-SD-EJD-01,02;
- Provision of sealant, flexcell and aluminium/galvanised iron flashing as per manufacturer's instructions and to Engineer's approval;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item WAT 3 shall be the length in **LINEAR METRE (m)** of joint treated as per standard sheet LM-FM-SD-EJD-01,02.

### **ITEM WAT 4**

#### **NEW ROOF SCREED**

The price quoted for this item shall include:-

- Preparation of surface to receive new screed;
- Supply of all necessary materials and plant;
- Mixing and placing new screed of minimum thickness 20 mm (1:3 mix and slope 1:100), to falls and crossfalls, with approved bonding agent and waterproofing compound mixed strictly in accordance with the manufacturer's instructions;
- Provision of scaffolding as required;
- Any miscellaneous cost which may arise.
- If average thickness exceeds 50mm, payment will be done as follows:

Rate X Actual Average Thickness

50

The unit of measurement for Item WAT 4 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of new screed laid.

**ITEM WAT 5****NEW FLOOR SCREED**

The price quoted for this item shall include:-

- Preparation of surface to receive new screed;
- Supply of all necessary materials and plant;
- Supply and placing of approved damp-proof sheetings;
  - Mixing and placing new screed of minimum thickness 20 mm (1:3 mix), with approved bonding agent;
  - Any miscellaneous cost which may arise.

The unit of measurement for Item WAT 5 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of new screed laid.

**ITEM WAT 6****WATERPROOFING MEMBRANE**

The price quoted for this item shall include:-

- Preparation of surface to receive new waterproofing membrane;
- Supply of all necessary materials and plant;
- Provision of scaffolding as required;
  - Submission of samples of waterproofing and technical literature to Engineer for approval prior to laying (refer paragraph 1.10 of the General Specifications);
- Laying of waterproofing membrane to specifications including closing over parapet walls, at rainwater pipes;
- Carry out no-ponding test to verify adequacy of screed slope;
- Carry-out 24 hours water test to verify leakage;
- Submission of 10 years guarantee certificate and;
- Any miscellaneous cost which may arise.

N.B: Closing over parapet wall to extend over parapet by a minimum 300mm, cut neat horizontally and painted over same colour as previous.

The unit of measurement for Item WAT 6 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of new waterproofing membrane laid.

**ITEM WAT 7****WATERPROOFING PAINT**

The price quoted for this item shall include:-

- Preparation of surface to receive new waterproofing paint;
  - Removal of loose paint including washing with high pressure jet and repair of minor cracks with appropriate crack filler;
  - Biocidal wall wash and fungicidal treatment;
  - Prepare surface as required prior to painting works including any treatment required;
  - Apply glass fibres paint reinforcing tissue;
  - Apply flexible acrylic emulsion paint;
  - \* Provision of scaffolding as required;

- \* Submission of technical literature to Engineer for approval prior to painting (refer paragraph 1.10 of the General Specifications); and
- Any miscellaneous cost which may arise.

The unit of measurement for Item wat 7 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of surface painted.

## **PAINTING WORKS**

### **ITEM PAI 1**

#### **PAINTING CONCRETE SURFACE**

The price quoted for this item shall include:-

- Removal of loose paint including washing with high pressure jet and repair of minor cracks with crack filler;
- Prepare surface as required prior to painting works including any treatment required;
- Supply of paint as per specification;
- Apply one coat of undercoat and two coats of paint;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

### **ITEM PAI 1A**

#### **ANTI-FUNGUS PAINT**

The unit of measurement for Item PAI 1A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of surface painted.

### **ITEM PAI 1B**

#### **EMULSION PAINT**

The unit of measurement for Item PAI 1B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of surface painted.

### **ITEM PAI 1C**

#### **CHLORINATED RUBBER PAINT**

The unit of measurement for Item PAI 1C shall be the area in **SQUARE METRE (m<sup>2</sup>)** of surface painted.

### **ITEM PAI 1D**

#### **HARD GLOSS PAINT**

The unit of measurement for Item PAI 1D shall be the area in **SQUARE METRE (m<sup>2</sup>)** of surface painted.

### **ITEM PAI 1E**

#### **FLOOR DRESSING PAINT**

The unit of measurement for Item PAI 1E shall be the area in **SQUARE METRE (m<sup>2</sup>)** of surface painted.

**ITEM PAI 1F****VIP SATIN PAINT**

The unit of measurement for Item PAI 1F shall be the area in **SQUARE METRE (m<sup>2</sup>)** of surface painted.

**ITEM PAI 2****PAINTING OF OTHER SURFACES****ITEM PAI 2A****PAINTING METAL SURFACES**

The price quoted for this item shall include:-

- Remove existing paint including cleaning;
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat of primer, undercoat and two coats hard gloss paint to internal and external surfaces;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item PAI 2A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of opening.

**ITEM PAI 2B****PAINTING WOODEN SURFACES**

The price quoted for this item shall include:-

- Remove existing paint including cleaning;
- Prepare surface as required prior to painting works;
- Brush pore sealant to surface;
- Supply of paint as per specification;
- Apply priming coat and two coats hard gloss enamel;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item PAI 2B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of surface painted.

**ITEM PAI 3****PAINTING OF ROAD MARKINGS**

The price quoted for this item shall include:-

- Remove existing paint including cleaning from any surface;
- Prepare surface as required prior to painting works;
- Supply of road marking paint as per specification;
- Apply paint as per manufacturer's instructions, and as directed by the Engineer;
- Provision of any traffic control measures, including traffic cones, lighted beacons etc as directed and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item PAI 3 shall be the area in **SQUARE METRE (m<sup>2</sup>)**

of surface delimited by the painting.

### **ITEM PAI 3A**

#### **PAINTING OF LETTERING**

The price quoted for this item shall include:-

- Remove existing paint including cleaning from any surface;
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Marking of lettering as per Engineer's instructions;
- Apply paint as per manufacturer's instructions, and as directed by the Engineer;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item PAI 3A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of surface painted.

### **TIMBER WORKS**

#### **ITEM TIM 1**

#### **REPAIRS TO WOODEN ROOF TRUSSES / NEW WOODEN ROOF TRUSSES**

The price quoted for this item shall include:-

- Removal of defective/damaged timber elements and cart away or deliver to M.P.I store according to Engineer's instructions, if applicable;
- Supply and fix new structural timber member (treated kerwin or approved equivalent); Typical sizes are:  
200x200mm,150x150mm,150x100mm,100x100mm,100x75mm, 25-50x300mm, 25-50x250mm,25-50x200mm,25-50x150mm,25-50x100mm, 25-50x75mm,25-50x50mm
- Fixation with gusset plates 10 mm thick(galvanised) with galvanised bolts and nuts;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item IM 1 shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of timber supplied & fixed.

#### **ITEM TIM 2**

#### **REPAIRS TO WOODEN SHINGLES AND BOARDS / NEW WOODEN SHINGLES AND BOARDS**

The price quoted for this item shall include:-

- Removal of defective/damaged timber shingles/board and cart away or deliver to Landscape store according to Engineer's instructions, if applicable;
- Supply and fix new timber shingles (treated teakwood) and tongue & groove timber boards (treated kerwin or equivalent) (200 x 25), (samples to be submitted for approval);
- Supply and fixing of bituminous roof felt (sample to be submitted for approval);
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item TIM 2 shall be area in **SQUARE METRE (m<sup>2</sup>)** of repaired area.

### **ITEM TIM 3**

#### **REPAIRS TO FALSE CEILING**

The price quoted for this item shall include:-

- Removal of all defective/damaged plywood sheets and battens/lippings and cart away;
- Removal of all defective/damaged framework and cart away;
- Supply and Erection of new timber framework (refer Std Sheet LM-FM-SD-FCD-01);
  - Supply and Fixing of plywood sheets 6mm thick including all fasteners;
  - Supply and fixing of lippings to cover underside of suspended framework;
  - Apply varnish or paint finish (hard gloss enamel);
  - Provision of scaffolding as required and;
  - Any miscellaneous cost which may arise due to the presence of existing services, etc...

The unit of measurement for Item TIM 3 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of false ceiling fixed.

### **ITEM TIM 4**

#### **REPAIRS TO WOODEN PARTITION**

The price quoted for this item shall include:-

- Removal of all defective/damaged plywood sheets and cart away;
- Removal of all defective/damaged framework and cart away;
- Supply and Erection of new timber framework (refer Std Sheet LM-FM-SD-TLP-01);
- Supply and Fixing of plywood sheets 6mm thick including all fasteners;
- Apply varnish or paint finish (hard gloss enamel);
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item TIM 4 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of partition fixed.

### **ITEM TIM 5**

#### **REPAIRS TO WOODEN FLOORS / NEW WOODEN FLOORS**

The price quoted for this item shall include:-

- Removal of defective/damaged timber elements including planks, joists, skirting and cart away or deliver to M.P.I store according to Engineer's instructions, if applicable;
- Supply and fix new structural timber member (treated kerwin or equivalent to Engineer's approval); Typical sizes for planks are: 25mmx150-200mm, 50mmx15-200mm
- Fixation with appropriate fasteners;
- Apply varnish or paint as per Engineer's instruction;
- Provision of scaffolding as required and;

- Any miscellaneous cost which may arise.

The unit of measurement for Item TIM 5 shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of timber fixed.

#### **ITEM TIM 6**

##### **PARQUET FLOORING**

The price quoted for this item shall include:-

- Preparation of surface to receive parquet flooring;
- Supply and fix new treated Teakwood parquet flooring; Typical sizes are: 8 mm x 50 mm x 200 mm and 20 mm x 75 mm x 1-2 m long (samples to be submitted for approval);
- Polish and apply varnish and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item TIM 6 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of parquet flooring fixed.

#### **ITEM TIM 7**

##### **POLISHING/VARNISHING PARQUET FLOORING**

The price quoted for this item shall include:-

- Polish and apply varnish to parquet flooring and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item TIM 7 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of parquet flooring polished and varnished.

#### **ITEM TIM 8**

##### **LAMINATED WOODEN FLOORING**

The price quoted for this item shall include:-

- Preparation of surface to receive laminated wooden flooring;
- Supply and fix new treated laminated wooden flooring; Typical sizes are: 8 mm x 50 mm x 200 mm and 20 mm x 75 mm x 1-2 m long (samples to be submitted for approval), complete with underlaying damp-proof sheeting;
- Polish, seal and clean as per Manufacturer's specifications and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item TIM 8 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of laminated wooden flooring fixed.

## **ROOFING WORKS**

#### **ITEM ROO 1**

##### **REMOVAL OF EXISTING ROOFING SHEETS**

The price quoted for this item shall include:-

- Removal of existing roofing sheets including gutters/rain water pipes and cart away or deliver to Landscape store according to Engineer's instructions;



- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item ROO 1 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of roofing removed.

### **ITEM ROO 2**

#### **REMOVAL OF EXISTING FALSE CEILING**

The price quoted for this item shall include:-

- Removal of existing false ceiling including plywood/battens/lippings/framework and cart away;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise due to the presence of existing services, etc...

The unit of measurement for Item ROO 2 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of false ceiling removed.

### **ITEM ROO 3**

#### **REMOVAL OF EXISTING FALSE CEILING AND RE-FIXING**

The price quoted for this item shall include:-

- Removal of existing false ceiling including plywood/battens/lippings/framework and store in a safe place for re-use;
- Re-fixing false ceiling including plywood/battens/lippings/framework, fittings and fasteners required;
- Provision of scaffolding as required and;
  - Any miscellaneous cost which may arise.

The unit of measurement for Item ROO 3 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of false ceiling re-fixed.

### **ITEM ROO 4**

#### **REMOVAL OF EXISTING SKIRTINGS**

The price quoted for this item shall include:-

- Removal of existing skirtings and cart away;
- Cleaning and;
- Any miscellaneous cost which may arise.

The Unit of measurement for Item ROO 4 shall be the length in **LINEAR METRE (m)** of skirting removed.

### **ITEM ROO 5**

#### **NEW ROOFING INCLUDING GUTTERS AND RAIN WATER PIPES**

The price quoted for this item shall include:-

- Supply and fix new pre-painted (both sides) and profilated, galvanised metal sheets or zinc & aluminium sheets, to roof including ridges, valleys, flashing and necessary fittings and accessories for fixing all as per manufacturer's specifications;
- Supply and fix new gutters and rain water pipes;

- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

**ITEM ROO 5A****ROOFING SHEETS OF NOMINAL THICKNESS 0.75 MM**

The unit of measurement for Item ROO 5A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of roofing fixed.

**ITEM ROO 5B****ROOFING SHEETS OF NOMINAL THICKNESS 0.63 MM**

The unit of measurement for Item ROO 5B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of roofing fixed.

**ITEM ROO 6****NEW ROOFING**

The price quoted for this item shall include:-

- Supply and fix new pre-painted (both sides) and profilated, galvanised metal sheets or zinc & aluminium sheets, to roof including ridges, valleys, flashing and necessary fittings and accessories for fixing all as per manufacturer's specifications;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

**ITEM ROO 6A****ROOFING SHEETS OF NOMINAL THICKNESS 0.75 MM**

The unit of measurement for Item ROO 6A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of roofing fixed.

**ITEM ROO 6B****ROOFING SHEETS OF NOMINAL THICKNESS 0.63 MM**

The unit of measurement for Item ROO 6B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of roofing fixed.

**ITEM ROO 7****PVC GUTTER**

The price quoted for this item shall include:-

- Removal of existing gutter;
- Supply and fix new gutter to roof including flashing, complete with necessary fittings and accessories for fixing all as per manufacturer's specifications;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise

**ITEM ROO 7A****GUTTER OF NOMINAL DIAMETER 75MM**

The unit of measurement for Item ROO 7A shall be the area in **LINEAR METRE (m)** of gutter fixed.

**ITEM ROO 7B****GUTTER OF NOMINAL DIAMETER 100MM**

The unit of measurement for Item ROO 7B shall be the area in **LINEAR METRE (m)** of gutter fixed.

**ITEM ROO 8****NEW EAVES/FACIA BOARD**

The price quoted for this item shall include:-

- Supply and Fixing of new eaves/facia board treated meranti timber 200 mm x 25 mm including all fasteners;
- Apply paint finish;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The Unit of measurement for Item ROO 8 shall be the length in **LINEAR METRE (m)** of board fixed.

**ITEM ROO 9****NEW SKIRTINGS**

The price quoted for this item shall include:-

- Displacement of furniture as required;
- Supply and fixing of moulded timber skirtings (teak/sapele wood) 100mmx12mm or rounded edge coloured ceramic tiles skirtings 100mmx8mm, sample to be submitted for approval prior to fixing – refer to paragraph 1.10 of the General Specifications;
- Polish and Apply sealant followed by varnish or paint finish (hard gloss enamel) and;
- Any miscellaneous cost which may arise.

**ITEM ROO 9A****NEW SKIRTINGS - WOODEN**

The Unit of measurement for Item ROO 9A shall be the length in **LINEAR METRE (m)** of skirting fixed.

**ITEM ROO 9B****NEW SKIRTINGS - CERAMIC**

The Unit of measurement for Item ROO 9B shall be the length in **LINEAR METRE (m)** of skirting fixed.

**ITEM ROO 9C****NEW SKIRTINGS - PVC**

The Unit of measurement for Item ROO 9C shall be the length in **LINEAR METRE (m)** of skirting fixed.

**ITEM ROO 10A****FALSE CEILING (Standard Sheet LM-FM-SD-FCD-01)**

The price quoted for this item shall include:-

- Manufacture false ceiling as per Standard Sheet;
- Supply of all necessary materials;

- Fixing in position complete with framework, distant 600mm centre to centre from each other;
- Apply sealant followed by varnish or paint finish (hard gloss enamel) as per Engineer's instructions;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item ROO 10A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of false ceiling constructed as per standard sheet LM-FM-SD-FCD-01.

### **ITEM ROO 10B**

#### **FALSE CEILING WITHOUT CATWALK (Drawing No LM-FM-SD-FCC-01)**

The price quoted for this item shall include:-

- Manufacture false ceiling as per Standard Sheet;
- Supply of all necessary materials;
  - Fixing in position complete with framework;
  - Apply sealant followed by varnish or paint finish (hard gloss enamel) as per Engineer's instructions;
  - Provision of scaffolding as required and;
  - Any miscellaneous cost which may arise.

The unit of measurement for Item ROO 10B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of false ceiling constructed as per drawing No LM-FM-SD-FCC-01.

### **ITEM ROO 10C**

#### **FALSE CEILING WITH GYPSUM BOARD (Standard Sheet 580)**

The price quoted for this item shall include:-

- Manufacture false ceiling as per Standard Sheet, but with gypsum board of at least 15mm thick;
- Supply of all necessary materials;
  - Fixing in position complete with aluminium framework;
  - Provision of scaffolding as required and;
  - Any miscellaneous cost which may arise.

The unit of measurement for Item ROO 10C shall be the area in **SQUARE METRE (m<sup>2</sup>)** of false ceiling constructed as per standard sheet 580.

### **ITEM ROO 10D**

#### **PVC FALSE CEILING**

The price quoted for this item shall include:-

- Manufacture false ceiling with PVC panels of at least 10mm thick;
- Supply of all necessary materials;
  - Fixing in position complete with aluminium/galvanized steel framework;
  - Provision of scaffolding as required and;
  - Any miscellaneous cost which may arise.

The unit of measurement for Item ROO 10D shall be the area in **SQUARE METRE (m<sup>2</sup>)** of false ceiling constructed.

### **ITEM OPE 1**

#### **PARTITIONS (Standard Sheets LM-FM-SD-TLP-01, 553, 423)**

The price quoted for this item shall include:-

- Manufacture partition/sliding folding door as per Standard Sheet;
- Supply of all necessary materials; Fixing partition/sliding folding door in position;
- Supply and fixing of 4/6 mm clear or frosted glass as per Engineer's instruction;
  - Apply sealant followed by varnish or paint finish (hard gloss enamel) as per Engineer's instructions;
  - Provision of scaffolding as required and;
  - Any miscellaneous cost which may arise.

### **ITEM OPE 1A**

#### **TYPES P1,P2,P3 – WOODEN – 4 mm thick Plywood**

The unit of measurement for Item OPE 1A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of partition constructed as per standard sheet LM-FM-SD-TLP-01 but with 4 mm clear or frosted glass.

### **ITEM OPE 1B**

#### **TYPES P1,P2,P3 – WOODEN – 6 mm thick Plywood**

The unit of measurement for Item OPE 1B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of partition constructed as per standard sheet LM-FM-SD-TLP-01 but with 6 mm thick plywood and 4 mm clear or frosted glass.

### **ITEM OPE 1C**

#### **SLIDING FOLDING DOOR**

The unit of measurement for Item OPE 1C shall be the area in **SQUARE METRE (m<sup>2</sup>)** of partition constructed as per standard LM-FM-SD-SFD-01.

### **ITEM OPE 1D**

#### **TYPES LP1,LP2,LP3, LPS - GYPSUM**

The unit of measurement for Item OPE 1D shall be the area in **SQUARE METRE (m<sup>2</sup>)** of partition constructed as per standard sheet LM-FM-SD-LPG-01 but with 6 mm clear or frosted glass.

### **ITEM OPE 2**

#### **FLUSH DOORS (Standard sheet LM-FM-SD-FDD-01)**

The price quoted for this item shall include:-

- Manufacture flush door as per Standard Sheet;
- Supply of all necessary materials;
- Provision of scaffolding as required;
- Fixing in position complete with framework and architraves;
- Supply and fixing of door handles/door lock;
- Apply sealant followed by varnish or paint (hard gloss enamel) as per Engineer's instruction and;

- Any miscellaneous cost which may arise.

### **ITEM OPE 2A**

#### **TYPE A**

The unit of measurement for Item OPE 2A shall be **PER UNIT** of door constructed as per standard sheet LM-FM-SD-FDD-01

### **ITEM OPE 2B**

#### **TYPE B**

The unit of measurement for Item OPE 2B shall be **PER UNIT** of door constructed as per standard sheet LM-FM-SD-FDD-01

### **ITEM OPE 2C**

#### **TYPE C**

The unit of measurement for Item OPE 2C shall be **PER UNIT** of door constructed as per standard sheet LM-FM-SD-FDD-01

### **ITEM OPE 3**

#### **SOLID TIMBER DOOR**

The price quoted for this item shall include:-

- Manufacture solid timber door (treated kerwin or equivalent), 40 mm thick, as per Engineer's instructions;
- Supply of all necessary materials;
- Provision of scaffolding as required;
- Fixing in position complete with framework and architraves;
- Supply and fixing of solid stainless steel lever door handles/door lock;
- Apply sealant followed by varnish or paint (hard gloss enamel) as per Engineer's instruction and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 3 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of solid timber door constructed.

### **ITEM OPE 4**

#### **DOOR CLOSER**

The price quoted for this item shall include:-

- Supply and fix surface mounted automatic door closer and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 4 shall be per **UNIT** of door closer fixed.

### **ITEM OPE 5**

#### **SOLID TIMBER DOOR PARTLY GLAZED**

The price quoted for this item shall include:-

- Manufacture timber door (treated kerwin or equivalent - design to be as per existing or to Engineer's instructions), 40 mm thick;
- Supply of all necessary materials;

- Supply and fixing of 6 mm clear or frosted glass as per Engineer's instruction;
- Provision of scaffolding as required;
- Fixing in position complete with framework and architraves;
- Supply and fixing of solid stainless steel lever door handles/door lock;
  - Apply sealant followed by varnish or paint (hard gloss enamel) as per Engineer's instruction and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 5 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of timber door fixed.

### **ITEM OPE 6**

#### **SOLID TIMBER GLAZED WINDOW**

The price quoted for this item shall include:-

- Manufacture wooden window (treated kerwin or equivalent - design pattern to be as per existing or to Engineer's instruction);
- Supply of all necessary materials;
- Supply and fixing of 6 mm clear or frosted glass as per Engineer's instruction;
- Provision of scaffolding as required;
- Preparation of surface prior to fixing of new opening;
- Fixing of new window including wooden frame;
- Supply and fixing of handles/latches;
  - Apply sealant followed by varnish or paint (hard gloss enamel) as per Engineer's instruction and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 6 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of timber window fixed.

### **ITEM OPE 7**

#### **PANELLING**

The price quoted for this item shall include:-

- Supply and fixing wooden panelling on walls with panels of minimum thickness 6 mm(3 mm thick plywood plus 3 mm plywood of teak finish) mounted on wooden battens of size 25 x 75 mm and 60 x 75 mm as required with spacing not exceeding 450 mm c/c;
- Providing and fixing 25 x 40 mm wooden moulding (teak) at top of panelling;
- Apply sealant followed by varnish or paint finish (hard gloss enamel) as per Engineer's instructions;
  - Provision of scaffolding as required and;
  - Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 7 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of panelling constructed.

### **ITEM OPE 8**

#### **DEMOLITION OF WOODEN OR METAL FRAME STRUCTURES**

The price quoted for this item shall include:-

- Demolition of wooden structures or metal frame structures;
- Removal and transport of material to any distance to disposal sites as located by Contractor and approved by Engineer or to Landscape store if so directed by the Engineer and;

- Any miscellaneous cost which may arise.

The unit of measurement for item OPE 8 shall be the volume in **CUBIC METRES (m<sup>3</sup>)** of demolition.

### **ITEM OPE 9**

#### **METAL DOOR**

The price quoted for this item shall include:-

- Manufacture metal door with 1.63 SWG(mm) pressed steel galv. Frame, 1.22 SWG pressed metal sheet on both sides (diamond shaped) at bottom, 6mm Georgian wired glass;
- Supply of all necessary materials;
- Provision of scaffolding as required;
- Preparation of surface prior to fixing of opening;
  - Fixing to blockwall including rendering of blockwall on all 4 sides to secure metal door frame;
  - Supply and fixing of door handles/door lock (metal casement lock one way action bronze finish Union 22931 or equivalent to BS 990);
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat etching primer and 2 coats hard gloss enamel and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 9 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of metal door fixed.

### **ITEM OPE 10**

#### **TROPICAL OPENING (Standard Sheet LM-FM-SD-TD-01) – Types A, B & C**

The price quoted for this item shall include:-

- Manufacture hot dip galvanised opening as per Standard Sheet LM-FM-SD-TD-01;
- Supply of all necessary materials;
- Provision of scaffolding as required;
- Preparation of surface prior to fixing of opening;
  - Fixing to blockwall including rendering of blockwall on all 4 sides to secure metal opening frame;
- Supply and fixing of handles/lock;
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat etching primer and 2 coats hard gloss enamel and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 10 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of metal opening fixed as per standard sheet LM-FM-SD-TD-01.

### **ITEM OPE 11**

#### **METAL WINDOW**

The price quoted for this item shall include:-

- Manufacture metal window(design pattern to be as per existing or to Engineer's instructions);



- Window to be hot dipped galvanised after manufacture;
- Supply of all necessary materials;
- Provision of scaffolding as required;
- Preparation of surface prior to fixing of new opening;
- Fixing to blockwall, casting of reinforced concrete cill at bottom of opening, rendering of blockwall on all 4 sides to secure metal window frame;
- Supply and fixing of stay bars, handles, 4 mm thick clear glass;
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat etching primer and 2 coats hard gloss enamel and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 11 shall be the area in **SQUARE METRE** (m<sup>2</sup>) of metal window fixed.

#### **ITEM OPE 12**

##### **REMOVAL OF EXISTING METAL/WOODEN DOOR/WINDOW**

The price quoted for this item shall include:-

- Removal of existing metal/wooden door/window including frames and cart away or deliver to the nearest Landscape store according to Engineer's instructions;
- Breaking of concrete/blockwork as required;
- Making good of arises after removal;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 12 shall be the area in **SQUARE METRE** (m<sup>2</sup>) of door/window removed.

#### **ITEM OPE 13**

##### **REMOVAL OF BURGLARPROOFING**

The price quoted for this item shall include:-

- Removal of existing burglarproofing and cart away or deliver to the nearest Landscape store according to Engineer's instructions;
- Breaking of concrete/blockwork as required;
- Making good of arises after removal;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 13 shall be the area in **SQUARE METRE** (m<sup>2</sup>) of burglarproofing removed.

#### **ITEM OPE 14**

##### **GALVANISED ROLLER SHUTTERS**

The price quoted for this item shall include:-

- **Submission of a certificate from a Registered Professional Engineer that the roller shutter will withstand cyclonic winds of not less than 280 km/hr;**
- Supply and fixing rolling shutters complete with locks with push and pull operation, fixing ball bearing, mechanical device chain and crank operation, etc;

- Provision of scaffolding as required;
- Concrete Works
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat etching primer and 2 coats hard gloss enamel and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 14 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of roller shutters constructed.

#### **ITEM OPE 14A**

##### **ALUMINIUM ROLLER SHUTTERS**

The price quoted for this item shall include:-

- **Submission of a certificate from a Registered Professional Engineer that the roller shutter will withstand cyclonic winds of not less than 280 km/hr;**
- Supply and fixing rolling shutters complete with locks with push and pull operation, fixing ball bearing, mechanical device chain and crank operation, etc;
- Provision of scaffolding as required;
- Concrete Works
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 14A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of roller shutters constructed.

#### **ITEM OPE 15**

##### **REPLACE GLASS PANES**

The price quoted for this item shall include:-

- Removal of broken/damaged glass panes to metal/aluminium/wooden openings/windows/doors including putty/joint/sealant and cart away;
- Preparation and cleaning of surface to receive new glass panes;
- Painting as required;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

#### **ITEM OPE 15A**

- Supply of fixing of glass panes up to 6 mm thick including all fixing materials, putty/joint/sealant, etc

The unit of measurement for Item OPE 15A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of glass pane fixed.

#### **ITEM OPE 15B**

- Supply of fixing of Georgian wired glass panes up to 6 mm thick including all fixing materials, putty/joint/sealant etc

The unit of measurement for Item OPE 15B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of glass pane fixed.

**ITEM OPE 15C**

- Supply of fixing of 20% homogeneous tinted glass panes up to 6 mm thick including all fixing materials, putty/joint/sealant etc

The unit of measurement for Item OPE 15C shall be the area in **SQUARE METRE (m<sup>2</sup>)** of glass pane fixed.

**ITEM OPE 16****REPLACE PUTTY**

The price quoted for this item shall include:-

- Removal of existing putty and cart away, preparation and cleaning of surface to receive new putty;
- Supply of fixing of putty;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 16 shall be the length in **LINEAR METRE (m)** of putty fixed.

**ITEM OPE 17****BURGLARPROOFING****ITEM OPE 17A****BURGLARPROOFING (Standard Sheet 452)**

The price quoted for this item shall include:-

- Manufacture and fixing of burglarproofing to openings as per standard sheet 452;
- \* Provision of scaffolding as required and;
- \* Any miscellaneous costs which may arise.

The Unit for Item OPE 17A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of opening.

**ITEM OPE 17B****BURGLARPROOFING (Drawing No LM-FM-SD-BPP-01)**

The price quoted for this item shall include:-

- Manufacture and fixing of burglarproofing Type 1 or Type 2 to openings as per drawing No LM-FM-SD-BPP-01;
- Provision of scaffolding as required and;
- \* Any miscellaneous costs which may arise.

The Unit for Item OPE 17B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of opening.

**ITEM OPE 17C****BURGLARPROOFING – T Bars**

The price quoted for this item shall include:-

- Welding of galvanised T<sup>3/4</sup>” bars on existing opening;
- Priming and painting (2 coats hard gloss enamel);
- \* Provision of scaffolding as required and;

- \* Any miscellaneous costs which may arise.

The Unit for Item OPE 17C shall be the length in **LINEAR METRE (m)** of bars fixed.

**ITEM OPE 17D**  
**COLLAPSIBLE BURGLARPROOFING**

The price quoted for this item shall include:-

- Manufacture and fixing of collapsible plastic coated galvanised metal burglarproofing to openings, type XPANDA or equivalent;
- Supply and fixing of handles and lock;
- Painting;
- \* Provision of scaffolding as required and;
- \* Any miscellaneous costs which may arise.

The Unit for Item OPE 17D shall be the area in **SQUARE METRE (m<sup>2</sup>)** of opening.

**ITEM OPE 18**  
**ALUMINIUM DOOR/WINDOW HANDLES**

The price quoted for this item shall include:-

- Removal of existing door/window handles;
- Supply and fix new door/window handles including lock as required;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 18 shall be per **UNIT** of handle fixed.

**ITEM OPE 19**  
**KEYLOCK TO METAL DOOR**

The price quoted for this item shall include:-

- Removal of existing door lock;
- Supply and fix new door lock (metal casement lock one way action bronze finish Union 22931 or equivalent to BS 990) and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 19 shall be per **UNIT** of keylock fixed.

**ITEM OPE 20**  
**STAY BARS**

The price quoted for this item shall include:-

- Removal of damaged stay bars;
- Supply and fix new stay bar and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item OPE 20 shall be per **UNIT** of stay bar fixed.

**ITEM PRO 1**  
**HOARDING**

The price quoted for this item shall include:-

- Supply and erect hoarding, for the whole duration of the job, in tubular section and corrugated iron sheets including all fittings required for assembly, to Engineer's approval;
- Excavation and casting of concrete (Grade 15) base to posts;
- Provision of scaffolding as required and;
- Dismantling and removal from site on completion of the job;
- Any miscellaneous cost which may arise.

The unit of measurement for Item PRO 1 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of hoarding fixed.

## **ITEM PRO 2**

### **ERECTION OF TEMPORARY WORKING PLATFORM**

The price quoted for this item shall include:-

- Supply and erect temporary working platform in tubular section, including all fittings required for assembly, wooden planks, secured ladder for access to platform, etc for the whole duration of the job;
- Temporary working platform to be designed and constructed as per prevailing Regulations;
- Dismantling and removal from site;
- Any miscellaneous cost which may arise.

### **ITEM PLATFORM AT 1.5 M HIGH PRO 2A**

The unit of measurement for Item PRO 2A shall be the area of working platform erected in **SQUARE METRE (m<sup>2</sup>)** for the whole duration of the job

### **ITEM PLATFORM AT 3.0 M HIGH PRO 2B**

The unit of measurement for Item PRO 2B shall be the area of working platform erected in **SQUARE METRE (m<sup>2</sup>)** for the whole duration of the job

### **ITEM PLATFORM AT 4.5 M HIGH PRO 2C**

The unit of measurement for Item PRO 2C shall be the area of working platform erected in **SQUARE METRE (m<sup>2</sup>)** for the whole duration of the job

### **ITEM PLATFORM AT 6.0 M HIGH PRO 2D**

The unit of measurement for Item PRO 2D shall be the area of working platform erected in **SQUARE METRE (m<sup>2</sup>)** for the whole duration of the job

### **ITEM PLATFORM AT 9.0 M HIGH PRO 2E**

The unit of measurement for Item PRO 2E shall be the area of working platform erected in **SQUARE METRE (m<sup>2</sup>)** for the whole duration of the job

## **ITEM STE 1**

### **STEEL STRUCTURES**

The price quoted for this item shall include:-

- Supply and fix new Galvanised CHS,SHS,RHS,UB,Z & C Sections, metal plates, Angle bars for roofing works, canopies, shelters, waiting areas, covered links, miscellaneous steel works, etc, as per Engineer's instructions;
  - Assembly/Fixation with galvanized bearing plates and galvanised bolts or by welding, as per Engineer's instructions;
  - Provision of scaffolding as required and;
  - Any miscellaneous cost which may arise.

The unit of measurement for Item STE 1 shall be the mass in **KILOGRAMME (kg)** of steel structures erected.

### **ITEM STE 2**

#### **STEEL CANOPY (Drawing No LM-FM-SD-COP-01)**

The price quoted for this item shall include:-

- Manufacture and fixing of steel canopy Type 1 or Type 2 as per drawing No LM-FM-SD-COP-01 inclusive of galvanized sections, prepainted roofing sheets, galvanised plates, galvanized purlins, galvanized bolts, flashing and sealant;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

### **ITEM STE 2A**

#### **STEEL CANOPY (TYPE 1 – 1M)**

The unit of measurement for Item STE 2A shall be the length in **LINEAR METRE (m)** of steel canopy constructed as per drawing No LM-FM-SD-COP-01.

### **ITEM STE 2B**

#### **STEEL CANOPY (TYPE 2 – 1.5M)**

The unit of measurement for Item STE 2B shall be the length in **LINEAR METRE (m)** of steel canopy constructed as per drawing No LM-FM-SD-COP-01..

### **ITEM STE 3**

#### **REPLACEMENT OF HINGES OF METAL OPENINGS**

The price quoted for this item shall include:-

- Grinding of existing hinges and cart away;
- Supply and fix new galvanized metal hinges including welding, cleaning and painting;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item STE 3 shall be per **UNIT** of hinges replaced.

## **ALUMINIUM WORKS**

### **ITEM ALU 1**

#### **ALUMINIUM PARTITIONS**

The price quoted for this item shall include:-

- Supply and fixing Aluminium Partitions, partly or fully glazed, consisting of anodized Aluminium Frames/Sections of minimal width 50mm complete with aluminium paneling and/or 6 mm thick clear, tinted or frosted glazing as per Engineer's instructions;
- Fixing of partitions at top, bottom and sides to secure partitioning, including necessary filling up of gaps at junctions, at top, bottom and sides with required rubber/pvc/neoprene gasket etc;
- Provision of scaffolding as required and;
  - Any miscellaneous cost which may arise.

The unit of measurement for Item ALU 1 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of partitioning fixed.

### **ITEM ALU 2**

#### **REMOVAL OF EXISTING ALUMINIUM DOOR/WINDOW**

The price quoted for this item shall include:-

- Removal of existing aluminium door/window including frames and cart away or deliver to the nearest Landscape store according to Engineer's instructions;
- Breaking of concrete/blockwork as required;
- Making good of arises after removal;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item ALU 2 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of door/window removed.

### **ITEM ALU 3**

#### **REMOVAL OF NACO OPENINGS**

The price quoted for this item shall include:-

- Removal of existing NACO openings and cart away or deliver to the nearest Landscape store according to Engineer's instructions;
- Breaking of concrete/blockwork as required;
- Making good of arises after removal;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item alu 3 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of NACO openings removed.

### **ITEM ALU 4**

#### **ALUMINIUM OPENINGS**

The price quoted for this item shall include:-

- **Submission, upon request, of a certificate from a Registered Professional Engineer certifying that the Aluminium openings fixed in place shall withstand cyclonic winds of not less than 280 km/hr;**

- Manufacture aluminium openings as per specifications (design pattern to be as per existing or to Engineer's instruction);
- Supply of all necessary materials;
- Preparation of surface prior to fixing of opening;
- Fixing to blockwall including rendering of blockwall on all 4 sides to secure opening;
- Supply and fixing of door handles/door lock, 6 mm thick clear, tinted or frosted glazing;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

**ITEM ALU 4A**  
**SINGLE GLAZING**

The unit of measurement for Item ALU 4A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of aluminium opening fixed.

**ITEM ALU 4B**  
**DOUBLE GLAZING**

The unit of measurement for Item ALU 4B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of aluminium opening fixed.

**ITEM ALU 5**

**ALUMINIUM SHELVING**

The price quoted for this item shall include:-

- Supply and fixing of aluminium shelving including all fittings required, as per Engineer's instructions;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item ALU 5 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of aluminium shelving fixed.

**ITEM ALU 6**

**ALUCOBOND**

The price quoted for this item shall include:-

- Design, supply, fabrication and fixing of alucobond panel cladding including all fittings required, as per specifications and Engineer's instructions;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item ALU 6 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of alucobond fixed.

**ITEM ALU 7**

**NACO**

The price quoted for this item shall include:-

- Supply and fix naco frame;
- Supply and fix naco blades;



- Provision of scaffolding as required, and;
- Any miscellaneous costs which may arise.

The Unit of measurement for Item ALU 7 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of naco fixed.

## **SITE WORKS**

### **ITEM SIT 1**

#### **CLEARING OF SITE**

The price quoted for this item shall include:-

- Clearing of site from bushes, bambous hedges, vegetation, wastes, rocks, debris, etc...
- Loading, carting away and disposal of all materials, and;
- Any miscellaneous costs which may arise.

The Unit of measurement for Item SIT 1 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of site cleared.

### **ITEM SIT 2**

#### **EXCAVATE TOP SOIL**

The price quoted for this item shall include:-

- Stripping of top soil (depth up to 300 mm);
- Loading, carting away and disposal of all materials, and;
- Any miscellaneous costs which may arise.

The Unit of measurement for Item SIT 2 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of top soil removed.

### **ITEM SIT 3**

#### **EXCAVATION**

The price quoted for this item shall include:-

- Loosening, digging, trimming, shaping and levelling in any material, including rock, depth up to 3.0 m;
- Loading, carting away and disposal of all excess material to stockpiles as instructed by the Engineer or to spoil tips located by Contractor and approved by the Engineer;
- Backfilling as required; and
- Any miscellaneous costs arising due to the presence of existing services, ditches etc..

The Unit of measurement for Item SIT 3 shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of excavation completed.

### **ITEM SIT 4**

#### **SOAKAWAY (Drawing No LM-FM-SD-CPS-01)**

The price quoted for this item shall include:-

- Loosening, digging, trimming, shaping and levelling in any material, including rock;

- Loading, carting away and disposal of excavated materials to spoil tips located by Contractor and approved by the Engineer;
- Supply and fix geotextile membrane;
- Supply and fix 100 mm PVC pipe inlet as per Engineer's instructions;
- Backfilling with stones/aggregates;
- Construction of kerbs and;
- Any miscellaneous costs arising due to the presence of existing services, ditches etc.

**ITEM SIT 4A****SOAKAWAY (TYPE 1)**

The unit of measurement for Item SIT 4A shall be per **UNIT** of soakaway constructed as per drawing No LM-FM-SD-CPS-01.

**ITEM SIT 4B****SOAKAWAY (TYPE 2)**

The unit of measurement for Item SIT 4B shall be per **UNIT** of soakaway constructed as per drawing No LM-FM-SD-CPS-01.

**ITEM SIT 4C****SOAKAWAY (TYPE 3)**

The unit of measurement for Item SIT 4C shall be per **UNIT** of soakaway constructed as per drawing No LM-FM-SD-CPS-01.

**ITEM SIT 5****FRENCH DRAINS (Drawing No LM-FM-SD-DRA02)**

The price quoted for this item shall include:-

- Loosening, digging, trimming, shaping and levelling in any material, including rock;
- Loading, carting away and disposal of excavated materials to spoil tips located by Contractor and approved by the Engineer;
- Supply and fix geotextile membrane;
- Supply and fix 110 mm dia. or 160mm dia. perforated PVC pipes, in an arrangement as directed by the Engineer;
- Provision of self draining top soil and drainage layer;
- Backfilling with hardcore/aggregates and;
- Any miscellaneous costs arising due to the presence of existing services, ditches etc.

**ITEM SIT 5A****FRENCH DRAINS (TYPE 1)**

The Unit of measurement for Item SIT 5A shall be per **LINEAR METRE** of french drain constructed as per drawing No LM-FM-SD-DRA02.

**ITEM SIT 5B****FRENCH DRAINS (TYPE 2)**

The Unit of measurement for Item SIT 5B shall be per **LINEAR METRE** of french drain constructed as per drawing No LM-FM-SD-DRA02.

**ITEM SIT 5C**

**FRENCH DRAINS (TYPE 3)**

The Unit of measurement for Item SIT 5C shall be per **LINEAR METRE** of french drain constructed as per drawing No LM-FM-SD-DRA02.

**ITEM SIT 6****CATCH PIT (Drawing No LM-FM-SD-CPS-01)**

The price quoted for this item shall include:-

- Loosening, digging, trimming, shaping and levelling in any material, including rock;
- Loading, carting away and disposal of excavated materials to spoil tips located by Contractor and approved by the Engineer;
- Supply and fix 100 mm PVC pipe outlet;
- Construction of catch pit complete with cover;
- Backfilling as required; and
- Any miscellaneous costs arising due to the presence of existing services, ditches etc..

The unit of measurement for Item SIT 6 shall be per **UNIT** of catch pit constructed as per drawing No LM-FM-SD-CPS-01.

**ITEM SIT 7****STANDARD MANHOLE WITH COVER (Standard sheet 465)**

The price quoted for this item shall include:-

- Loosening, digging, trimming, shaping and levelling in any material, including rock;
- Loading, carting away and disposal of excavated materials to spoil tips located by Contractor and approved by the Engineer;
- Construction of manhole complete with cover (depth up to 900 mm measured from cover to invert level) and;
- Any miscellaneous costs arising due to the presence of existing services, ditches etc..

The Unit of measurement for Item SIT 7 shall be per **UNIT** of manhole constructed as per standard sheet 465.

**ITEM SIT 7A****HEAVY DUTY MANHOLE WITH COVER (Drawing No LM-FM-SD-SEW-01)**

The price quoted for this item shall include:-

- Loosening, digging, trimming, shaping and levelling in any material, including rock;
- Loading, carting away and disposal of excavated materials to spoil tips located by Contractor and approved by the Engineer;
- Construction of manhole complete with cover (depth up to 1000 mm measured from cover to invert level) and;
- Any miscellaneous costs arising due to the presence of existing services, ditches etc..

The Unit of measurement for Item SIT 7A shall be per **UNIT** of manhole constructed as per drawing No LM-FM-SD-SEW-01.

**ITEM SIT 8**

**ABSORPTION PIT**

The price quoted for this item shall include:-

- Loosening, digging, trimming, shaping and levelling in any material, including rock;
- Loading, carting away and disposal of excavated materials to spoil tips located by Contractor and approved by the Engineer;
- Supply and backfill with Spalls, of dimensions not more than 150mm, or as instructed by the Engineer;
- Provision of R.C Slab (to be measured and paid under item 2), if applicable, and;
- Any miscellaneous costs arising due to the presence of existing services, ditches etc.

The Unit of measurement for Item SIT 8 shall be volume in **CUBIC VOLUME (m<sup>3</sup>)** of absorption pit.

**ITEM SIT 9****TRIAL PIT (up to 1.5 m deep)**

The price quoted for this item shall include:-

- Excavation, in any material including rock, of trial pit of 1.5 m x 2 m x 1.5 metres deep and a hole 300 mm x 300 mm x 450 mm at bottom of pit;
  - Provision of safety measures and backfilling of the trial pit on completion; and
  - Any miscellaneous costs arising due to the presence of existing services, ditches etc.

The Unit of measurement for Item SIT 9 shall be per **UNIT** of trial pit excavated.

**ITEM SIT 9A****TRIAL PIT (up to 2.5 m deep)**

The price quoted for this item shall include:-

- Excavation, in any material including rock, of trial pit of 1.5 m x 2 m x 2.5 metres deep and a hole 300 mm x 300 mm x 450 mm at bottom of pit;
- Provision of safety measures and backfilling of the trial pit on completion; and
- Any miscellaneous costs arising due to the presence of existing services, ditches etc.

The Unit of measurement for Item SIT 9A shall be per **UNIT** of trial pit excavated.

**ITEM SIT 9B****TRIAL PIT (up to 3.5 m deep)**

The price quoted for this item shall include:-

- Excavation, in any material including rock, of trial pit of 1.5 m x 2 m x 3.5 metres deep and a hole 300 mm x 300 mm x 450 mm at bottom of pit;
- Provision of safety measures and backfilling of the trial pit on completion; and
- Any miscellaneous costs arising due to the presence of existing services, ditches etc.

The Unit of measurement for Item SIT 9B shall be per **UNIT** of trial pit excavated.

**ITEM SIT 10****CAR SHED (DRAWINGS No LM-FM-SD-CSM-01, No LM-FM-SD-CSM-02 AND LM-FM-SD-CSM-03)**

The price quoted for this item shall include:-

- Construction of car shed complete, as per drawing;
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat etching primer and 2 coats hard gloss enamel;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

**ITEM SIT 10A**

**CAR SHED (TYPE 1)**

The unit of measurement for Item SIT 10A shall be the roof area in **SQUARE METRE (m<sup>2</sup>)** of shed constructed as per drawing No LM-FM-SD-CSM-01.

**ITEM SIT 10B**

**CAR SHED (TYPE 2)**

The unit of measurement for Item SIT 10B shall be the roof area in **SQUARE METRE (m<sup>2</sup>)** of shed constructed as per drawing No LM-FM-SD-CSM-01.

**ITEM SIT 10C**

**CARSHED (MODULE OF 2 PARKINGS)**

The unit of measurement for Item SIT 10C shall be per **UNIT** of shed constructed as per drawings No LM-FM-SD-CSM-02 and LM-FM-SD-CSM-03.

**ITEM SIT 11**

**TARMAC**

The price quoted for this item shall include:-

- Construction of tarmac, including preparation and compaction of subgrade; supply, laying and compacting of crusher run and hardcore; provision of prime/tack coat; supply, laying and compacting of asphaltic/bituminous concrete as per respective drawing;
- Testing at MNICD, MSB, University of Mauritius or other approved laboratory and submission of test results (including core tests, bitumen content, sieve analysis, test certificates of materials, etc) upon request of the Engineer and as per paragraph 1.10 of the General Specifications, and;
- Any miscellaneous cost which may arise.

**ITEM SIT 11A**

**TARMAC (Based on drawing No LM-FM-SD-DRA-03)**

The unit of measurement for Item SIT 11A shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tarmac constructed based on drawing No LM-FM-SD-DRA-03.

**ITEM SIT 11B**

**TARMAC (Based on drawing No LM-FM-SD-DRA-04)**

The unit of measurement for Item SIT 11B shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tarmac constructed based on drawing No LM-FM-SD-DRA-04.

**ITEM SIT 11C**

**TARMAC TYPE 1 (Based on drawing No LM-FM-SD-DOT-01)**

The unit of measurement for Item SIT 11C shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tarmac constructed based on drawing No LM-FM-SD-DOT-01.

#### **ITEM SIT 11D**

#### **TARMAC TYPE 2 (Based on drawing No LM-FM-SD-DOT-01)**

The unit of measurement for Item SIT 11D shall be the area in **SQUARE METRE (m<sup>2</sup>)** of tarmac constructed based on drawing No LM-FM-SD-DOT-01.

#### **ITEM SIT 12**

#### **ASPHALTIC CONCRETE 0/10**

The price quoted for this item shall include:-

- Preparation of existing surface, including levelling and compaction, to receive asphaltic concrete;
- Provision of prime/tack coat;
- Supply, laying and compacting of asphaltic concrete 0/10 (compacted thickness 50 mm, 5.5% bitumen content);
- Testing at MNICD, MSB, University of Mauritius or other approved laboratory and submission of test results (including core tests, bitumen content, sieve analysis, compaction, test certificates of materials, etc) upon request of the Engineer and as per paragraph 1.10 of the General Specifications, and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 12 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of area resurfaced.

#### **ITEM SIT 13**

#### **BITUMINOUS CONCRETE 0/14 FOR RESHAPING**

The price quoted for this item shall include:-

- Preparation of existing surface, including levelling and compaction, to receive bituminous concrete;
- Provision of prime/tack coat;
- Supply, laying and compacting of bituminous concrete 0/14 (4.5% bitumen content) and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 13 shall be the weight in **TON (T)** of bituminous concrete laid.

#### **ITEM SIT 14**

#### **CRUSHER RUN 0/20**

The price quoted for this item shall include:-

- Preparation of existing surface, including levelling and compaction, to receive crusher run;
- Supply, laying and compacting of crusher run 0/20 in layers not exceeding 150 mm;
- Testing at M.P.I, MSB, University of Mauritius or other approved laboratory and submission of test results (including compaction tests, sieve analysis, test

certificates of materials, etc) upon request of the Engineer and as per paragraph 1.10 of the General Specifications, and;

- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 14 shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of compacted crusher run.

#### **ITEM SIT 14A**

##### **ROCKSAND 0/4**

The price quoted for this item shall include:-

- Preparation of existing surface, including levelling and compaction, to receive rocksand;
- Supply, laying and compacting of rocksand 0/4 in layers;
- Testing at MNICD, MSB, University of Mauritius or other approved laboratory and submission of test results (including compaction tests, sieve analysis, test certificates of materials, etc) upon request of the Engineer and as per paragraph 1.10 of the General Specifications, and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 14A shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of compacted rocksand.

#### **ITEM SIT 15**

##### **SPALLS 150 mm**

The price quoted for this item shall include:-

- Preparation of existing surface, including levelling and compaction, to receive spalls;
- Supply, laying and compacting of spalls and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 15 shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of compacted spalls.

#### **ITEM SIT 16**

##### **PRECAST KERBS (Drawing No LM-FM-SD-DRA-03)**

The price quoted for this item shall include:-

- Construction of precast kerb, including blinding layer as per drawing No LM-FM-SD-DRA-03 and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 16 shall be the length in **LINEAR METRE (m)** of precast kerb constructed as per drawing No LM-FM-SD-DRA-03.

#### **ITEM SIT 16A**

##### **PRECAST KERBS (Concrete/Block material)**

The price quoted for this item shall include:-

- Construction of precast kerb, including blinding layer as per drawing No LM-FM-SD-DRA-03, with concrete/block material instead of reinforced concrete and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 16A shall be the length in **LINEAR METRE (m)** of precast kerb constructed as per drawing No LM-FM-SD-DRA-03 but with concrete/block material.

#### **ITEM SIT 17**

##### **INTERLOCKING BLOCKS/PAVING BLOCKS (Drawing No LM-FM-SD-DRA-05)**

The price quoted for this item shall include:-

- Construction of interlocking block/paving block including preparation and compaction of subgrade; supply, laying and compacting of rocksand, crusher run and hardcore as per drawing No LM-FM-SD-DRA-05 and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 17 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of interlocking/paving block constructed as per drawing No LM-FM-SD-DRA-05.

#### **ITEM SIT 18**

##### **PRECAST CONCRETE SLAB (Drawing No LM-FM-SD-DRA-05)**

The price quoted for this item shall include:-

- Construction of precast concrete slab including preparation and compaction of subgrade, supply, laying and compacting of rocksand, crusher run and hardcore as per drawing No LM-FM-SD-DRA-05 and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 18 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of precast concrete slab constructed as per drawing No LM-FM-SD-DRA-05.

#### **ITEM SIT 19**

##### **HANDRAILING METAL (Drawing No LM-FM-SD-HTD-01)**

The price quoted for this item shall include:-

- Construction of hot dipped galvanised handrailing as per drawing No LM-FM-SD-HTD-01;
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat of primer, undercoat and two coats hard gloss paint to internal and external surfaces; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 19 shall be the length in **LINEAR METRE (m)** of handrailing constructed as per drawing No LM-FM-SD-HTD-01.

#### **ITEM SIT 19A**

##### **HANDRAILING WOODEN (Standard sheet LM-FM-SD-TBD-01)**

The price quoted for this item shall include:-

- Construction of wooden handrailing as per standard sheet, timber to be treated kerwin or equivalent;
- Apply sealant followed by Painting or varnishing as per Engineer's Instructions and;
- Any miscellaneous cost which may arise.



The unit of measurement for Item SIT 19A shall be the length in **LINEAR METRE (m)** of handrailing constructed as per standard sheet LM-FM-SD-TBD-01.

#### **ITEM SIT 19B**

##### **HANDRAILING STAINLESS STEEL GRADE 316 (Drawing No LM-FM-SD-SSH-01)**

The price quoted for this item shall include:-

- Construction of stainless steel (Grade 316) handrailing as per drawing with welded joints;
- Fixing to concrete with all fittings required; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 19B shall be the length in **LINEAR METRE (m)** of handrailing constructed as per drawing No LM-FM-SD-SSH-01.

#### **ITEM SIT 19C**

##### **HANDRAILING STAINLESS STEEL GRADE 316 (Based on Drawing No LM-FM-SD-SSH-01) BUT WITH 50mm DIA. INOX CIRCULAR UPRIGHTS**

The price quoted for this item shall include:-

- Construction of stainless steel (Grade 316) handrailing as per drawing with welded joints, except for the use of 50mm diameter inox circular sections for the uprights;
- Fixing to concrete with all fittings required; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 19C shall be the length in **LINEAR METRE (m)** of handrailing constructed based on drawing No LM-FM-SD-SSH-01.

#### **ITEM SIT 20**

##### **REMOVAL OF HANDRAIL**

The price quoted for this item shall include:-

- Removal of handrail and cart away or deliver to the nearest Landscape store according to Engineer's instructions;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 20 shall be the length in **LINEAR METRE (m)** of handrailing removed.

#### **ITEM SIT 21**

##### **DRAINS (Based on Drawing No LM-FM-SD-DRA-01)**

The price quoted for this item shall include:-

- Construction of drains including cover as per Drawing No LM-FM-SD-DRA-01;
- Excavation in any materials, trimming and levelling to the desired level and depth;
- Testing at MNICD laboratory and submission of test results (including cube tests, sieve analysis, test certificates of materials, etc) upon request of the Engineer and as per paragraph 1.10 of the General Specifications, and;
- Any miscellaneous cost which may arise.

**ITEM SIT 21A**

**DRAINS (Type I – Depth not exceeding 500 mm, measured from the underside of the cover to the invert level)**

The unit of measurement for Item SIT 21A shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

**ITEM SIT 21B**

**DRAINS (Type II – Depth not exceeding 500 mm, measured from the underside of the cover to the invert level)**

The unit of measurement for Item SIT 21B shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

**ITEM SIT 21C**

**DRAINS (Type III – Depth not exceeding 500 mm, measured from the underside of the cover to the invert level)**

The unit of measurement for Item SIT 21C shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

**ITEM SIT 21D**

**DRAINS (Type IV – Depth not exceeding 500 mm, measured from the underside of the cover to the invert level)**

The unit of measurement for Item SIT 21D shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

**ITEM SIT 21E**

**DRAINS (Type V- Depth not exceeding 500 mm, measured from the underside of the cover to the invert level)**

The unit of measurement for ItemSIT 21E shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

**ITEM SIT 21F**

**DRAINS (Type VI – Depth not exceeding 500 mm, measured from the underside of the cover to the invert level)**

The unit of measurement for Item SIT 21F shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

**ITEM SIT 21G**

**DRAINS (Type I – Depth from 500 mm up to 1 m, measured from the underside of the cover to the invert level)**

The unit of measurement for Item SIT 21G shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

**ITEM SIT 21H**

**DRAINS (Type II – Depth from 500 mm up to 1 m, measured from the underside of the cover to the invert level)**

The unit of measurement for Item SIT 21H shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

#### **ITEM SIT 21i**

**DRAINS (Type III – Depth from 500 mm up to 1 m, measured from the underside of the cover to the invert level)**

The unit of measurement for Item SIT 21i shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

#### **ITEM SIT 21J**

**DRAINS (Type IV – Depth from 500 mm up to 1 m, measured from the underside of the cover to the invert level)**

The unit of measurement for Item SIT 21J shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

#### **ITEM SIT 21K**

**DRAINS (Type V- Depth from 500 mm up to 1 m, measured from the underside of the cover to the invert level)**

The unit of measurement for ItemSIT 21K shall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

#### **ITEM SIT 21L**

**DRAINS (Type VI – Depth from 500 mm up to 1 m, measured from the underside of the cover to the invert level)**

The unit of measurement for Item SIT 21Lshall be the length in **LINEAR METRE (m)** of drain constructed as per drawing No LM-FM-SD-DRA-01.

#### **ITEM SIT 21M**

**METAL GRATING (Light Duty) (Drawing No LM-FM-SD-MGD-01)**

The price quoted for this item shall include:-

- Supply and fix hot dipped galvanised metal grating as per drawing No LM-FM-SD-MGD-01;
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat of primer, undercoat and two coats hard gloss paint to internal and external surfaces; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 21M shall be the area in **SQUARE METRE (m<sup>2</sup>)** of metal grating constructed as per drawing No LM-FM-SD-MGD-01.

#### **ITEM SIT 21N**

**STEEL GRATING (Heavy Duty) (Drawing No LM-FM-SD-DRA-01 – Type II)**

The price quoted for this item shall include:-

- Supply and fix hot dipped galvanised steel grating as per drawing No LM-FM-SD-DRA-01;

- Prepare surface as required prior to painting works;
  - Supply of paint as per specification;
  - Apply one coat of primer, undercoat and two coats hard gloss paint to internal and external surfaces; and
  - Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 21N shall be the area in **SQUARE METRE (m<sup>2</sup>)** of metal grating constructed as per drawing No LM-FM-SD-DRA-01.

#### **ITEM SIT 21O**

##### **CLEAN OPEN DRAINS**

The price quoted for this item shall include:-

- Loosening and removal of silted deposits;
- Carting away of removed materials;
- Provide safety measures for pedestrians until work is completed and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 21o shall be the length in **LINEAR METRE (m)** of open drains cleaned.

#### **ITEM SIT 21P**

##### **CLEAN COVERED DRAINS**

The price quoted for this item shall include:-

- Removal of slabs over drains;
- Loosening and removal of silted deposits;
- Carting away of removed materials;
- Provide safety measures for pedestrians until work is completed;
- Replacing and fixing of existing slabs over drain and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item Sit 21P shall be the length in **LINEAR METRE (m)** of covered drains cleaned.

#### **ITEM SIT 22**

##### **STONE MASONRY STRUCTURE (Drawing No LM-FM-SD-CON04)**

The price quoted for this item shall include:-

- Excavation in any material, including rock;
- Supply of all necessary materials and plant on site;
- Mixing of cement mortar and concrete as per specifications;
- Mixing and placing of concrete strip footing and coping;
- Supply, cutting and placing of sound stones for masonry works to lines and levels;
- Provision of scaffolding as required and;
- Any miscellaneous cost arising.

The Unit of measurement for Item SIT 22 shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of stone masonry structure completed as per drawing No LM-FM-SD-CON04.

#### **ITEM SIT 22A**

**STONE FACING WORKS**

The price quoted for this item shall include:-

- Supply, cutting and placing of sound dressed stone facing;
- Setting, bedding, jointing, raking out, grouting, pointing, wetting and fair faced work including rough and fair cutting;
- Stone facing to be bedded in concrete;
- Supply and placing of cement mortar and concrete;
- Supply of all necessary materials and plant on site;
- Provision of scaffolding as required and;
- Any miscellaneous cost arising.

The Unit of measurement for Item SIT 22A shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of stone facing works completed.

**ITEM SIT 23****SALLE VERTE/BLANCHE**

The price quoted for this item shall include:-

- Supply and erection of salle verte/blanche. Frames to be in galvanised steel tubes properly braced to provide adequate structural stability to Engineer's approval;
  - Supply and fixing of tarpaulins (green/white) in good condition, leak proof, on all sides and on top;
  - Dismantling and remove from site;
  - Provision of scaffolding as required and;
  - Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 23 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of floor area, **PER DAY** counted from the time the salle verte/blanche is ready for use.

**ITEM SIT 24****PODIUM (Standard Sheet LM-FM-SD-PSD-01)**

The price quoted for this item shall include:-

- Supply and erection of podium, including steel support & bracing and marine plywood platform including any timber lining to Engineer's approval, height to be up to 1.5 metres;
  - Dismantling and remove from site;
  - Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 24 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of floor area, **PER DAY** counted from the time the podium is ready for use.

**ITEM SIT 25****TREATED PINE POLES**

The price quoted for this item shall include:-

- \* Trimming ground on the line of fence, including excavation and backfilling;
- \* Disposal of surplus material;
- \* Excavation and casting of concrete (Grade 15) base to posts 400x400x600mm deep;
- \* Supply treated pine poles to SABS 457-3:2000, including half sawn;

- \* Assemble and erect treated pine poles, inclusive of all necessary fittings for fixing and assembly (hot dipped galvanised metal shoe, bolts, nuts, washers, etc..) and;
- \* Apply sealant followed by varnish, if instructed by Engineer;
- \* Any miscellaneous costs which may arise.

The Unit for Item SIT 25 shall be the volume in **CUBIC METRE** of treated pine poles supplied and fixed.

### **ITEM SIT 26**

#### **GEOTEXTILE**

The price quoted for this item shall include:-

- Supply and fix geotextile for use in subsurface drainage, sediment control and erosion control, or as a permeable separator, as per Engineer's instructions;
- Submission of samples of geotextile and technical literature to Engineer for approval prior to supply and fixing and;
- Any miscellaneous costs which may arise.

The Unit of measurement for Item SIT 26 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of geotextile fixed.

### **ITEM SIT 27**

#### **CLEANING OF YARD**

The price quoted for this item shall include:-

- Clearing and sweeping of yard from vegetation, fallen branches & leaves, wastes, rocks, debris, etc., including weeding;
- Lopping of branches as instructed by the Engineer;
- Loading, carting away and disposal of all materials, and;
- Any miscellaneous costs which may arise.

The Unit of measurement for Item SIT 27 shall be the volume in **CUBIC METRE (m<sup>3</sup>)** of waste materials measured on the lorry.

### **ITEM SIT 28**

#### **TRIMMING OF GRASS**

The price quoted for this item shall include:-

- Removal of wastes, debris and stones prior to trimming;
- Trimming of grass with lawnmower;
- Sweeping of trimmed grass;
- Loading, carting away and disposal of trimmed grass, wastes, debris and stones, and;
- Any miscellaneous costs which may arise.

The Unit of measurement for Item SIT 28 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of grass trimmed.

### **ITEM SIT 29**

#### **FELL TREES AND REMOVE STUMPS**

The price quoted for this item shall include:-

- Liaison with Forestry Department for clearance for felling of trees;
- Felling of trees and grubbing up roots;

- Loading, carting away and disposal of felled trees and roots;
- Back-filling of holes left by the roots with compacted materials approved by the Engineer to existing ground level; and
- Any miscellaneous cost which may arise.

**ITEM SIT 29A**

Trees of average girth not exceeding 300mm diameter, measured 1.5m above ground level

**The unit of measurement for item SIT 29A shall be the NUMBER of trees felled.**

**ITEM SIT 29B**

Trees of girth exceeding 300mm diameter, measured 1.5m above ground level

**The unit of measurement for item SIT 29B shall be the NUMBER of trees felled.**

**ITEM SIT 30****TOP SOIL AND GRASSING**

The price quoted for this item shall include:-

- Picking up top soil from spoil tip or from natural ground, identified by contractor, and transport to any distance to area required;
- Removal of debris, stones, etc.;
- Spreading, levelling and light compaction of top soil to a depth of at least 300mm;
- Trimming and shaping to levels and contours;
- Reducing soil to a tilth immediately prior to grassing;
- Fertilising;
- Supply, transport and planting of grass;
- Raking, watering and herbicide treatment;
- Cutting grass twice during maintenance period;
- Carting away of grass cuttings during maintenance period; and
- Any miscellaneous costs which may arise.

**The Unit of measurement for Item SIT 30 shall be the area in SQUARE METRE (m<sup>2</sup>) of top soil and grassing.**

**ITEM SIT 30A****TOP SOIL**

The price quoted for this item shall include:-

- Picking up top soil from spoil tip or from natural ground, identified by contractor, and transport to any distance to area required;
- Removal of debris, stones, etc.;
- Spreading, levelling and light compaction of top soil to a depth of at least 200mm;
- Trimming and shaping to levels and contours; and
- Any miscellaneous costs which may arise.

**The Unit of measurement for Item SIT 30A shall be the area in SQUARE METRE (m<sup>2</sup>) of top soil.**

**ITEM SIT 31****IMPORTED FILL MATERIALS**

The price quoted for this item shall include:-

- Picking up selected fill materials from spoil tip or from natural ground, identified by contractor, and transport from any distance to area required;
- Spreading, levelling and light compaction of imported fill materials, as per specifications and to the Engineer's approval;
- Trimming and shaping to levels and contours; and any miscellaneous costs which may arise.

The Unit of measurement for Item SIT 31 shall be the net volume in **CUBIC METRE (m<sup>3</sup>)** of imported fill materials.

### **ITEM SIT 32**

#### **ANTI-TERMITE TREATMENT**

The price quoted for this item shall include:-

- the spraying of approved Termite Treatment chemicals to all wooden parts of the buildings, and also all such parts which may be susceptible to termite attacks;
- the Termite Treatment of wooden shingles, purlins, etc. irrespective of the presence of false ceilings, which shall be partly removed for the purpose of the works;
- Any removed part, for this purpose of this item, shall be made good to the satisfaction of the Engineer, on completion of each treatment exercise.
- Provision of scaffolding as required, and;
- Any miscellaneous costs which may arise.

The Unit of measurement for Item SIT 32 shall be the net volume in **SQUARE METRE (m<sup>2</sup>)** of treated area.

### **ITEM SIT 33**

#### **CONCRETE BENCH (Drawing No LM-FM-SD-CON-01)**

The price quoted for this item shall include:-

- Excavation, trimming and levelling;
- Construction of concrete bench as per drawing No LM-FM-SD-CON-01, complete with anchorage, foundation, compacted rocksand, crusher run and hardcore; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item SIT 33 shall be the area in **UNIT (No.)** of concrete bench constructed as per drawing No LM-FM-SD-CON-01.

## **MISCELLANEOUS WORKS**

### **ITEM (MIS 1)**

#### **EPOXY GROUTING COMPOUND EPIDERMIX OR EQUIVALENT**

The Unit of measurement for Item MIS 1 shall be the volume in **LITRE (L)** of compound placed.

### **ITEM MIS 2**

#### **REMOVAL OF EXISTING WATER TANKS**

The price quoted for this item shall include:-



- Removal of existing water tanks and store in a safe place for re-use;
- Re-fixing of water tank including all associated plumbing works;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 2 shall be **PER UNIT** of water tank removed.

### **ITEM MIS 3**

#### **REMOVAL OF EXISTING AIR CONDITIONING UNITS**

The price quoted for this item shall include:-

- Removal of existing air conditioning units and store in a safe place for re-use;
- Re-fixing of air conditioning unit including all associated electrical works;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 3 shall be **PER UNIT** of air conditioning unit removed.

### **ITEM MIS 4**

#### **RAIN WATER PIPES**

The price quoted for this item shall include:-

- Supply and fixing of PVC rain water pipes, including all fittings required;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

### **ITEM MIS 4A**

#### **50 MM Diameter**

The unit of measurement for Item MIS 4A shall be the length in **LINEAR METRE (m)** of pipes fixed.

### **ITEM MIS 4B**

#### **75 MM Diameter**

The unit of measurement for Item MIS 4B shall be the length in **LINEAR METRE (m)** of pipes fixed.

### **ITEM MIS 4C**

#### **100 MM Diameter**

The unit of measurement for Item MIS 4C shall be the length in **LINEAR METRE (m)** of pipes fixed.

### **ITEM MIS 5**

#### **WIRE BALLOON**

The price quoted for this item shall include:-

- Supply and fixing of new plastic wire balloons 75/150 mm;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 5 shall be **PER UNIT** of wire balloon fixed.

### **ITEM MIS 6**

#### **CUPBOARD (Standard sheet LM-FM-SD-GCD-01, 02)**

The price quoted for this item shall include:-

- Manufacture and fixing of cupboard as per standard sheet LM-FM-SD-GCD-01, 02;
- Provision of scaffolding as required;
- Apply sealant followed by Varnishing and painting and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 6 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of cupboard fixed as per standard sheet LM-FM-SD-GCD-01, 02.

#### **ITEM MIS 7**

##### **CONCRETE WORKTOP (Standard LM-FM-SD-CWD-01)**

The price quoted for this item shall include:-

- Manufacture and fixing of worktop complete as per standard LM-FM-SD-CWD-01;
  - \* Provision of shelving, sink, vanity wash hand basin, tiles, granite slab, ironmongery, etc. as per drawing and;
  - \* Any miscellaneous costs which may arise.

#### **ITEM MIS 7A**

##### **TYPE A (WITH SHELVING)**

The Unit for Item MIS 7A shall be per **UNIT** of worktop fixed as per standard LM-FM-SD-CWD-01.

#### **ITEM MIS 7B**

##### **TYPE B (WITH SINK)**

The Unit for Item MIS 7B shall be per **UNIT** of worktop fixed as per standard LM-FM-SD-CWD-01.

#### **ITEM MIS 7C**

##### **CONCRETE WORKTOP WITH VANITY WASH HAND BASIN**

The Unit for Item MIS 7C shall be per **UNIT** of worktop fixed as per standard LM-FM-SD-CWD-01.

#### **ITEM MIS 7D**

##### **CONCRETE WORKTOP WITH VANITY WASH HAND BASIN WITH GRANITE SLAB 20 MM IN LIEU OF GLAZED TILES**

The Unit for Item MIS 7D shall be per **UNIT** of worktop fixed as per standard LM-FM-SD-CWD-01 but with granite slab 20 mm in lieu of Glazed tiles.

#### **ITEM MIS 8**

##### **SAND BLASTING**

The price quoted for this item shall include:-

- Preparation and cleaning of surface. All grease and oil to be removed by steam cleaning/solvent prior to sand blasting;
- Sand blasting shall be uniform with no depressions caused by blasting too long in one place;
- Compressed air used for sand blasting shall be free from oil and moisture;
- Protection of all surfaces, not being blasted, from impingement of the abrasive grit;
- Cleaning of surfaces, using dry air, after sand blasting to remove any dust or grit;

- Protection of cleaned surfaces;
- Provision of dust proof nets as required to Engineer's approval;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 8 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of surface sand blasted.

#### **ITEM MIS 9**

##### **CORING OF CONCRETE/STONE ELEMENTS**

The price quoted for this item shall include:-

- Coring of concrete/stone elements, from 50 mm diameter to 150 mm diameter, using coring machine, to procedures specified by the latest British Standards, or equivalent;
- Supply and all necessary materials and plant;
- Making good of the cored area;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 9 shall be per **UNIT** of core executed.

#### **ITEM MIS 10**

##### **REMOVAL OF EXISTING CARPET FLOORING**

The price quoted for this item shall include:-

- Removal of furniture and re-placing;
- Removal of existing carpet flooring and cart away or deliver to MPI store;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 10 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of carpet removed.

#### **ITEM MIS 11**

##### **CARPET FLOORING**

The price quoted for this item shall include:-

- Removal of furniture and re-placing;
- Supply of all necessary materials and plant;
- Supply and laying of new carpet flooring – Application: T5(extra duty), Yorn type: 85% to 100% wool, Yorn weight: 550 to 650 Gm/m, Pile height: 3.5-4.0 mm, Machine gauge: 2.5-3.5 mm, Backing: jute or equivalent, Stiches 10 cm 40-60, Anti static, Fire resistance: to be specified (not less than 30 minutes), (sample to be submitted for approval – refer paragraph 1.10 of the General Specifications) and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 11 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of carpet laid.

#### **ITEM MIS 12**

##### **POLYTHENE SHEETING**

The price quoted for this item shall include:-

- Supply and fixing of one layer of Polythene sheeting 0.23 mm thick;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 12 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of polythene

sheeting laid.

### **ITEM MIS 13**

#### **POLYETHYLENE WATER TANKS**

The price quoted for this item shall include:-

- Supply, installation and connection of a water tank at location specified including any sealing tape, special tools, gaskets, etc required;
- Disinfection and cleaning of the tank prior to domestic use;
- Provision of scaffolding as required;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

### **ITEM MIS 13A**

#### **WATER TANK APPROX 1000L**

The unit of measurement for Item MIS 13A shall be **PER UNIT** of water tank fixed.

### **ITEM MIS 13B**

#### **WATER TANK APPROX 2000L**

The unit of measurement for Item MIS 13B shall be **PER UNIT** of water tank fixed.

### **ITEM MIS13C**

#### **WATER TANK APPROX 3000L**

The unit of measurement for Item MIS 13C shall be **PER UNIT** of water tank fixed.

### **ITEM MIS 13D**

#### **WATER TANK APPROX 6000L**

The unit of measurement for Item MIS 13D shall be **PER UNIT** of water tank fixed.

### **ITEM MIS 13E**

#### **WATER TANK APPROX 9000L**

The unit of measurement for Item MIS 13E shall be **PER UNIT** of water tank fixed.

### **ITEM MIS 14**

#### **WC PAN AND CISTERN EUROPEAN STYLE**

The price quoted for this item shall include:-

- Supply, installation and connection of a WC pan and cistern at location specified including all accessories and fittings required;
- Disinfection and cleaning of the tank prior to use;
- Provision of scaffolding as required;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

### **ITEM MIS 14A**

#### **PORCELAIN “CHINA” WC PAN WITH OVERHEAD CISTERN**

The unit of measurement for Item MIS 14A shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 14B**

**PORCELAIN “CHINA” WC PAN WITH CLOSED COUPLED CISTERN**

The unit of measurement for Item MIS 14B shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 14C**

**PORCELAIN “CHINA” WC PAN WITH CONCEALED CISTERN**

The unit of measurement for Item MIS 14C shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 14D**

**STAINLESS STEEL WC PAN WITH OVERHEAD CISTERN**

The unit of measurement for Item MIS 14D shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 14E**

**STAINLESS STEEL WC PAN WITH CLOSED COUPLED CISTERN**

The unit of measurement for Item MIS 14E shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 14F**

**STAINLESS STEEL WC PAN WITH CONCEALED CISTERN**

The unit of measurement for Item MIS 14F shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 14G**

**PORCELAIN “CHINA” WC PAN WITH CLOSED COUPLED CISTERN FOR HANDICAPPED PERSONS**

The unit of measurement for Item MIS 14G shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 15**

**WC PAN AND CISTERN ASIAN STYLE**

The price quoted for this item shall include:-

- Supply, installation and connection of a WC pan and cistern at location specified including all accessories and fittings required;
- Disinfection and cleaning of the tank prior to use;
- Provision of scaffolding as required;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

**ITEM MIS 15A****PORCELAIN “CHINA” WC PAN WITH OVERHEAD CISTERN**

The unit of measurement for Item MIS 15A shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 15B****PORCELAIN “CHINA” WC PAN WITH CONCEALED CISTERN**

The unit of measurement for Item MIS 15B shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 15C****STAINLESS STEEL WC PAN WITH OVERHEAD CISTERN**

The unit of measurement for Item MIS 15C shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 15D****STAINLESS STEEL WC PAN WITH CONCEALED CISTERN**

The unit of measurement for Item MIS 15D shall be **PER UNIT** of WC pan and cistern fixed.

**ITEM MIS 16****REMOVAL OF EXISTING WC PAN AND CISTERN**

The price quoted for this item shall include:-

- Removal of existing WC pan and cistern, associated plumbing elements and carting away as per Engineer’s instructions;
- Breaking of concrete/blockwork as required and making good;
- All associated works to remove enclosing partition and re-fixing same on completion of works, inclusive of repairs to any damage to same (in case of concealed cistern);
- Provision of scaffolding as required;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 16 shall be **PER UNIT** of WC pan and cistern removed.

**ITEM MIS 17****TOILET PAPER HOLDER**

The price quoted for this item shall include:-

- Supply and fix new Porcelaine China or stainless steel toilet paper holder approx. dimensions 150 x 80 mm to Engineer’s approval;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 17 shall be per **UNIT** of toilet paper holder fixed.

**ITEM MIS 18****CISTERN ONLY**

The price quoted for this item shall include:-

- Supply, installation and connection of a cistern at location specified including all accessories and fittings required;
- Disinfection and cleaning of the tank prior to use;
- Provision of scaffolding as required;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

**ITEM MIS 18A****PORCELAINE OVERHEAD CISTERN**

The unit of measurement for Item MIS 18A shall be **PER UNIT** of cistern fixed.

**ITEM MIS 18B****PORCELAINE CLOSED COUPLED CISTERN**

The unit of measurement for Item MIS 18B shall be **PER UNIT** of cistern fixed.

**ITEM MIS 18C****PORCELAINE CONCEALED CISTERN**

The unit of measurement for Item MIS 18 C shall be **PER UNIT** of cistern fixed.

**ITEM MIS 18D****PLASTIC OVERHEAD CISTERN**

The unit of measurement for Item MIS 18D shall be **PER UNIT** of cistern fixed.

**ITEM MIS 18E****STAINLESS STEEL CISTERN**

The price quoted for this item shall include:-

- Supply, installation and connection of a cistern at location specified including all accessories and fittings required;
- Disinfection and cleaning of the tank prior to use;
- Provision of scaffolding as required;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 18E shall be **PER UNIT** of cistern fixed.

**ITEM MIS 19****WC PAN ASIAN STYLE**

The price quoted for this item shall include:-

- Supply, installation and connection of a WC pan at location specified including all accessories and fittings required;
- Disinfection and cleaning prior to use;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

**ITEM MIS 19A****PORCELAIN “CHINA” WC PAN**

The unit of measurement for Item MIS 18A shall be **PER UNIT** of WC pan fixed.

**ITEM MIS 19B****STAINLESS STEEL WC PAN**

The unit of measurement for Item MIS 18B shall be **PER UNIT** of WC pan fixed.

**ITEM MIS 20****WC PAN EUROPEAN STYLE**

The price quoted for this item shall include:-

- Supply, installation and connection of a WC pan at location specified including all accessories and fittings required;
- Disinfection and cleaning prior to use;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

**ITEM MIS 20A****PORCELAIN “CHINA” WC PAN**

The unit of measurement for Item MIS 20A shall be **PER UNIT** of WC pan fixed.

**ITEM MIS 20B****STAINLESS STEEL WC PAN**

The unit of measurement for Item MIS 20B shall be **PER UNIT** of WC pan fixed.

**ITEM MIS 20C****PORCELAIN “CHINA” WC PAN FOR HANDICAPPED**

The unit of measurement for Item MIS 20C shall be **PER UNIT** of WC pan fixed.

**ITEM MIS 21****URINAL AND CISTERN**

The price quoted for this item shall include:-

- Supply, installation and connection of a Urinal and cistern at location specified including all accessories and fittings required;
- Disinfection and cleaning prior to use;
- Provision of scaffolding as required;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

**ITEM MIS 21A****PORCELAIN INDIVIDUAL BOWL TYPE**

The unit of measurement for Item MIS 21A shall be **PER UNIT** of Urinal and cistern fixed.

**ITEM MIS 21B****PORCELAIN WALL HUNG THROUGH TYPE**



The unit of measurement for Item MIS 21B shall be **PER UNIT** of Urinal and cistern fixed.

**ITEM MIS 21C**

**PORCELAIN FLOOR RECESSED TYPE**

The unit of measurement for Item MIS 21C shall be **PER UNIT** of Urinal and cistern fixed.

**ITEM MIS 21D**

**STAINLESS STEEL INDIVIDUAL BOWL TYPE**

The unit of measurement for Item MIS 21D shall be **PER UNIT** of Urinal and cistern fixed.

**ITEM MIS 21E**

**STAINLESS STEEL WALL HUNG THROUGH TYPE**

The unit of measurement for Item MIS 21E shall be **PER UNIT** of Urinal and cistern fixed.

**ITEM MIS 21F**

**STAINLESS STEEL FLOOR RECESSED TYPE**

The unit of measurement for Item MIS 21F shall be **PER UNIT** of Urinal and cistern fixed.

**ITEM MIS 22**

**REMOVAL OF EXISTING URINAL AND CISTERN ANY TYPE**

The price quoted for this item shall include:-

- Removal of existing Urinal and cistern, associated plumbing elements and carting away as per Engineer's instructions;
- Breaking of concrete/blockwork as required and making good;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MISS 22 shall be **PER UNIT** of Urinal and cistern removed.

**ITEM MIS 23**

**HAND WASH BASIN PORCELAIN**

The price quoted for this item shall include:-

- Supply, installation and connection of a Hand wash basin at location specified including all accessories and fittings (waist, bottle trap, etc...) required;
- Disinfection and cleaning prior to use;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

**ITEM MIS 23A****PORCELAIN SINGLE BOWL, WALL MOUNTED, CORNER TYPE**

The unit of measurement for Item MIS 23A shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 23B****PORCELAIN SINGLE BOWL, CORNER TYPE WITH CABINET**

The unit of measurement for Item MIS 23B shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 23C****PORCELAIN SINGLE BOWL, CORNER TYPE ON PEDESTAL**

The unit of measurement for Item MIS 23C shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 23D****PORCELAIN SINGLE BOWL, WALL MOUNTED TYPE**

The unit of measurement for Item MIS 23D shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 23E****PORCELAIN SINGLE BOWL WITH CABINET**

The unit of measurement for Item MIS 23E shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 23F****PORCELAIN SINGLE BOWL, PEDESTAL TYPE**

The unit of measurement for Item MIS 23F shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 23G****PORCELAIN MULTIPLE BOWL, WALL MOUNTED TYPE**

The unit of measurement for Item MIS 23G shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 23H****PORCELAIN MULTIPLE BOWL, WITH CABINET**

The unit of measurement for Item MIS 23H shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 23i**

**PORCELAIN VANITY BASIN**

The unit of measurement for Item MIS 23i shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 24****HAND WASH BASIN STAINLESS STEEL**

The price quoted for this item shall include:-

- Supply, installation and connection of a Hand wash basin at location specified including any accessories and fittings (waist, bottle trap, etc...) required;
- Disinfection and cleaning prior to use;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

**ITEM MIS 24A****STAINLESS STEEL SINGLE BOWL WITH CABINET**

The unit of measurement for Item MIS 24A shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 24B****STAINLESS STEEL MULTIPLE BOWL WITH CABINET**

The unit of measurement for Item MIS 24B shall be **PER UNIT** of Hand wash basin fixed.

**ITEM MIS 25****REMOVAL OF HAND WASH BASIN ANY TYPE**

The price quoted for this item shall include:-

- Removal of existing Hand wash basin, associated plumbing elements and carting away as per Engineer's instructions;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 25 shall be **PER UNIT** of Hand wash basin removed.

**ITEM MIS 26****SINK**

The price quoted for this item shall include:-

- Supply, installation and connection of a sink at location specified including all accessories and fittings (waist, bottle trap, etc...) required;
- Disinfection and cleaning prior to use;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

**ITEM MIS 26A****PORCELAIN SINGLE RIGHT OR LEFT HAND OR CENTRAL BOWL**

The unit of measurement for Item MIS 26A shall be **PER UNIT** of sink fixed.

**ITEM MIS 26B****PORCELAIN DOUBLE CENTRAL BOWL**

The unit of measurement for Item MIS 26B shall be **PER UNIT** of sink fixed.

**ITEM MIS 26C****STAINLESS STEEL SINGLE RIGHT OR LEFT HAND OR CENTRAL BOWL**

The unit of measurement for Item MIS 26C shall be **PER UNIT** of sink fixed.

**ITEM MIS 26D****STAINLESS STEEL DOUBLE CENTRAL BOWL**

The unit of measurement for Item MIS 26D shall be **PER UNIT** of sink fixed.

**ITEM MIS 26E****SLUICE SINK STAINLESS STEEL**

The price quoted for this item shall include:-

- Supply, installation and connection of a stainless steel sluice sink, approx. dim 550x400x300 mm at location specified including all accessories and fittings (waist, bottle trap, etc...) required;
- Disinfection and cleaning prior to use;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 26E shall be **PER UNIT** of sluice sink fixed.

**ITEM MIS 27****REMOVAL OF SINK ANY TYPE**

The price quoted for this item shall include:-

- Removal of existing sink, associated plumbing elements and carting away as per Engineer's instructions;
- Breaking of concrete/blockwork as required and making good; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 27 shall be **PER UNIT** of sink removed.

**ITEM MIS 27A****REMOVAL OF SHOWER TRAY**

- Removal of existing shower tray, associated plumbing elements and carting away as per Engineer's instructions;
- Breaking of concrete/blockwork as required and making good; and
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 27A shall be **PER UNIT** of shower tray removed.

**ITEM MIS 28****SHOWER TRAY**

The price quoted for this item shall include:-

- Supply, installation and connection of a shower tray at location specified including all accessories and fittings required;
- Supply and laying waterproofing compound as per manufacturer's specifications and to Engineer's approval, prior to fixing of shower tray;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

**ITEM MIS 28A****PVC SHOWER TRAY**

The unit of measurement for Item MIS 28A shall be **PER UNIT** of shower tray fixed.

**ITEM MIS 28B****PORCELAIN CHINA SHOWER TRAY**

The unit of measurement for Item MIS 28B shall be **PER UNIT** of shower tray fixed.

**ITEM MIS 29****BATH TUB**

The price quoted for this item shall include:-

- Supply, installation and connection of an adult size fibre glass bath tub at location specified including all materials, accessories and fittings required;
- Testing and commissioning and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 29 shall be **PER UNIT** of bath tub fixed.

**ITEM MIS 30****REMOVAL/FIXING OF TAPS AND ACCESSORIES - STAINLESS STEEL**

The price quoted for this item shall include:-

- Removal of existing tap and associated plumbing elements and carting away, if applicable;
- Supply, installation and connection of tap arrangement complete with all accessories and fittings required;
- Disinfection and cleaning prior to use and;
- Any miscellaneous cost which may arise.

**ITEM MIS 30A****STAINLESS STEEL SINGLE TYPE**

The unit of measurement for Item MIS 30A shall be **PER UNIT** of tap fixed.

**ITEM MIS 30B****STAINLESS STEEL HIGH/LOW NECK COBRA TYPE**

The unit of measurement for Item MIS 30B shall be **PER UNIT** of tap fixed.

**ITEM MIS 30C****STAINLESS STEEL HIGH/LOW NECK MIXER TYPE, WITH TWO PIPES ENTRY**

The unit of measurement for Item MIS 30C shall be **PER UNIT** of tap fixed.

**ITEM MIS 30D****STAINLESS STEEL SHOWER/BATH TUB MIXER TYPE, WITH DOUBLE PIPES ENTRY**

The unit of measurement for Item MIS 30D shall be **PER UNIT** of tap fixed.

**ITEM MIS 31****REMOVAL/FIXING OF TAPS AND ACCESSORIES - CHROMED**

The price quoted for this item shall include:-

- Removal of existing tap and associated plumbing elements and carting away, if applicable;
- Supply, installation and connection of tap arrangement complete with all accessories and fittings required;
- Disinfection and cleaning prior to use; and
- Any miscellaneous cost which may arise.

**ITEM MIS 31A****CHROMED SINGLE TYPE**

The unit of measurement for Item MIS 31A shall be **PER UNIT** of tap fixed.

**ITEM MIS 31B****CHROMED HIGH/LOW NECK COBRA TYPE**

The unit of measurement for Item MIS 31B shall be **PER UNIT** of tap fixed.

**ITEM MIS 31C****CHROMED HIGH/LOW NECK MIXER TYPE, WITH TWO PIPES ENTRY**

The unit of measurement for Item MIS 31C shall be **PER UNIT** of tap fixed.

**ITEM MIS 31D****CHROMED SHOWER/BATH TUB MIXER TYPE, WITH DOUBLE PIPES ENTRY**

The unit of measurement for Item MIS 31D shall be **PER UNIT** of tap fixed.

**ITEM MIS 31E****CHROMED PILLAR TAP**

The unit of measurement for Item MIS 31E shall be **PER UNIT** of tap fixed.

**ITEM MIS 32****PIPES AND FITTINGS – POLYCOP EQUIPMENT**

The price quoted for this item shall include:-

- Removal of existing pipes and fittings and associated plumbing elements and carting away, if applicable;
- Supply, installation and connection of pipes and fittings arrangement complete with all accessories and fittings (measured separately) required;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

**ITEM MIS 32A****POLYCOP PIPES SIZE NOT EXCEEDING 1 INCH DIAMETER**

The unit of measurement for Item MIS 32A shall be the length in **LINEAR METRE** of pipes fixed.

**ITEM MIS 32B****POLYCOP PIPES SIZE BETWEEN 1 INCH AND 2 INCHES DIAMETER**

The unit of measurement for Item MIS 32B shall be the length in **LINEAR METRE** of pipes fixed.

**ITEM MIS 32C****POLYCOP FITTINGS INCLUDING BUT NOT LIMITED TO ELBOW, TEE, CROSS, NIPPLE, PLUG, SOCKETS, REDUCERS, ADAPTORS, CONNECTOR, SIZE NOT EXCEEDING 1 INCH**

The unit of measurement for Item MIS 32C shall be **PER UNIT** of fittings fixed.

**ITEM MIS 32D****POLYCOP FITTINGS INCLUDING BUT NOT LIMITED TO ELBOW, TEE, CROSS, NIPPLE, PLUG, SOCKETS, REDUCERS, ADAPTORS, CONNECTOR, SIZE BETWEEN 1 INCH AND 2 INCHES**

The unit of measurement for Item MIS 32D shall be **PER UNIT** of fittings fixed.

**ITEM MIS 33****PIPES AND FITTINGS – PRESSURE PVC EQUIPMENT**

The price quoted for this item shall include:-

- Removal of existing pipes and fittings and associated plumbing elements and carting away, if applicable;
- Supply, installation and connection of pipes and fittings arrangement complete with all accessories and fittings (measured separately) required;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

**ITEM MIS 33A****PRESSURE PVC PIPES SIZE NOT EXCEEDING 1 INCH DIAMETER**

The unit of measurement for Item MIS 33A shall be the length in **LINEAR METRE** of pipes fixed.

**ITEM MIS 33B****PRESSURE PVC PIPES SIZE BETWEEN 1 INCH AND 2 INCHES DIAMETER**

The unit of measurement for Item MIS 33B shall be the length in **LINEAR METRE** of pipes fixed.

**ITEM MIS 33C****PRESSURE PVC PIPES 50 MM DIAMETER**

The unit of measurement for Item MIS 33C shall be the length in **LINEAR METRE** of pipes fixed.

**ITEM MIS 33D**

**PRESSURE PVC PIPES 100/150 MM DIAMETER**

The unit of measurement for Item MIS 33D shall be the length in **LINEAR METRE** of pipes fixed.

**ITEM MIS 33E**

**PRESSURE PVC FITTINGS INCLUDING BUT NOT LIMITED TO ELBOW, TEE, CROSS, NIPPLE, PLUG, SOCKETS, REDUCERS, ADAPTORS, CONNECTOR, SIZE NOT EXCEEDING 1 INCH**

The unit of measurement for Item MIS 33E shall be **PER UNIT** of fittings fixed.

**ITEM MIS 33F**

**PRESSURE PVC FITTINGS INCLUDING BUT NOT LIMITED TO ELBOW, TEE, CROSS, NIPPLE, PLUG, SOCKETS, REDUCERS, ADAPTORS, CONNECTOR, SIZE BETWEEN 1 INCH AND 2 INCHES**

The unit of measurement for Item MIS 33F shall be **PER UNIT** of fittings fixed.

**ITEM MIS 33G**

**PRESSURE PVC FITTINGS INCLUDING BUT NOT LIMITED TO ELBOW, TEE, CROSS, NIPPLE, PLUG, SOCKETS, REDUCERS, ADAPTORS, CONNECTOR, SIZE 50 MM**

The unit of measurement for Item MIS 33G shall be **PER UNIT** of fittings fixed.

**ITEM MIS 33H**

**PRESSURE PVC FITTINGS INCLUDING BUT NOT LIMITED TO ELBOW, TEE, CROSS, NIPPLE, PLUG, SOCKETS, REDUCERS, ADAPTORS, CONNECTOR, SIZE 100/150 MM**

The unit of measurement for Item MIS 33H shall be **PER UNIT** of fittings fixed.

**ITEM MIS 34****PIPES AND FITTINGS – PVC EQUIPMENT**

The price quoted for this item shall include:-

- Removal of existing pipes and fittings and associated plumbing elements and carting away, if applicable;
- Supply, installation and connection of pipes and fittings arrangement complete with all accessories and fittings (measured separately) required;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

**ITEM MIS 34A****PVC PIPES 50 MM DIAMETER**

The unit of measurement for Item MIS 34A shall be the length in **LINEAR METRE** of pipes fixed.



**ITEM MIS 34B****PVC PIPES 100/150 MM DIAMETER**

The unit of measurement for Item MIS 34B shall be the length in **LINEAR METRE** of pipes fixed.

**ITEM MIS 34C****PVC FITTINGS INCLUDING BUT NOT LIMITED TO ELBOW, TEE, CROSS, NIPPLE, PLUG, SOCKETS, REDUCERS, ADAPTORS, CONNECTOR, SIZE 50 MM**

The unit of measurement for Item MIS 34C shall be **PER UNIT** of fittings fixed.

**ITEM MIS 34D****PVC FITTINGS INCLUDING BUT NOT LIMITED TO ELBOW, TEE, CROSS, NIPPLE, PLUG, SOCKETS, REDUCERS, ADAPTORS, CONNECTOR, SIZE 100/150 MM**

The unit of measurement for Item MIS 34D shall be **PER UNIT** of fittings fixed.

**ITEM MIS 35****FITTINGS – BRASS EQUIPMENT**

The price quoted for this item shall include:-

- Removal of existing pipes and fittings and associated plumbing elements and carting away, if applicable;
- Supply, installation and connection fittings arrangement (measured separately) complete with all accessories required;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

**ITEM MIS 35A****BRASS FITTINGS INCLUDING BUT NOT LIMITED TO ELBOW, TEE, CROSS, NIPPLE, PLUG, SOCKETS, REDUCERS, ADAPTORS, CONNECTOR, SIZE 50MM OR LESS**

The unit of measurement for Item MIS 35A shall be **PER UNIT** of fittings fixed.

**ITEM MIS 35B****BRASS FITTINGS INCLUDING BUT NOT LIMITED TO ELBOW, TEE, CROSS, NIPPLE, PLUG, SOCKETS, REDUCERS, ADAPTORS, CONNECTOR, SIZE ABOVE 50MM**

The unit of measurement for Item MIS 35B shall be **PER UNIT** of fittings fixed.

**ITEM MIS 36****REMOVAL/FIXING OF ANGLE VALVE AND ACCESSORIES**

The price quoted for this item shall include:-

- Removal of existing angle valve and associated plumbing elements and carting away, if applicable;
- Supply, installation and connection of new angle valve arrangement complete with all accessories and fittings required;
- Disinfection and cleaning prior to use and;

- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 36 shall be **PER UNIT** of angle valve fixed.

#### **ITEM MIS 37**

##### **REMOVAL/FIXING OF NON RETURN VALVE AND ACCESSORIES**

The price quoted for this item shall include:-

- Removal of existing non return valve and associated plumbing elements and carting away, if applicable;
- Supply, installation and connection of new non return valve arrangement complete with all accessories and fittings required;
- Disinfection and cleaning prior to use and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 37 shall be **PER UNIT** of non return valve fixed.

#### **ITEM MIS 38**

##### **FIXING OF HOSE SPRAY**

The price quoted for this item shall include:-

- Supply, installation and connection of flexible hose spray with chrome plated hand spray complete with all accessories and fittings required;
- Disinfection and cleaning prior to use and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 38 shall be **PER UNIT** of hose spray fixed.

#### **ITEM MIS 39**

##### **MIRROR**

The price quoted for this item shall include:-

- Supply and installation of good quality bevelled edge mirror fixed with round-headed chrome plated screws on plywood backing 600 x 450 x 6 mm;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 39 shall be per **UNIT** of mirror fixed.

#### **ITEM MIS 40**

##### **SOAP HOLDER**

The price quoted for this item shall include:-

- Supply and fix new Porcelaine China or Stainless steel soap holder to Engineer's approval;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 40 shall be per **UNIT** of soap holder fixed.

#### **ITEM MIS 41**

##### **TOWEL HOLDER**

The price quoted for this item shall include:-

- Supply and fix new stainless steel towel holder;

- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 41 shall be per **UNIT** of towel holder fixed.

#### **ITEM MIS 42**

##### **SHOWER KIT**

The price quoted for this item shall include:-

- Supply and fix wall mounted chrome plated kit for exposed shower with flexible hose, handspray, sliding rail and wall connection; 80 mm chrome plated shower head or equivalent and chrome plated stop-cock;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 42 shall be per **UNIT** of shower fixed.

#### **ITEM MIS 43**

##### **CURTAIN RAILS**

The price quoted for this item shall include:-

- Supply and fix 25 mm dia. curtain rail in aluminium anodised silver finish with all supports and fittings;
- Provision of scaffolding as required and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 43 shall be the length in **LINEAR METRE** of curtain rails fixed.

#### **ITEM MIS 44**

##### **FIBRE GLASS SEPTIC TANK**

The price quoted for this item shall include:-

- Excavation in any material and cart away;
- Supply and fix fibre glass septic tank of 2.5 m<sup>3</sup> capacity to Manufacturer's specifications, including backfilling with rock sand and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 44 shall be per **UNIT** of fibre glass septic tank fixed.

#### **ITEM MIS 45**

##### **GRAB RAIL**

The price quoted for this item shall include:-

- Supply and fix new 32 mm diameter stainless steel grab rail minimum 450 mm long;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 45 shall be per **UNIT** of grab rail fixed.

#### **ITEM MIS 46**

##### **GREASE TRAP Standard Sheet LM-FM-SD-TGT-01**

The price quoted for this item shall include:-

- Excavation in any material and cart away;
- Supply and fix fibre glass grease trap of 75/100 L capacity to Manufacturer's specifications, including backfilling with rock sand and;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 46 shall be per **UNIT** of grease trap fixed.

#### **ITEM MIS 47**

##### **FLOOR DRAIN STRAINER**

The price quoted for this item shall include:-

- Supply and fix new floor drain strainer 100x100 mm made of stainless steel or brass to Manufacturer's specifications;
- Any miscellaneous cost which may arise.

The unit of measurement for Item MIS 47 shall be per **UNIT** of floor drain strainer fixed.

#### **ITEM MIS 48**

##### **GALVANISED METAL STRIPS WITH SPIKES**

The price quoted for this item shall include:-

- Manufacture metal strips (37mm x 6 mm thick) with welded spikes (8 mm dia., 70 mm height including 20 mm sharp end) at 50 mm interval;
- Metal strips with welded spikes to be hot dipped galvanised after manufacture;
- Prepare surface as required prior to painting works;
- Supply of paint as per specification;
- Apply one coat of primer, undercoat and two coats hard gloss paint to internal and external surfaces;
- Provision of scaffolding as required;
- Fixing of galvanised metal strips as instructed by the Engineer; and
- Any miscellaneous costs which may arise.

The Unit of measurement for Item MIS 48 shall be the length in **METRE (m)** of metal strips fixed.

#### **ITEM MIS 49**

##### **BIRD PROOF NET**

The price quoted for this item shall include:-

- Supply and fix bird net with squared mesh not exceeding 25 mm size, inclusive of all fasteners, brackets, aluminium frames, cables and clips, etc for fixation as per manufacturer's specifications;
- Nets to be manufactured from galvanised wire, polyethylene or other materials to Engineer's approval;
- All fixation materials to be galvanized or stainless steel to Engineer's approval;
- Provision of scaffolding as required; and
- Any miscellaneous costs which may arise.

The Unit of measurement for Item MIS 49 shall be the area in **SQUARE METRE (m<sup>2</sup>)** of bird

net fixed.

**ITEM MIS 50**

**MOSQUITO NET**

The price quoted for this item shall include:-

- Supply and fix mosquito net inclusive of all fasteners, brackets, aluminium frames, cables and clips, etc for fixation as per manufacturer's specifications;
- Nets to be manufactured from polyester fiberglass, nylon, galvanised steel wire, polyethylene or other materials to Engineer's approval;
- All fixation materials to be galvanised or stainless steel to Engineer's approval;
- Provision of scaffolding as required; and
- Any miscellaneous costs which may arise.

The Unit of measurement for Item MIS 50 shall be the area in **SQUARE METRE** **(m<sup>2</sup>)** of mosquito net fixed.

## **DAYWORK SCHEDULES**

### **PLANT/EQUIPMENT (D) PLA**

The rates to be inserted are to include all operational maintenance costs including fuel, oil, grease, spare parts, repairs, any extra costs of overtime and all superintendence, overheads and profit. The rates shall also include for all travelling time and costs for the plant operators, etc, to, from and about the site. Idle time, where due solely to the nature of the dayworks or the authorised method of procedure, will be paid for, at 1/2 (one half) of the rates entered herein. Idle time due to breakdowns, inefficiency or unsuitability or incompleteness of the plant will not be paid.

### **LABOUR (E) LAB**

The rates to be inserted herein are to include all costs of labour and maintenance of tools and small plants such as scaffolding, trestles, wheelbarrows, picks, shovels, handpumps, etc; any extra costs of overtime, insurances, accommodation, travelling time and expenses to, from and about the site, etc; together with all superintendence, overheads and profit.

### **MATERIALS (F) MAT**

The Materials are to be all to the qualities and descriptions stated in the specifications. The rates to be inserted are to include all loading, transport, unloading, storage, double-handling, etc., together with all overheads and profit. Payment for materials authorised by the Engineer for use on dayworks and not included in the following items shall be at net invoice costs received for supply and delivery to a central store or stockpile area on site. The net quantities and weights actually used and verified by the Engineer only shall be certified and paid under dayworks.