TECHNICAL SPECIFICATIONS

Kigali, Rwanda

Construction of driveway and drainage system

CONTENTS:

OVERSEAS BUILDINGS OPERATIONS
FACILITY MANAGEMENT

PART ONE - GENERAL

C. 1.1 SUMMARY:

A. The American Embassy in Kigali, Rwanda is currently willing to upgrade the driveway and stormwater drainage at a residence located in Kacyiru neighborhood in Kigali, Rwanda. The existing driveway consists of bitumen surfacing that appears to have been applied over a concrete surface. Existing surface is cracked, is improperly graded, and has inadequate stormwater management system resulting in stormwater flowing into the garage and settling along the house's foundation.

The project consists of demolition of existing pavements, grading, construction of new pavement surfaces and associated curbs and drainage directing stormwater from the driveway to the municipal drainage trench. The existing driveway area is approximately 800 m2 with two vehicle gates of the driveway accessing KG 694 St. (Refer to drawings). For that purpose, the Contractor shall perform construction works as specified and shown in the technical drawings.

The proposed works are, but not limited to, the following:

1. Extraction of roots likely to result in road pavement damage keeping a 50cm offset from the road edge and transportation of debris away from the project site.

2. Diversion or protection of underground utilities: consult embassy's officials or use existing maps to accurately locate existing utilities. Proceed with care during excavation and protect, replace or relocate the installations inside the proposed ducts.

3. Demolition of existing pavements, curbs and manholes, transport and stockpiling of waste in approved dumpsites.

4. Driveway and basketball court excavation for bases, 430mm for driveway and 450mm for basketball court below project levels.

5. Subgrade levelling, watering and compaction to 95% OPM min.

6. Compaction of raodbase (30cm after compaction) and basketball base layer (20cm after compaction) in Selected Natural Gravels (SNG) such as murram.

7. Supply, spread and screed 50cm thick layer of well graded washed river sand.

8. Laying of 80mm concrete pavers in an approved pattern by the project manager. This item includes also the filling of empty spaces between curbstones and pavers with concrete at the driveway edges where necessary and final compaction of pavers as specified.

9. Casting of concrete ground slab for basketball court (Pavement), water drain and root barrier.

10. Laying of curbstones.

11. Fabrication and laying of metal grating.

12. Trench excavation, 50cm of width x 80cm of depth in average, for stormwater drain trench.

13. Supply, lay and sand bed Φ200mm PVC pipe.

14. Supply and spread 500mm thick layer of sand along the drain pipe.

15. Backfill and compaction of earth above PVC pipes.

16. Construction of manholes.

17. Construction of secondary soak pit.

18. Cleaning and disposal of surplus materials and all debris, garden replantation in all affected areas, watering till complete establishment of grass.

A. 1.2 SUBMITTALS:

A. Contractor's executed bonds and insurance certificate.
B. Contractor's crew individual identification information for background checks.
C. Submit list of all mechanical and/or electrical equipment and all other subcontractors with evidence of subcontractor's insurance coverage.
D. Project schedule showing work phasing and proposed daily progress.

E. Construction Accident Prevention Plan (CAPP)
F. Material manufacturers and accessory product data sheets.
G. Warranty: The Contractor shall provide a written one-year workmanship warranty after date of substantial completion to cover the maintenance and repair cracks or any other defect.

C. 1.3 SUBSTITUTIONS AND PRODUCT OPTIONS:

A. Contractor's Representation: Request for substitution constitutes a representation that Contractor:
   1. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
   2. Shall coordinate installation or usage of accepted substitution into work and make such other changes as may be required for work to be complete in all respects.
   3. Waives all claims for additional costs, under his responsibility, related to substitution, which subsequently becomes apparent.
   4. If substitution is not approved or accepted, contractor shall furnish specified product.

B. Substitutions:

   1. During solicitation, only written requests for substitutions of products in place of those specified will be considered. Such requests must be received at least two weeks prior to Proposal Date. Requests received after that time will not be considered. Approval of substitutions will be set forth in an amendment.

   2. Requests for substitutions supported with complete data, drawings, and appropriate samples shall include data listed below:
      a. Product description, performance and test data, and applicable reference standards.
      b. Changes required in other elements of work because of substitution.
      c. Effect on construction schedule.

C. Product Options: for products specified by naming several products or manufacturers, select any product and manufacturer named.

C. 1.4 QUALITY CONTROL:

A. The Embassy and OBO has the right to inspect and test all services, to the extent practicable at all times and places during the work. OBO may perform full time quality assurance inspections [QAI] and tests during construction to confirm the work is installed according to the Construction Documents.
B. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of specified quality.
C. Manufacturer’s product to perform the work for the specified guarantee period shall be approved by the contractor.

C. 1.5 STORAGE OF MATERIALS:

A. Proper storage of materials is the sole responsibility of Contractor. Keep all labels intact and legible, clearly showing the product, manufacturer, and other pertinent information. Prior approval by embassy officials regarding materials storage area shall be sought for by the contractor.
B. Store materials on site. Cover and protect materials subject to damage by weather, including during transit. Stored materials shall be available for inspection.
C. Store flammable and volatile liquids in sealed containers located a minimum of 6m from existing buildings.
D. Liquid products shall be delivered sealed, in original containers. Store roll goods in an upright position.

C.1.6 TEMPORARY FACILITIES:

A. Temporary office and W.C:

1. Provide and install a movable site office in indicated area (A 20ft shipping container office is recommended for example). Negotiate with embassy officials for other alternatives.

2. Provide two PVC toilets and connect them to the existing septic tank through the nearest manhole
3. Connect electricity and water to site offices toilets

B. Temporary water:

1. Make arrangements with the Embassy for water required for construction. Embassy will pay for the cost of water.
2. Do not disrupt existing water service to the building.
3. Provide hoses for conveyance.

C. Temporary Electrical

1. Arrange with Embassy for temporary electrical service. Embassy will pay energy charges for temporary power and lighting.
2. Notify Embassy prior to each required interruption of mechanical or electrical services in building.
3. Provide all necessary temporary wiring extensions and temporary lighting devices.

D. Temporary equipment and installations:

1. Furnish and maintain temporary equipment and installations for proper execution of Work.
2. Provide all required protection on sites.
3. Restrict debris removal to Embassy - approved area of building site.
4. Restrict location of construction machines to areas as approved by Embassy.
5. Machines, various equipment, and construction process shall meet requirements of applicable standards, local safety and labor laws.
6. Restrict compaction energy of machines to safeguard the stability of existing constructions; provide similar compaction density with smaller machines.

C.1.7 PROJECT PROCEDURES:

A. Embassy will hand over the construction site during entire period of construction to the contractor. However, security teams and key embassy officials shall have full access at all times and Embassy will keep minimum operations. Contractor shall conduct his activities so as to ensure least inconvenience to the Embassy's operations.

B. Contractor shall take precautions to avoid excessive noise or vibration that would disturb Embassy's operations. When directed by Embassy, Contractor shall perform certain operations at designated time of day or night in order to minimize disturbances.

C. 1.8 PROJECT SAFETY:

A. Contractor is responsible for safety and shall comply with all local labor laws, regulations, customs and practices pertaining to labor, safety and similar matters. Contractor shall prepare a construction accident prevention plan to cover total project safety.

B. Demolition and the construction process in general give off dust. Close and seal all doors and windows near and around work area. Close off and seal all HVAC air intake points, goose necks, and vents with duct tape and polyethylene sheeting. Shutting down the HVAC may be necessary during the work so as not to affect the equipment.

C. 1.9 PROJECT SECURITY:

A. Personnel Clearances:

Local labor background checks will require a minimum of 21 days for clearance. Local labor may be used on this project provided that they are escorted by local embassy employees or U.S. cleared citizens.

B. Vehicle and machine clearances: Submit authorization requests, to include dates, vehicle/machine type, license number, and driver name, for each motorized vehicle/machine used on-site.

C. Access to Site: Contractor shall have limited access to or be admitted into the compound outside the areas designated for the project except with permission by the Embassy.

D. Access to work area:
   1. Access shall be from the main gates of the compound
   2. Material loading/off-loading shall be from the EXTERIOR of the compound.

E. Procurement/Storage: Materials shall be procured by NON-SECURE or local means and stored NON-SECURE. All materials may be inspected prior to use on the project.

PART TWO – STANDARD SPECIFICATIONS FOR BUILDING WORKS

General Table of Contents

ARCHITECTURAL, STRUCTURAL AND GENERAL WORKS

1.1 GENERAL MATTERS

1.1.1 General Conditions of Contract

All clauses, definitions and procedures described in the Rwanda Building Code and General Conditions of Contract for the Procurement of Works, issued by the Rwanda Housing Authority / Ministry of infrastructure and the Rwanda Public Procurement Authority (RPPA) respectively will apply to these specifications unless specifically ruled otherwise.

1.1.2 Instructions to Bidders

All clauses, definitions and instructions issued in the Invitation to Bid and Instructions to Bidders will apply to these specifications unless otherwise ruled.

1.1.3 Scope of Contractor's Obligations

The Contractor shall provide everything necessary for the proper execution and completion of the works, according to these specifications, the particular specification and/or the bills of quantities whether the same is particularly described or not.

The Contractor shall provide all labour, carriage, freightage, building materials, implements, tools, tackle and plant and whatever else may be required for the proper and efficient execution and completion of the works.

The Contractor shall obtain necessary consents, pay any charges for, provide, erect, maintain and remove all necessary self-supporting and other scaffolding, staging, gangways etc together with the necessary planks, ladders, trestles, etc.

The Contractor shall include in his rates, unit prices or tender for all charges for waste, establishment and overhead charges and profit.

1.1.4 Interpretation of Terms

- Wherever the word "Project Manager" is used in these technical specifications will stand for Project consultant, "Employer" stands for the procuring entity
- Wherever the words – "selected" as "directed" "as required", or words of similar meaning are used in these documents, it is to be understood that the selection, direction or requirements of the Project Manager are intended. Similarly, the words "approved","satisfactory" or other synonyms shall mean "approved by" or " satisfactory to" the Project Manager and the Project Manager's approval must first be obtained before the materials are ordered or the works to which the words refer are put in hand.

Where the words "necessary", "proper" or words of similar meaning are used in these documents with respect to the extent conduct or character or work described, it is to be understood that they shall mean that the said work shall be executed to the extent, must be conducted in a manner or be of a character which is "necessary" or "proper" in the opinion of the Project Manager.

1.1.5 Workmanship

All workmanship shall be carried out by skilled operatives well versed in their respective trades.
All persons carrying out electrical works shall hold licenses for carrying out such work in accordance with the regulation of the Rwanda Utilities Regulatory Authority.

1.1.6 Codes of Practices

Where certain classes of work are described as in accordance with a Code of Practice or Standard, this shall be understood to mean the most recent and up to date editions of the Codes of Practices or Standards referred to. Where a Rwandan Standard is not in existence, the most recent version of British Standards may be applied.

1.1.7 Materials

All materials shall be new unless otherwise directed or permitted by the Project Manager and in all cases where the quality of goods or materials is not described or otherwise specified is to be the best quality obtainable in the ordinary meaning of the word "best" and not merely a trade signification of that word.

A reference to Standard Specification shall be understood to mean the most recent and up to date edition of that specification as published by Rwanda Standard Board

The Project Manager reserves the right to substitute, amend, alter, enlarge upon, correct or revise any of the foregoing and where this is intended it will be expressly stated herein.

1.1.8 Ordering of Materials

The Contractor shall be solely responsible for ordering all materials required for use on the works.

The Contractor shall order all material, other than those covered by Prime Cost or Provisional Sums, as early as necessary after the Contract is signed to ensure that such material will be on site when required for incorporation in the works.

Materials which are the subject of Prime Cost or Provisional sums in these documents shall be ordered immediately after written instructions are received to do so from the Project Manager.

The Contractor is to take his own measurements for the ordering of materials. No responsibility will be taken by the employer for surplus, shortage, loss or expense if the goods are wrongly ordered.

The Contractor shall be responsible for and shall replace or make good at his own expense any materials lost or damaged, no matter how arising.

1.1.9 Proprietary of Materials

All proprietary materials and goods, i.e. those specified to be obtained from a particular manufacturer shall be used and fixed strictly in accordance with their instructions.

Where proprietary materials are specified hereafter the Contractor may propose the use of materials of other manufacture and equal quality for approval by the Project Manager. If such approval is given, in writing, then these alternative materials may be incorporated in the works at no extra cost to the Procurement entity.

1.1.10 Samples

The Contractor shall furnish at the earliest possible opportunity before work commences and at his own cost, any samples of materials or workmanship that may be called for by the Project Manager for his approval or rejection and any further samples in the case of rejection until such samples are approved. Such samples when approved shall be of not less than the minimum standard for the work to which they apply.

Samples shall be as representative as possible and no attempt shall be made to be unduly selective, samples shall be taken separately from a number of places in a particular load, heap, stock pile, batch deposit pit or suppliers store as the case may be, as directed by the Project Manager.

1.1.11 Prove Vouchers

The contractor shall upon, request by the Project Manager, furnish vouchers to prove that materials are being supplied in accordance with the specifications.

1.1.12 Tests

The Project Manager shall, be at liberty to make all tests necessary in order to satisfy himself that the materials and workmanship of every kind are in accordance with the Specification.

Where tests are carried out on the Works or samples taken by the Project Manager, the Contractor shall give all necessary assistance when called upon to do so.

The testing of materials will, unless expressly stated to the contrary, be carried out either by the licensed laboratory approved by the Project Manager and/or the procuring entity. Tests may also be carried out by Project Manager or his representative on site when adequate facilities for such site tests exist.

1.1.13 Payment for Tests

In case the Contract Documents include a Provisional Sum to meet the cost of testing all materials other than concrete work cube tests as later described, the contractor in his bid will ensure that the cost bid will cover expected cost for tests. In any case the employer shall not be responsible for paying test

1.1.14 Test Samples

Each sample submitted to the laboratory for testing shall be properly packed, adequately labeled and have affixed to it the following information for the purposes of identification: -

(a) Name of project and location

(b) Type of material

(c) Intended use

(d) Date sample taken

(e) By whom sampled

(f) In cases of aggregate or other naturally occurring material, the location of the pit or deposit.

(g) Name of Contractor and Contractor's sample reference number.

1.1.15 Rejected Workmanship and Materials

Any workmanship or materials not complying with the requirements of the specification or approved samples which have been damaged, contaminated or have deteriorated, must be immediately removed from the site and replaced at the Contractor's expense, as directed by the Project Manager.

1.1.16 Materials intended for the Works

No timber or other materials required in the permanent construction of the works will be allowed to be used as plant or scaffolding.

1.1.17 Overtime or Night work

If the Contractor determines for the purpose of expediting the Works or for any other reason to permit the working of overtime or night work necessary so that the works or any part thereof, shall be completed in every respect ready for occupation and use within the time stated, he must include for same in his tender as no extra payment will be allowed for this at the settlement of the accounts.

When the Project Manager directs the Contractor in writing, for any reasons whatsoever; to carry out work outside normal working hours, he will be reimbursed the net difference in cost between the operatives normal hourly or daily rate of pay and the enhanced overtime rate where this applies. The instruction of working outside the normal working hours shall only be effective on approval - from the procuring entity in official writing.

1.1.18 Nuisance to Adjoining Buildings and Property

The Contractor is to make every reasonable and practical effort, consistent with good and expeditious work, to avoid nuisance from noise, dust, transport or any other cause to the occupants of existing buildings and adjoining property and to the public in general.

1.1.19 Existing and Adjacent Property

The Contractor must take all steps necessary to safeguard the existing property and adjacent property, take care, at his own expense, any injury to persons or damage to property caused thereon, and hold the Employer indemnified against any such claim arising.
The Contractor shall take all necessary precautions to avoid damage to the surrounding ground, grass, plants, shrubs and trees and reinstate at his own expense any damage caused thereto.

1.1.20 Damage to Public and Private Roads

The Contractor will repair, at his own expense, any damage he may cause to public road surfaces and pavements during the period of the works.

1.1.21 Existing Services

Prior to commencement of any work the Contractor is to ascertain from the relevant Authorities the exact position, depth and level of all existing electric and telephone cables water pipes or other services in the area and he shall make whatever provisions may be required by the Authorities concerned for the support and protection of such services. Any damage or disturbance caused to any service shall be reported immediately to the Project Manager and the relevant authority and shall be made good to their satisfaction at the Contractor's expense.

1.1.22 Lighting and warning

The Contractor shall provide red and white boundary safety tape to all obstructions and excavations that may constitute life hazards on site. He shall also provide additional lighting if necessary.

1.1.23 Licenses and Permits

The Contractor must ensure that he, as sole proprietor or as an authorized director of his company and his workpeople are in possession of valid work permit and practice license pertinent to type of works to be executed including but not limited to Institution of Engineer practice certificate, RURA authorisations. He must also ensure that he or his suppliers are in possession of relevant authorisations to import materials which are required to be obtained from outside Rwanda.

1.1.24 Notices and Fees

The Contractor shall allow for giving all notices to Public Authorities and Statutory undertakings and for payment all fees and charges legally demandable. (See separate clause regarding water charges).

1.1.25 Definition of "Fix only"

For all items described in these documents as "Fix only" the Contractor shall allow in addition to the foregoing for taking delivery where directed, checking with invoices or indents, reporting and claiming damages for shortages and damaged goods, defraying demurrage charges, transporting, unloading, storing and protecting until the time of fixing, unpacking, replacing anything lost or damaged, sorting, assembling, distributing, hoisting to required levels and fixing complete in accordance with the directions supplied or specified.

1.1.26 Temporary Roads

The Contractor shall provide and maintain as necessary, all temporary roads, ramps, hard-standing, tracks, crossings and the like for the efficient running of the Works for all vehicles entering and on the site and afterwards remove and reinstate the ground to its original condition if so directed by the Project Manager.

1.1.27 Storage of Materials

The Contractor shall provide erect and maintain and clear away on completion suitable watertight

sheds and other protection for the storage of materials including those of all Sub-Contractors. Floors of sheds used for the storage of cement and other perishable materials shall be raised at least 150 mm above ground level. Cement stacks or bags shall be placed on timber pallets approved by the Project Manager.

1.1.30 Sheds for Operatives

The Contractor shall similarly provide suitable watertight sheds for the operatives.

1.1.31 Site Office

The Contractor shall provide erect and maintain and clear away on completion suitable watertight temporary office accommodation for the use of his site staff and a similar separate-office for the use of the Project Manager's Supervising Officer.
He shall negotiate with the employer in case existing houses are to be used as offices.

1.1.32 Site Meetings

Site Meetings will be held in the Site Office at intervals as directed and the contractor will be required to summon the attendance of Sub-Contractors and specialists and key staff.

1.1.33 Works Diary

The contractor will ensure to have a copy of the Standard Works Diary which shall be kept on the site at all times.

1.1.34 Foreman-in-Charge

The Contractor shall keep a Foreman-in-Charge and a site engineer in constant attendance upon the works. They shall be capable of reading, writing and speaking English and they shall keep copies of all drawings, details, specifications, letters, instructions, etc. of the works. They shall also be required to keep a day today record in the Works Diary of the weather on the site.

1.1.35 Temporary Latrines and Ablutions

The Contractor shall provide the necessary temporary latrines, water closets and ablutions for his staff and workmen to the requirements and satisfaction of the Health Authorities and maintain the same in a thoroughly clean and sanitary condition and pay all conservancy fees and connection charges during the period of the Works and remove when no longer required and make good all disturbed surfaces.

1.1.36 Water for Works

The cost of water consumption during works shall be borne by the Embassy. The Contractor shall provide at his own risk and cost all required additional water connection. When the main supply is not available locally he will be required to bring in water by tanker or other approved method and pay all costs and fees in connection therewith. He shall also provide temporary storage tanks and tubing, etc. as he may consider necessary and clear way after completion.

All water shall be fresh, clear and pure, free from earthly vegetable or organic matter, acid or alkaline substance, in solution or suspension.

1.1.37 Light and Power for the Works

The cost of electricity consumption during works shall be borne by the Embassy. The Contractor shall provide any required additional lighting and all temporary connections, wiring, fittings etc during works and clear away after completion.

1.1.38 Signboards

Within 10 days from the commencement of works, the Contractor shall provide, erect and clear away on completion a signboard for the display of the General Contractor's names which shall be of an approved size and design with the Employers' names painted thereon.

Particulars of all parties to the contract shall be given and words shall be printed in a minimum size of 80 mm letters. No other signboard or advertising signs shall be permitted without the

permission of the Project Manager.

1.1.39 Protection of Works

The Contractor shall allow for covering up and protecting the Works during inclement weather and provision of all temporary covers, surface water drains, etc. as required.

1.1.40 Keeping and Delivering Site and Works Clean

He will also allow for carefully protecting all work and prove all necessary temporary casing, linings, coverings to steps, floors, tiles, paving, walls, ceilings, fittings and fixtures of all kinds to the complete satisfaction of the Project Manager and finally clear all away afer completion.

1.1.41 Contingencies

The Contractor shall allow for cleaning out drains, gullies, interceptors, manholes, etc. Cleaning glass inside and out, cleaning metalwork and woodwork, sweeping and scrubbing all floors pavings etc. or treating with special finishes as described, cleaning all cisterns, sanitary fittings, etc, testing all water supplies, cisterns and sanitary fittings and leaving drip dry, oiling all door and window hinges, bolts and looks and removing all paint and cement stains and clear and cart away all rubbish as it accumulates to a tip to be provided by the Contractor and leave the whole of the site and Works clean and tidy ready for occupation to the complete satisfaction of the Project Manager.

The Contractor shall include unit costs, in his Tender, the Contingency Sum as no payment shall be allocated to such works by the employer after signature of the contract.

1.2 WORKS OF DEMOLITION AND ALTERATIONS

1.2.1 Demolition

All taking down and demolition is to be carried out without damage to the remaining structures or the adjoining property. Where any such damage occurs the Contractor shall reinstate and make good at his own expense

1.2.2 Obstruction of Public Road

The Contractor shall not obstruct the Public Thoroughfares or Private Rights of Way without the approval of the Local authority and shall pay all their charges and conform to all instructions issued by them.

1.2.3 Prevention of Dust and Fans during works

The Contractor shall thoroughly water the work during all demolition to prevent any nuisance from dust, dirt, etc., and is to provide all necessary protecting fans, barricades, dust sheets, tarpaulins etc to protect the new and existing work, the public, the occupants and the workmen.

The Contractor shall allow for providing and fixing temporary waterproof and dustproof screens, coverings, etc. to all sections of the existing building, which may be exposed by reason of the pulling down and shall efficiently keep the premises water tight (where applicable) and dust freewhilst building work is in progress.

He will, for example, cover all HVAC air intake points, goose necks, and vents with duct tape and polyethylene sheeting. Shutting down the HVAC may be necessary during the work so as not to affect the equipment

1.2.4 Removal of Rubbish

All items of taking down etc., shall be included for removing, basketting, getting out and clearing away from site all debris and rubbish whether specifically mentioned or not from site.

1.2.5 Disposal of Rubbish

The Contractor shall make his own arrangements for a shoot or spoil heap for disposal of all materials arising from demolition works and he is to pay all charges in connection therewith

1.2.6 Use of existing Material

Following prior careful removal, the Contractor may use existing materials in agreement with the project manager. In case of such event the cost relevant to such material reuse by the contractor may be deducted from the cost work subjected to the agreement with the project manager.

1.2.8 Shoring

The Contractor's price for shoring where described shall include for all shoring, needling, strutting etc., as required, altering and adapting same as necessary and the Contractor shall be responsible for the sufficiency and maintenance of the same and removal when no longer required and making good all works disturbed at completion.

1.2.11 Existing Public Service Mains

The contractor is to allow for protecting supporting or diverting as required any Public Service Mains encountered during the execution of the works or he must allow for and pay all fees chargeable if this work is executed by the Public Authorities concerned.

1.2.12 Embassy to Retain Ownership of Old Materials

Where materials as described "to set aside for re-use" they shall remain the property of the embassy and shall be carefully preserved by the Contractor and loaded and carted to a store where directed by the Project Manager, and the Contractor shall allow in his prices for this activity.

1.2.13 Materials to be Cleared Away

All old materials described to be "cleared away" shall become the property of the Contractor and

shall be removed from the site and stored in approved dumpsites.

1.2.14 Definition of “Make Out” and “Make Good”

The terms “make out” and “make good” shall be read as including all necessary labour and new materials required to match in every respect the existing surrounding work, unless the same are described as „measured separately”.

1.3 EXCAVATION AND COMPACTION

1.3.1 Clearance of Site

Clearance of the site of the Works shall be done to the extent as directed by the Project Manager but not otherwise. This shall include demolition and removal of all obstruction, removal of rubbish, cutting down vegetation, shrubs and roots where required to a 50cm offset from the driveway's edge and clearing away from site, as appropriate. Holes made in grubbing up stumps and roots shall be filled in and rammed solid with approved material deposited in layers not exceeding 150mm thick.

1.3.2 Trees to be Preserved

All trees are to be preserved. For trees whose part of roots are to be extracted, the contractor shall remove earth around the roots so as to determine their contribution to the destruction of pavement and seek approval from the project manager before extraction.

1.3.3 Felling Trees

All useable timber trees shall remain the property of the Client. Trees shall be cut down as near to the ground as possible, leaves and branches removed, and useful trunks cut into suitable lengths and removed and placed in stocks on the site where directed.

1.3.4 Anthills

All anthills, nests, queen ants and grubs shall be removed as necessary, and the ground sterilized either by lighting fires and burning for not less than 24 hours or use of an approved insecticide, and filling any holes excavated with approved material, rammed solid in layers not exceeding 0mm thick. The use of approved insecticide will be the preferred option, the use of fire will only be executed after approval of competent authority after request by the contractor or Project Manager

1.3.5 Removal of existing pavement

The Contractor shall excavate as specified in technical drawings the surface of the driveway removing the tarmac and concrete pavements, curbstones, manholes etc. and stockpiling waste in approved dumpsites.

1.3.6 Excavation to Reduce Level

The Contractor shall excavate over the surface of driveway to reduced level in accordance with the technical drawings.

1.3.10 Excess Excavations

The Contractor shall level or trim to falls and crossfalls as indicated on the drawings, ram and consolidate the surface of the ground and bottom of all excavations to receive pavements, etc.

1.3.11 Bottoms of Excavations to be Approved

The bottom of all excavations shall be inspected and approved by the Project Manager before proceeding with the driveway base construction.

1.3.12 Soft Spots

Where pockets of soft or other unsuitable material are found to extend below the approved foundation or formation level, the pockets shall be removed to such extent and levels as directed by the Project Manager and filled up to the underside of the adjacent foundations, with selected natural gravels and compacted in layers not exceeding 200mm to the satisfaction of the project manager.

1.3.13 Excess Excavations

Should any excavation be made below the depths shown or required to obtain a solid bottom, the Contractor shall fill up the excess excavation in the same manner as described for Soft Spots -

1.3.14 Working Space

Where work carried out by other trades demand it, or when instructed by the Project Manager, the Contractor shall excavate working space sufficient to facilitate the proper carrying out of such work

1.3.15 Excavation in Rock

The Contractor's prices for all excavation work will be deemed to include solid rocks.

1.3.16 Definition of Solid Rock

Solid rock shall mean any naturally occurring material found in ledges or masses in its original position which can only be extracted using compressors or by blasting, and solid boulders or detached pieces of rock in size: -

(i) Exceeding 0.3 m^3 in trenches.

(ii) Exceeding 1.3 m^3 in general excavation

1.3.20 Returning, Filling and Ramming

The Contractor shall return and fill selected excavated material around foundations, to backs of walls etc., up to formation level or as directed by the Project Manager, in layers not exceeding 250 mm thick, ram, consolidate and water it as required. No back filling shall be done until the foundation work has been inspected and approved by the Project Manager.

1.3.22 Borrow Pits and Quarries

The Contractor shall conduct a geotechnical investigation to locate borrow pits and quarries of suitable materials and shall seek the project manager's approval before delivering the materials to site.

1.3.23 Vegetable Soil and grass

The Contractor shall remove where necessary top vegetable soil and paspalum rhizomes and store them in indicated area for later replanting. Excess materials shall be cleared away to approved dumpsites.

1.3.24 Disposal of Surplus Excavated Material

All surplus excavated material, generally, shall be cleared away from site and deposited in approved dumpsites.

1.3.27 Keeping Excavations Free of Water

The Contractor shall keep the whole of the excavations free from water, slop and mud arising from surface water, rain, drains, floodwater or any other similar cause by baling pumping, temporary drains or otherwise until completion of the Works. Where hidden underground springs are encountered or where foundations extend below the level of the water table which requires continuous pumping, the Contractor will, where this is properly authorized in writing by the Project Manager be paid for this at rates to be agreed for the use of such pumps.

1.3.29 Earth materials for backfill and compaction

- **Quality of materials**

Information appearing in the literature regarding the characteristics of earth materials from different quarries that were prospected in the past for other projects are of a merely indicative value and the Contractor will have to conduct, at his expenses, all investigating, verifications and lab analyses in order to look for quarries that would limit the hauling distance.

Prior to commencement of works, the contractor shall gather all information regarding the characteristics of materials he intends to use and submit to the project manager for approval.

- **Natural backfill materials**

Materials for fills will originate from borrow areas accepted by the Project Manager. They will be exempt of plant or organic matters. They will have to present the following minimum characteristics:

ACCEPTABILITY CRITERIA		Specifications
Materials for embankment structure		
- Index bearing CBR 90% OMP, 4 days soaked		>15
- Plasticity Index	IP	<30
- % of fine	F	<30
- Modulus of Plasticity	F.IP	<800
- Minimum compaction rate		≥ 90% OPM
Materials for soil exchange and subgrade		
- Index bearing CBR 95% OMP		
- Plasticity Index	IP	>20
- % of fine	F	<20
- linear swelling	%	<25
- Minimum compaction rate		<1
These specifications should be verified on the top layer of earthworks (thickness = 30 cm)		≥ 95% OPM

- **Selected Natural Gravel materials for subbase/driveway base**

These materials shall originate from approved quarries and shall have the following characteristics:

ACCEPTABILITY CRITERIA		Specifications
-Index bearing CBR to 95 % OMP, 4	days soaked	≥30
-Maximum dry density to 95% OMP	t/m3	≥2.0
-Plasticity Index	Ip	≤20
-Percentage of fines < 0.08 mm	F	5 ≤ F ≤20
-Modulus of Plasticity	F.IP	<500
-Linear swelling	%	<1
QUALITY CRITERIA		
- Maximum D	mm	40
- % Passing to ten (10) mm	<10	35-90
- % Not passing to five (5) mm	<5	20-60
- Not passing to two (2) mm	>2	10-40

1.3.30 Compaction

The contractor shall spread, water and compact to 95% density, 30cm thick driveway base in layers with thickness not exceeding 150mm using materials as specified in the above paragraph. He shall further restrict compaction energy of machines to safeguard the stability of existing constructions; provide similar compaction density with smaller machines. The contractor shall submit characteristics of the compactor he intends to use with the compaction energy and number of passes well defined for the Project Manager's approval.

1.4 CONCRETE WORK

1.4.1 General requirements

All concrete work shall be carried out in accordance with Rwandan Standards RS 142: 2012: Design for concrete structures or B.S 8110-1: 1997: Structural Use of Concrete - Part 1: Code of Practice for Design and Construction, may be applied after approval by the project manager and procuring entity. The Contractor shall submit to the Project Manager full details of all materials which he proposes to use to make concrete.

1.4.2 Cement

The cement shall, unless specifically stated to the contrary, be common cement complying with the requirements of Rwandan Standard RS EAS 18. Where other cements are specified, they shall comply with the requirements of the relevant European Norms (EN) Standards or British Standard.

All cement shall be obtained from manufacturers in Rwanda. Where cement is to be imported, prior approval of the Project Manager and Procuring Entity shall have to be obtained.

The Contractor shall supply, when requested by the Project Manager, test certificates relating to each type of cement used certifying that it complies with the appropriate Rwanda Standard.

Unless approval is given for bulk handling, all cement shall be transported and delivered in sound and properly secured bags and stored in a dry, weatherproof, well ventilated shed with a raised floor or in such a building as is approved by the Project Manager.

Each delivery of cement in bags shall be stacked in one place. The bags shall be closely stacked to reduce air circulation but shall not be stacked against an outside wall. Where pallets are used, they shall be constructed so that the bags are not damaged during handling and stacking. No stack of cement bags shall exceed 3 m in height. Different types of cement in bags shall be clearly distinguished by visible markings and shall be stored in separate stacks. Cement in bags shall be used in the order in which it is delivered.

Bulk cement shall be stored in weatherproof silos, which shall bear a clear indication of the type of cement contained in them. Different types of cement shall not be mixed in the same silo.

Cement shall be delivered or stored on site in such quantities to ensure that the concrete work on any section of the Works can be carried out without interruption. Each consignment shall be kept separate and distinct.

Any cement that has been injuriously affected by dampness or any other cause shall not be used and shall immediately be removed from the site. Cement which has become hardened and lumpy shall be removed from site.

At the discretion of the project manager or procuring entity a Cement which has been stored on site for longer than one month and which is suspected of having lost its quality properties shall be tested at the Materials Laboratory of the Rwanda Standard Institution as directed by the Project Manager. This shall be done at the expense of the contractor.

1.4.3 Aggregate for Concrete

Aggregates for concrete shall consist of clean natural sands, gravel, crushed stone or other material which have been approved for use by the Project Manager and shall apply in respect of quality with the requirement of BS EN 12620 “Coarse and Fine Aggregates from Natural Sources for Concrete”.

Tests shall be made at frequent intervals or when called for to determine the amount of impurities in the aggregates and if ordered by the Project Manager fine aggregates shall be washed at the Contractor”s own expense.

BS EN 12620 requires aggregates to be hard, durable clean and free from adherent coatings such as clay.

They shall not contain harmful materials such as iron pyrites, iron oxide, mica, shale or similar laminar materials, or flaky or elongated particles, in such a form or in sufficient quantity as to adversely affect the strength or durability of the concrete or any materials which might attach

reinforcement where this is required.

The various sizes of particles of which an aggregate is composed shall be uniformly distributed throughout the mass. The quantities of clay, silt and fine dust shall not exceed: -

(i) Sand or crushed gravel sand, 3% by weight when using the test given in or BS 812 Clause 13
(ii) Crushed stone sand, 5% by weight when using the test given in BS 812 Clause 12.
(iii) Coarse aggregate, 1% by weight when using the test given in BS 812 Clause 13.
(iv) All in aggregate, 2% by weight when using the test given in BS 812 Clause 13.

A guide to the silt and clay content of sand and crushed gravel sand can be obtained by the field settling test described in B.S. 812 Clause 14 when the silt and clay content should not exceed 65 by volume.

1.4.4 Grading of Aggregates

The grading of aggregates shall be within the limits in the following tables: -

Table 1-1: Fine Aggregates

B.S.Sieve	Percentage by weight passing B.S. Sieves			
	Grading Zone 1	Grading Zone 2	Grading Zone 3	Grading Zone 4
9 mm	100	100	100	100
4.5 mm	90-100	90-100	90-100	95-100
No. 7	60-75	75-100	85-100	95-100
No. 14	30-70	55-90	75-100	80-100
No. 25	15-34	35-59	60-79	80-100
No. 52	5-20	10-30	15-40	15-50
No. 100	0-10*	0-10*	0-10*	0-15*

** For crushed stone sands the permissible limit is increased to 20%*

A fine aggregate whose grading falls outside the limits of any particular Grading Zone on sieves other than No. 25 by a total amount not exceeding 5% shall be regarded as being in that Grading Zone. The 5% can be split up, for example, as 1% on each of three sieves and 2% on another or 4% on one sieve and 1% on another, etc.

No tolerance is allowed for fine aggregate on the coarsest and finest limits of grading in all four Grading Zones.

Grading Zone 4 material should not be used in reinforced concrete unless tests have been made to ascertain the suitability of the proposed mix proportions.

Table 1-2: Coarse Aggregates

B. S Sieve	Percentage by Weight Passing B.S. Sieves							
	Nominal Size of Graded Aggregate							
	38 mm to 5 mm	19 mm to 5 mm	12 mm to 5 mm	64 mm	38 mm	19 mm	12 mm	9 mm
75 mm	100	-	-	10	-	-	-	-
64 mm	-	-	-	85-100	100	-	-	-
38 mm	95-100	100	-	0-30	85-100	100	-	-
19 mm	30-70	95-100	100	0-5	0-20	85-100	100	-
12 mm	-	-	90-100	-	-	-	85-100	100
9mm	10-35	22-55	40-85	-	0-5	0-20	0-45	85-100
5 mm	0.5	0-10	0-10	-	-	0-5	0-10	0-20
No. 7	-	-	-	-	-	-	-	0-5

The use of All-in aggregate may, with the specific approval of the Project Manager, be permitted in the case of mass concrete, unreinforced work etc., and where such approval is given the proportions of All-in aggregate to cement shall so gauged as to give a mix equivalent to that using separate aggregates.

The All-in aggregate shall comply with the requirements of B.S. 812 the grading being in accordance with the following table

Table 1-3: All-in Aggregates

B.S Sieve	Percentage by Weight Passing B.S. Sieve	
	38 mm Nominal Size	19mm Nominal Size
78 mm	100	-
38 mm	95-100	100
19 mm	45-75	95-100
5 mm	25-45	30-50
No. 25	8-30	10-35
No. 100	0-6	0-6

1.4.5 Sand

All sands for making mortar shall be clean well graded siliceous sand of good, sharp, hard quality equal to samples which shall be deposited with and approved by the Project Manager. earth, loam, dust, salt, organic matter and any other deleterious substances,
sieved

1.4.7 Maximum Sizes of Coarse Aggregates

The maximum size of the largest size coarse aggregate shall not be larger than a quarter of the least size of the member in which it is being used and at least 6 mm less than the smallest space between reinforcing bars where the member is reinforced.

1.4.8 Storage of Aggregates

Aggregates of different sizes shall be stored in separate bins on hard clean floor free from contamination of any kind. Samples shall be supplied to the Project Manager for testing prior to the Works being commenced.

Aggregates shall be kept in sufficient quantity to enable the work on any section to be completed without interruption.

All aggregates shall be tested regularly as directed by the Project Manager, and any material which is below standard, or which has become contaminated or adulterated in any way shall be immediately removed from the site.

Water for concrete mixing shall be from an approved source and shall be clean and free from acids, vegetable matter and any other deleterious material in solution or suspension. Potable water shall be suitable for concrete preparation.

1.4.9 Concrete Mixes by Volume or Weight

The proportion for concrete mix sizes shall be specified either by:

a) Volume
b) Weight

Concrete mixes by volume will be permitted for concrete works

1.4.10 Concrete Mixes

Concrete mixes shall be designed to satisfy the specified characteristic strengths. All concrete classes shall conform to BS 8500-2. The mean strength of the designed mix shall exceed the specified values by twice the expected standard deviation so as to take into account the inevitable variation.

Both fine and coarse aggregates shall be from natural sources and shall be graded such as to produce a concrete of specified proportions which will work readily into position without

segregation and without excessive water content.

1.4.11 Design Mixes

The contractor will calculate and present to the Project Manager for approval the proposed design mix to achieve the desired concrete strength as described in structural analysis note. If, because of the nature of the aggregates available, it becomes impossible to achieve the desired strength and workability, the Project Manager reserves the right to vary or "design" the mix proportion in order that concrete of the necessary quality will be produced.

The Contractor shall include for this and for a minimum increase of 10% in the cement content of any specified mix, whether by volume or weight, without extra charge.

1.4.12 Trial Mixes

When directed by the Project Manager, the Trial Contractor shall make trial mixes for his approval mixes, before general manufacture of concrete commences.

Trail mixes shall be made using the identical plant and compaction methods which will be used in the works and deposited in suitable representative formwork.

Careful measurements of the cement, aggregate and water: cement ratios, slump and workability shall be made and the time of mixing noted for each mix.

Six "preliminary" test cubes shall also be made for each mix. Three cubes from each batch shall be tested for compressive strength at seven (7) days and the remaining three at twenty eight (28) days. The density of all the cubes shall be determined before the strength tests are carried out.

Mixes shall be made in such numbers as directed until the desired qualities are obtained.

Every precaution shall be observed to ensure that the manufacture and placing of concrete in the works is carried out in the same fashion as that used in the manufacture of the selected trial mix.

The Project Manager may direct that fresh trial mixes be made should there be any change in the source or grading of the aggregate, manner of making and compacting, or other change from the trial mix adopted originally.

The crushing strength of "preliminary" test cubes taken from trial mixes, shall at 28 days be not less than 25% more than that specified for the minimum crushing strength of "Works" test cubes as later described, for the same quality of concrete.

Concrete cubes shall be submitted to the Project Manager for "Preliminary" and "Work" Cube Tests. The Contractor shall equip himself with accurately made metal moulds for casting 100mm square concrete cubes.

The moulds and method of preparing such cubes shall be in accordance with B.S 1881 "Method of Testing Concrete".

Batches of six "Preliminary" cubes shall be taken from the trial mixes as previously described. Six "Work" cubes shall be taken for testing from any batch or class of concrete in use on the works as directed by the Project Manager.

Three cubes shall be tested at 7 days and three at 28 days.

All concrete cubes when tested shall give the minimum compressive strengths for the appropriate class of concrete shown in the following table:-

Table 1-5: Compressive Strength and Modulus of Elasticity of Concrete (N/mm^2)

Grade	Characteristic compressive strength at 28 days (N/mm^2)	Characteristic tensile strength at 28 days (N/mm^2)	Modulus of elasticity at 28 days (GPa)
15	15	1.1	25
20	20	1.3	27
25	25	1.5	29
30	30	1.7	32
40	40	21	35
50	50	2.5	37

Concrete test cubes shall be submitted to approved laboratory for testing, for testing and the Contractor shall carefully identify each cube and provide all information relative thereto, e.g. contract number, mix proportions, date cast, where the rest of the batch has been incorporated in the works and the Contractor's name and test cube reference number.

In the event that any cubes representative of concrete which has already been incorporated in the work failing to give the required compressive strength, the Project Manager reserves the right to instruct the contractor to cut out and remove all work affected by these cubes and replace it entirely at his own expense.

1.4.13 Mixing of Concrete

Concrete shall be thoroughly mixed to a uniform consistency in measured batches in a mechanical mixer of capacity proportionate to the amount of concrete required in any section of the works under construction. Mixing shall continue for not less than two minutes after all the materials including water, which shall be added last of all, have been passed into the drum and before any portion of the batch is discharged but in all cases the actual shall conform to that required for the selected trail mix.

The water content shall be carefully controlled and shall be added in sufficient quantity to make up the amount found to be necessary in the trial mix under no circumstances will the water; cement ratio be exceeded and any batch which is mixed too wet shall be rejected. The entire contents of the mixer drum shall be discharged before the succeeding batch is introduced into the drum.

Mixers and or batching plant shall be properly maintained throughout the contract and any mixer of plant which is faulty in any respect shall not be used. Drums of all mixers shall revolve at a constant speed recommended by the manufacturers. A mixer which has been standing idle for twenty minutes after mixing the last batch shall be thoroughly washed and cleaned before any fresh mix is made. Mixers shall be thoroughly cleaned at the finish of each run of concrete mixing or at the end of each day. All mixing plant shall be thoroughly cleaned if used for High Aluminium or other specialised cement concretes after Common Cement concretes and vice-versa.

1.4.14 Hand Mixing

Hand mixing shall only be allowed with the express permission of the Project Manager. The mixing shall be done on a clean, watertight, non-absorbent platform. The cement and fine aggregate shall be mixed dry until the mixture is thoroughly blended and uniform in colour. The coarse aggregate shall then be added and mixed in until it is uniformly distributed throughout the batch. The correct quantity of water shall be added using a can with a rose nozzle and the mixing continued until the entire batch of concrete appears to be homogenous and has the desired consistency. Each batch of concrete shall be turned over at least three times dry and three times wet.The platform shall be emptied before a subsequent batch is mixed and thoroughly cleaned if not in use for more than 20 minutes before the next batch is prepared or if a different type of cement is used as previously described.

For hand mixing the cement content of each mix shall be increased by 10% over that required for machine mixing and this shall be done at the Contractor"s own expense.

1.4.15 Transporting and Placing Concrete

Concrete shall be transported in a manner which will avoid any segregation, loss consolidation

or drying out of the consistent materials and placing in the forms shall be completed before the initial set takes place. Concrete shall not be dropped through a height greater than 2m. Chutes and pumps may be used provided they shall be so arranged as to avoid segregation.

All equipment for the transporting and placing of concrete shall be constantly cleaned and kept free of all coatings of hardened concrete or other obstructions.

Concreting of any unit or section of the work shall be carried out in one continuous operation and no interruption of the concrete will be allowed without the approval of the Project Manager.

In no case shall more than 20 minutes elapse between mixing and placing of any concrete in its final position.

1.4.16 Ready Mix Concrete

The term “Ready Mix” concrete is applied in cases where concrete is obtained from a firm which specializes in the manufacture of concrete in bulk at a central plant whence it is transported to the site in transit mixers which keep it agitated until it is delivered. This term also applied to concrete in which the aggregate and cement are batched dry at a central plant and fed into the drum of a mixer mounted on a lorry in which it is transported to the site. Water is carried in a special container and is measured and fed into the drum and wet mixing started, either during the journey or when the mixer lorry reaches the site.

This type of concrete will only be allowed on the specific instructions of the Project Manager who will require a certificate with every batch of concrete delivered giving the actual weights of aggregate, cement and water used so that a guarantee is provided that the concrete is in accordance with the Specifications.

1.4.17 Compaction of Concrete

After concrete has been placed in the forms it shall be compacted with approved tools and in such a manner as to produce a dense homogenous mass, free from segregation honeycombs and entrained air, filling all spaces between and around forms and reinforcement without voids of any kinds.

Where vibrators are used they shall be of the immersion type, approved by the Project Manager and have a frequency of not less than 5000 hertz (HZ). Vibrators shall not be attached to or allowed to come into contact with reinforcement or used in such a manner as to damage concrete in other parts of the structure, which has taken its initial set. Care is also to be taken so that concrete is not over vibrated or compacted and segregation taken place.

Partially set concrete shall not be disturbed in any way and the Contractor shall ensure that it is not subjected to unnecessary loads, shocks or vibrations from adjacent plant or vibrators in the vicinity nor allow his workmen to walk on it or disturb it in any other way.

1.4.18 Construction Joints

Construction joints shall be made where shown on the drawings or as directed by the Project Manager, but in either case they shall be so arranged that their number is kept to the minimum.

Construction joints shall be formed at right angles to the axis of the member concerned by the insertion of rigid stopping off forms.

Construction joints in slabs shall be vertical and in general, parallel to the main reinforcement, but, when required at right angles to the main reinforcement they shall be constructed in the middle of the span.

The upper surface of lifts of concrete in walls and columns shall be horizontal and in the case of exposed finished work shall be so constructed so that they cannot be seen.

Lifts in walls and columns shall not exceed a height of 1m unless approved otherwise by the Project Manager.

Forms at construction joints shall be so made that they shall produce within the thickness of the joint a suitably grooved or keyed surface to act as a bond for the subsequent concrete.

As soon as the concrete is sufficiently set stop boards shall be removed and the face hacked and wire brushed to form a key and washed. Before placing of the adjacent concrete the surface of the joint is to be coated with a neat cement grout and left ready to receive the new adjacent concrete which is to be tightly packed up against its face.

1.4.19 Protection of Concrete

Freshly placed concrete shall be protected from the sun, drying winds and rain until it has properly set and shall be kept damp with hessian, sand, polythene or other waterproof sheeting for not less than seven days after laying. In the case of rapid hardening cements being employed this shall be reduced to three days.

Concrete which has not been properly protected and is damaged or adversely affected in any way whatsoever shall be carefully cut out and replaced at the Contractor"s own expense.

1.4.21 Fair Face and Fine Face Finishes of Concrete

When exposed concrete is required to have a "Fair Faced Finish" it means that it is to be finished to a perfectly plane surface free from all blemishes, irregularities, honeycombing, joint or grain marks.

The manner of obtaining this type of finish will be left to the discretion of the Contractor but the Project Manager reserves the right to instruct the Contractor to adopt an alternative method where he thinks the method in use is unsatisfactory.

Where "Fine Face" concrete finish is specified, the exposed surfaces where produced by formwork shall have all fins and other small protuberances rubbed down but no pittances nor large fins or other protuberances will be allowed.

1.4.23 Steel Reinforcement

Steel reinforcement shall conform to RS EAS 412 or BS 4449, BS 4492 or BS 4483 whichever is higher.

Mild steel reinforcement shall consist of plain round mild steel rods as specified in BS 6722.

Twisted mild steel reinforcement shall be cold twisted mild steel reinforcement as specified in BS 449.

Fabric reinforcement shall be hard drawn steel fabric reinforcement in accordance with BS 4483.

All steel reinforcement shall be of approved manufacture and shall be free from loose rust, mill scale, oil and grease or any other material which may impair the proper adhesion of the reinforcement and the concrete or cause corrosion of the reinforcement and subsequent disintegration of the concrete cover. If directed by the Project Manager, all the reinforcement shall be wire brushed to remove such imperfections before concrete is poured around it.

The Contractor shall produce Certificates of Manufacture indicating that the material complies with the requirement of the appropriate B.S. or RS standards for the inspection of the Project Manager. Random samples from any consignment may be taken for testing at a certified laboratory and any material found to be brittle, cracked or unsatisfactory in any way whatsoever shall be rejected and removed from the site at once.

Reinforcement shall be stored on site in level tiers raised above the ground.

1.4.24 Bending Reinforcement

All steel reinforcement shall be bent cold and shaped as shown on the drawings before placing in position and shall comply with the bending dimensions and tolerance laid down in BS 8666 or BS 4466

An approved former shall be used to produce gradual and even bending and no steel shall, once, bent, be straightened and rebent.

Bends made whilst the reinforcement is hot or welding either by gas or electricity shall not be carried out without the prior approval of the Project Manager.

1.4.25 Spacing of RC bars

The spacing of bars, amount of reinforcement and the type of fabric, mesh size, disposition, etc. shall be in accordance with the drawings.

1.4.26 Fixing and Assembly of Reinforcement

All reinforcement shall be accurately placed, fixed and maintained in the positions shown on the drawings. Intersecting bars shall be securely wired together with No. 16 gauge (1.626 mm) soft iron tying wired with the ends twisted and turned into the body of the concrete. Binders, links and the like shall make close contact with main reinforcement and shall be securely wired to same.

When reinforcement is placed in horizontal of sloping layers whether in beams, slabs or staircases, etc., the distance between each layer shall be carefully maintained by the insertion of sufficient spacer bars to prevent either movement or sagging of the main reinforcement in each layer.

1.4.27 Cover to Concrete

The concrete cover to all reinforcement shall be carefully maintained as shown on the drawings within a tolerance of 3 mm under or over.

1.4.28 Inspection of Reinforcement

No concrete shall be poured until the Project Manager has inspected and approved the reinforcement.

All reinforcement shall be properly fixed in position and every precaution shall be taken to ensure that no movement takes place whilst the concrete is being poured and compacted and that it is properly surrounded by concrete.

Any rods which have worked loose during fixing shall be securely retied and any small pieces of rood or fabric shall be removed from the forms before pouring is commenced.

1.4.29 Formwork

The term formwork shall include for any material or mould required for forming the concrete into the desired shape and upholding it until it is set, together with all necessary temporary supports, stagings, bolts, nuts, wedges, clamps, and other fixing, all cutting and waste and the cost of all labour and material in the construction, erection and removal of such formwork.

Formwork shall be of timber or other approved material and shall be of such strength as will ensure complete rigidity throughout the placing, compaction, vibration and setting of the concrete and so designed and constructed that it can be easily removed without shock, vibration or damage to the finished concrete.

All joints in forms shall be sufficiently tight to prevent leakage of grout and in timber forms, unless otherwise specified, they shall be tongued and grooved.

Timber boards for formwork shall be seasoned to 20% moisture content and shall be in widths not exceeding 150 mm or narrower if the Project Manager so directs.

The use of internal ties shall be avoided as far as possible, but, if used they shall be reduced to the minimum, of metal and capable of easy removal without damage to the face of the concrete. No part of any metal tie or spacer remaining permanently embedded in the concrete shall be nearer the finished surface of the concrete than the thickness of the general cover dimension as shown on the drawings.

When vibrators are used, special care shall be taken to see that all bolts, wedges, clamps, etc. are kept tight so that no distortion of the forms takes place.

1.4.30 Formwork Non-Exposed Concrete

When the surface of the concrete is to be covered with some other finishing material, the forms may be constructed of plain, but jointed sawn timber, unless otherwise instructed by the

Project Manager. The boards shall be sufficiently thick to withstand the loading of the concreting operations without deflection so that the finished surface cover specified is maintained.

1.4.31 Formwork for Exposed Concrete

When a particular type of finish is required to be produced by formwork on exposed concrete surfaces this will be fully described in by the project manager, and the material to be used to achieve it will be specified, i.e. plywood, hardboard, hessian, polythene paper, strips, panels, etc.

1.4.32 Preparation of Formwork before Concreting

Unless otherwise directed the inside faces of all formwork shall be coated with lime wash or approved non-retarding mould oil. Care shall be taken to keep reinforcement free of any coating material.
Forms shall be thoroughly scraped and cleaned down between each and before subsequent uses.

Prior to depositing concrete, the forms shall be thoroughly cleaned and freed from all sawdust shavings, mud, dust or other debris by hosing with clean water and draining through temporary openings left for this purpose.

1.4.33 Approval of Formwork

All formwork shall be inspected and approved by the Project Manager before pouring of concrete is commenced, but such approval will not relieve the contractor of his overall responsibility for the safety and efficiency of the works. Details of special forms and systems of formwork i.e. self lifting or sliding forms etc. shall be submitted to the Project Manager for his approval before they are put into use.

1.4.34 Removal of Formwork

The removal or striking of formwork shall be carried out in such a manner that the concrete will not be subjected to sudden shock or injury, nor shall it be removed before the concrete is sufficiently set hardened.
The minimum time shall elapse between placing and compaction of the concrete and the removal of the formwork for various parts of the structure is indicated in Table 1-6 below:-

Table 1-6: Minimum Times for Removing Formwork

Location	Removal of Forms Only	Removal of Props
Side of concrete pavements	5 days	-

The foregoing figures are given as a guide for normal cement concrete for average conditions of setting and hardening. For vibrated concrete or extreme climatic conditions or for special surface finishes the above times may be varied on the instructions of the Project Manager.

Compliance with the requirements of the foregoing shall not relieve the Contractor of his obligations and overall responsibility. Should the removal of the formwork be found to have been carried out prematurely, any damage caused thereby shall be made good entirely at the contractor"s own expense.

1.10 PAVING

1.10.11 Concrete pavers, Concrete and Quarry Tile Paving

Concrete pavers shall comply in all respects with BS 6717 and samples shall be submitted to the Project Manager for testing and approval. Concrete pavers of the driveway will have a minimum compression strength of 40Mpa.

Concrete tiles and fittings shall comply in all respects with BS 1197-2 and samples shall be submitted to the Project Manager for testing and approval.

Quarry floors tiles and fittings shall comply in all respects with BS 6431 and samples shall be submitted to the Project Manager for testing and approval.

All tiles shall be well soaked in water before use.

Tiles shall be laid to the patterns indicated on the drawings with either close butt joints or wide joints as required.

All tiles shall be laid on a prepared cement and sand screed and bedded and jointed in cement mortar (1:3) as before described and pointed as indicated on the drawings.

1.10.14 Dividing Strips

Dividing strips shall be black ebonite or plastic of approved colour to the sizes and positions as indicated on the drawings, Particular Specification or Bills of Quantities. The strips shall extend to the full depth of the pavings in which they are inserted and in the case of terrazzo work shall be let into the screed under for a depth of not less than 6 mm.

1.10.15 Cover up and Protection of Paving

The Contractor shall cover up and protect all pavings and finishes as required to assist slow and even drying and to prevent damage by traffic. Remove all such coverings and leave the work clean and perfect at completion.

1.11 WALL AND FLOOR FINISHES

1.11.1 Cement

All cement shall be as previously described in concrete works.

1.11.2 Lime

The lime for plastering shall comply with BS EN 459-1 or RS 414: 2009 and be as rich as obtainable and to the approval of the Project Manager. It must be freshly burned and shall be slaked at least one month before being used by drenching with water, well broken up and mixed and the wet mixture shall be passed through a sieve of 10 meshes to 100 square mm. Lime putty shall consist of freshly slaked lime as above described, saturated with water until semi-fluid and passed through a fine sieve, it shall then be allowed to stand until superfluous water has evaporated and it has become of the consistency of thick paste, in no case for a shorter period than one month before using, during which time it must be kept damp and clean and no portion of it allowed to become dry.

1.11.3 Sand

The sand for plaster work shall be in accordance with BS 1199 and BS 1200: It shall be clean and well graded to a suitable fineness especially in accordance with the nature of the plaster and the finish to be obtained. Sand laying (Sand paver base or sand bedding) shall conform to ASTM C33.

1.11.4 Plastering Generally

Where walls are to be rendered or plastered, the joints shall be raked out 12 mm deep and brushed clean to afford a key and joints and walls shall be sprayed with clean water before rendering or plastering. Concrete surfaces shall be hacked to form key in addition.

All surfaces to be plastered must be scored for a key and brushed clean and well wetted before each coat is applied.

All materials shall be properly mixed either by hand or by machine.

Hand mixing shall be carried out on a clean properly prepared platform which shall be thoroughly scraped and cleaned between batches.

Machine mixers shall be thoroughly cleaned out between each batch.

No batch of mixture shall be used after the initial set of the cement has taken place and no material shall be allowed to stand and be subsequently "knocked" up for reuse.

All cement plaster shall be kept continually damp in the interval between application of coats and for seven days after application of the final coat.

All arrises and angles shall be clean and sharp except where the Drawings indicate otherwise.

The Contractor shall include for filling plaster into chases and working around pipes, conduits, switch boxes and outlets, into rebates, up to metal window frames etc. and the like and for all making good.

1.11.6 External Rendering

External rendering is to consist of one part cement and five parts sand by volume (1: 5). One coat

work is to have a minimum finished thickness of 12 mm and two coats work 19 mm.

Unless otherwise described rendering is to be floated smooth with a wood float.

1.11.9 Wall and Floor Tiling

Wall or floor tiles shall comply with BS 6431 Glazed Ceramic tiles and Tile Fittings.

All tiles shall be of the size, colour and quality similar to that existing or in accordance with

the Project Manager's instructions and shall be perfectly true to shape and free of all blemishes and flaws. Samples shall be submitted to the Project Manager for approval.
All tiling shall be fixed on a perfectly plane vertical screed of cement and sand (1: 3). Tiling shall be bedded on the prepared screed in a slurry of cement and sand (1: 4) or in an approved tile adhesive. The surface of each tile shall finish flush with the adjacent tiles. Joints shall be continuous straight joints both horizontally and vertically not exceeding 3 mm wide. Spacers shall be used to ensure that the correct joint width is maintained.

All cutting shall be kept to a minimum and the tiling shall be set out so that only the largest possible pieces of cut tiles are used.

1.11.13 Make Good

The Contractor shall cut out and make good all cracks, blisters and other defects and leave the whole of the plasterwork perfect on completion. When making good defects the plaster shall be cut out cleanly as directed, with the edges undercut to form a good key with the surrounding work, and the new material shall finish flush with the adjacent plaster.

Tiled and sheeted surfaces shall be left perfectly clean on completion.

1.13 PAINTING

1.13.1 Workmanship

All paintings work shall be carried out by skilled tradesmen and finished in a manner in accordance with the best acceptable trade practice.

1.13.2 Sub-letting Work

The work shall not be sub-let to a specialist firm without the written approval of the Project Manager.

1.13.3 Materials

All materials shall be the best of their respective kinds and shall be in accordance with their respective current Rwanda Standard.

1.13.4 Paint

All paints, including cement paint, oil paints, emulsion paint and oil bound distemper shall be ready mixed and obtained, unless specifically instructed to the contrary, from approved local manufacturers, and they shall be delivered to the site in sealed cans and shall be thoroughly mixed and applied in accordance with the manufacturer's instructions.

1.13.5 Linseed Oil

The linseed oil to be refined linseed oil, boiled or raw.

1.13.6 Knotting

The knotting is to be in accordance with BS 1336

1.13.7 Wax Polish

The wax polish shall be furniture polish of an approved brand.

1.13.8 Lacquer Treatment

Lacquer shall be an approved catalytic polyurethane lacquer and used strictly in accordance with the manufacturer"s instructions.

1.13.9 Generally

The Contractor shall arrange his programme of work so that all other trades are completed and away from the area to be painted before painting is commenced. The Contractor shall remove all concrete and mortar droppings and the like from all work to be decorated and remove all stains therefrom to obtain s uniform colour of the surface.

All materials to be applied externally shall be of exterior quality and/ or recommended by the manufacturers for external use.

Unless specially instructed by the Project Manager, no paints, distemper etc., shall be used as supplied by the manufacturers and direct from the tins.

If required by the Project Manager the Contractor shall provide samples of paints and other decorative materials with containers which shall be forwarded to an approved laboratory for testing.

The priming, undercoats and finishing coats shall each be of different tints and the priming and undercoat shall be the correct brands and tints to suit the respective finishing coats, in accordance with the Manufacturer"s instructions. All finishing coats shall be of colours and tints selected by the Project Manager.
Each coat shall be properly dry and in the case of oil or enamel paints shall be well rubbed down with fine glass paper before the next coat is applied. The paintwork shall be finished smooth and free from brush marks.

Colour cards of all paints, etc., shall be submitted to and samples prepared for approval of the Project Manager before laying on, and such samples, when approved, shall become the standard for the work.

All paints, emulsion paints, and distempers shall be applied by means of a brush or spray gun or rollers of an approved type, where so agreed by the Project Manager.

No painting is to be done in wet weather or on surfaces which are not thoroughly dry.

1.13.10 Preparation

All surfaces to be painted shall be entirely free from all dirt, grease and dust.

(i) Plaster

Areas of defective plaster shall be cut out and made good with similar plaster finished smooth.

Large cracks shall be cut out, under cut and filled with plaster finished smooth and flush. Small cracks and holes shall be filled with an approved hard filler.

Plastered surfaces to be painted with oil paint shall be treated with one coat of alkali resistant primer.

(ii) Metal

All rust and loose scale is to be removed by means of wire brushing or scraping.

All bare metal is to be primed with a primer conforming to BS 2523 and all bare patches of works priming shall be touched up and brought forward.

Coated surfaces, such as stack pipes shall be thoroughly brushed down and painted with one coat of knotting.

Galvanised surfaces to be washed down, after drying shall be coated with an approved solution approved by the Project Manager.

(iii) Woodwork

All woodwork shall be rubbed down, all knots covered with a thick coat of good shellac knotting, given one coat of approved ready-mixed proprietary wood primer and all cracks, nail holes, defects and uneven surfaces etc., stopped and faced up with hard stopping rubbed down flush.

(iv) Insulation or Fibre Boards

All holes shall be stopped with an approved plaster compound rubbed down flush and all surfaces treated with one coat of thinned paint or emulsion paint as specified.

1.13.11 Backs of Frames

Prime backs of all timber frames, skirtings and the like in contact with masonry or plaster with one coat of approved ready mixed proprietary wood priming paint before fixing.

1.13.12 Remove Ironmongery

Metal fittings and fastenings etc., are not to be fixed until painting is completed. Where they have been fixed, they shall be removed and stored until painting is completed and then carefully cleaned and refixed in position. Lugs to metal windows and door handles shall be painted before glazing.

1.13.13 Cover up and Protect

Before painting is commenced, surfaces must be washed and thoroughly cleaned out and every precaution taken to keep down dust.

The Contractor shall provide covers as may be required to prevent marking and staining by paint.

1.13.14 Cleaning up

Replace any cracked or broken glass. Remove and replace any gauze screens which may be stained with paint. Remove all other paint splashes, spots and stains and clean out and leave the buildings to the requirements and satisfaction of the Project Manager.

B: BUILDING SANITATION

2.1 PLUMBING

2.1.1 Statutory Requirements

All plumbing work, pipework and sanitary installations shall be carried out in accordance with the Regulations described in the building code and in accordance to guide of the Water and Sanitation Corporation (WASAC). Where no such guidance exists, then such work shall be carried out in accordance with the directions of the Project Manager.

2.1.2 Galvanised Steel Pipes and Fittings

Galvanised Steel Pipes shall comply with BS 1387 Class "B" except where the WASAC requires otherwise.

Fittings shall be galvanized malleable iron to BS 143 and BS 1256.

All pipes and fittings shall be obtained from an approved manufacturer.

Galvanised steel water tubes shall have screwed and socketted joints put together with ties and red leads and fixed to walls with approved patter clips spaced at not more than
1750 mm apart. Made-bends shall be formed cold and shall wherever possible be used in preference to elbows. Elbows shall be of the round kind where possible unless otherwise specified, pipes shall be fixed in chases in walls. Where pipes are required to be fixed to the wall surfaces, they shall be fixed with approved holder-bats 25 mm clear of the finished wall surface.

2.1.3 PPR pipes and fittings

The PPR pipes and fittings shall be produced from polypropylene Random type PN25 material or equivalent which has high molecular weight and excellent creep resistance.

The installation shall be in accordance with the manufacturer"s recommendation with provision for expansion, including all necessary fittings and accessories. The pipe shall be tested at 15 bars for one hour, immediately after the preliminary test, the main test shall be carried out at 10bars for 24 Hours. There shall be no leakage of any kind not even in the form of moisture in either of the tests. The installation must be perfectly tight.

2.1.4 Cast Iron Soil, Waste and Vent Pipes

Coated cast iron soil waste and vent pipes and fittings shall be of a medium quality to comply with BS 416 with ears cast on and shall be obtained from an approved manufacturer.

Pipes shall have spigot and socketted joints with a tarred hempen gasket rammed down the sockets and lead wool well caulked in, and shall be fixed to walls with clout rose- headed nails and 38 mm gas barrel distance pieces and hardwood plugs built into the wall. All junctions and bends on exposed cast iron soil and waste pipes shall be fitted with access doors and screwed inspection eyes. The top end of all vent pipes shall be fitted with a galvanized domical wire grating covered with 32 S.W.G. x 20 Mesh copper wire mosquito gauze.

u. P.V.C soil pipes and fittings shall be supplied and fixed where indicated on the Drawings and Schedules. They shall comply in all respects to British Standard 4514 and shall where appropriate bear the British Standard Kite Mark as Terrain Manufacture or equal and approved.

2.1.5 Tubing Generally

All pipes shall whenever possible be located in such a manner as to minimize risk of mechanical damage and shall be readily accessible for inspection and repair, but shall nevertheless not appear unsightly.

All waste pipes shall be fitted with sweep-tees with screwed cleaning caps at each change of direction. All services shall be connected to sanitary fittings, tanks, etc. with approved union connectors. The exposed ends of all overflow pipes shall be mosquito- proofed by means of 32 S.W.G x 20 mesh copper wire gauze, tightly bound on with stout wire.

2.1.6 Water Service and Distribution Pipework

Service pipes shall be laid from the stop-valves at the boundary of the site to a storage tank; stop-valves being inserted in all positions as required by the Project Manager and all pipe work inside the building shall be securely fixed in position.

2.1.7 Branches to Drinking Water Draw-off Taps

Branches to drinking water draw-off taps shall be taken directly from the service pipe to drinking water draw off points in the building.

2.1.8. Delivery Pipes

Delivery on distribution pipes shall be fitted with stop valves and shall be taken from the storage cistern to feed draw-off taps over baths, lavatory basins, water closet flushing cisterns, etc. and the hot water system.

2.1.9 Running, Jointing and Fixing Pipes

Branches taken from vertical services and delivery pipes shall have a slight rise or fall as the case may require for the release of air to cisterns or taps and to enable the system to be drained. Pipe runs shall be set out to avoid traps and air locks.

Cold water piping shall not run in close proximity to hot water services. Where this cannot be avoided then both hot and cold water pipes shall be lagged.

2.1.10 Stops, Taps and Ball Valves

Stop-valves shall be provided and fixed on the service pipes at the entry to the buildings, at entry to water storage cisterns and on the delivery pipes close to water storage cisterns. Bib-taps shall be provided to the direction and approval of the Project Manager and shall be marked „hot" and „cold"

All ball valves shall comply with BS 1212 and all copper float balls shall comply with BS 1968. Brass taps and valves shall comply with BS 1010- 2.

2.1.11 Storage Cisterns

Storage tanks or cisterns shall be provided where shown. Storage cisterns shall have overflow pipes the cross section area of which shall not be less than 50% in excess of that of the supply pipe and shall be fixed at a height of not less than 25 mm above top water level, but below ball-valve inlet and shall be arranged to discharge externally. The outlet end of the overflow pipes shall be fitted with 32
S.W.G. x 20 mesh copper wire gauze of other approved material to prevent entry of mosquitoes and vermin. Ball valves shall be provided and fixed to cisterns at a distance not less than 50 mm above the top of the overflow pipe.

2.1.12. Testing of Water Mains and Services

The service pipe from the WASAC main to the storage tank and all other terminal points inside the building shall be tested at a hydraulic pressure of not less than twice the working pressure in the wasac's main and the same pressure shall be maintained without drop and without further pumping for a period of not less than thirty minutes. The down service pipes from the storage tanks to the various fittings shall be tested throughout to a pressure specified by the Water Authority.

2.1.13 Sanitary Fittings General

All sanitary fittings shall be made of hard, smooth, non-absorbent and non corrodible material conforming to the latest Rwanda Standards or BS.

All fittings shall be fitted with traps with approved seals and where the trap is not an integral part of the fitting, a separate trap shall be connected between the fitting and the pipe. Separate traps shall be made of cast iron, galvanized iron lead, brass or copper and shall have a minimum seal of 35 mm and shall be fitted with a screwed cleaning- eye.

2.1.14 Water Closets

All water-closet suits shall be of approved material and shall comprise a flushing cistern and a pan are made to work together as a system and shall not be made up of pans and cisterns unsuitably

selected.

Water closet pans shall be fixed to floors with large-gauge gunmetal screws and approved proprietary wall plugs. The brackets for water-waste preventer cistern shall be built into walls or secured with screws and approved proprietary wall plugs, and where cisterns are supported by lugs these shall be fixed by screws and proprietary wall plugs.

Water-waste preventers for high-level suites shall be set with the top of each cistern 2.15m above floor level.

2.1.15 Urinals

Urinals shall consist of glazed fireclay urinals, stalls, slab or bowl types. Slab or stall types shall not be less than 1.1m high and shall be fitted immediately above the edge of a glazed half round channel not less than 100 mm internal diameter and laid to a fall of not less than 1 in 40. such channel shall discharge into a salt-glazed ware or virtuous enameled trap with a water seal of not less than 50 mm in depth. Traps shall have an internal diameter of not less than 50 mm for a single stall or bowl and not less than 75 mm for a range of stalls or bowls.

Channel shall be provided with approved lead traps with removable cast gunmetal domical gratings.

2.1.16 Baths, Lavatory Basins and Sinks

Baths, lavatory basins, sinks etc shall be of approved material and shall be provided complete with all fittings and accessories.

Lavatory basins or sinks shall be supported on suitable brackets which shall be built 115 mm into walls or fixed with heavy screws and approved proprietary wall plugs.

2.2 DRAIN LAYING

2.2.1 Drainage & Sanitation Rules

All drainage work is to be carried out in accordance with the Regulations for Sanitary Installations in Buildings

2.2.2 Excavation

Excavation shall be made for manholes, lines of pipe and other works to the depth as shown on the Drawings, or as shall be required by the Project Manager or as necessary to permit proper execution of the work, should there be erroneous over-excavation to levels below those required for drains, foundations or other works, refilling and making up of levels shall be carried out in concrete of approved mix and no other material shall be used for this purpose.

All excavations shall be kept clear of water or mud by approved means. Sides of excavations shall be adequately supported by timbering or other means approved by the Project Manager.

2.2.3 Laying Lines of Pipes

The Contractor shall provide and fix properly painted sight rails which will be checked by the Project Manager before any pipes are laid, and there shall be no fewer than three sights rails in position at one time on every length of pipe under construction.

Boning rods shall be provided and wooden pegs driven into the bottom of the trench at required intervals, the top of each peg being set at the exact level of the proposed invert of the pipe. The alignment and level of each pipe laid must be tested by inserting the shoe of the boning rod.

2.2.4 Materials

The quality and description of all materials and appliances including pipes, cement, sand etc. used for construction or repair of any drain shall be approved by the Project Manager.

2.2.5 Size of Pipe and Fall

Drains shall be of adequate internal diameters and shall be laid with falls that ensure a self-cleansing velocity viz (a min velocity of flow of 0.76 m per second when the pipe is 25% full).

2.2.6 Minimum Cover to Pipes

Drains shall, whenever possible, have sufficient cover which shall, excepting cast iron and steel pipes, comply with Table 2-1 below:-

Table 2-1: Minimum Cover to Pipes

Location	Minimum Cover (mm)
Elsewhere than mentioned above	500

PVC drain pipes shall be laid inside a layer of sand in accordance with the drawings.

2.2.9 Drain Junctions

Every branch drain or tributary drain shall, at the point of junction join the rain drain obliquely in the direction of the flow of the main drain and at half channel eight above the main channel. All bends and turnings shall be uniformly curved and any alteration in the size of the drain shall be properly tapered and of good shape.

2.2.10 Provision of manholes

Appropriate manholes shall be provided:

a) At every point in a drain where two or more branch drains converge;

b) At every point in a drain where there shall occur any angle, bend, deviation from a direct

alignment, change in gradient, difference in level or alteration in size; provided that pipe bends shall be allowed without inspection chambers for the connection of soil pipes, gullies, soil waste fittings to a drain, if such bends are surrounded by not less than 100 mm thick concrete mix 1: 3: 6

c) At such points that no part of a drain shall be more than 15.25 m distant from the centre of an inspection chamber without a rodding eye.

Manholes shall be laid out in accordance with the drawings.

2.2.16 Vent pipe

The vent pipe shall not be located near the building and shall be brought to such a height so as to effectually prevent any escape of foul air from the drain into the nearby building. The top end of the ventilating pipe shall not be less than than 1.5 m and the end of ventilating pipes shall be adequately covered with an approved copper or aluminum mosquito wire gauze securely fixed on.

2.2.21 Rain Water Pipes

Rain water down pipes shall be solely for disposal of rainwater from the roof buildings and shall not be used for the purpose of carrying soil-waste, waste-water or be used as a ventilating pipe, anti-siphon pipe to any drain, soil pipe or waste-pipe.

2.2.22 Overflow Pipes

Overflow pipes from any water storage cisterns, flushing cisterns or water-waste preventers shall not be connected to drains, soil-pipes, waste drain pipe, ventilating pipes or soil-water fittings. Overflow pipes shall discharge into external open air and whenever possible in a conspicuous position. Overflow pipes shall be protected against the ingress of mosquitoes, insects and other vermin.

C: ELECTRICAL SERVICES

3.1 GENERAL REQUIREMENTS

3.1.1 General electrical requirements specified in these technical specifications are in addition to the requirements of the General Conditions of Contract and specific requirements set to the particular project in the Specification and Bill of Quantities.

3.1.2 The supply, erection, installation, testing and commissioning of the complete Low Voltage (400/230V) supply network electrical installation services and street lights or any related repair to existing installations shall be understood as included.

3.1.3 The procurements, installations or repair of existing installations are described in this specification and other related design documents are for manufacture, testing, supply, delivery to site, execution, demonstrating, commissioning and maintaining of the specified system to complete and fully operational condition.

3.1.4 Any work whether shown or not on the drawings and/or described in this specification but which can reasonably be inferred as necessary for the completion of installations and proper operation of the systems will also form part of the extent of the contract.

3.1.5 Workmanship and the method of installation shall conform to IEE Wiring Regulation Sixteenth Edition and Regulations for Electrical Installations and Equipment in Buildings. All work shall be performed by skilled tradesmen to the satisfaction of the Project Manager. Any work that does not conform to the best standard practice will be removed and reinstated at the contractor"s expense.

3.1.6 Permits, Certificates or Licenses must be held by all tradesmen for the type of work in which they are involved and such Permits, Certificates or Licenses exist under Government Legislation.

3.1.7 The Contractor shall be responsible for the coordination of the works on site with other trades. The Contractor shall plan the installation before the work is commenced and he shall ensure correct installation to the design intent during the course of construction. Any work which has to be re-done due to negligence in this respect shall not constitute an extra to the contract.

3.1.8 The Contractor shall produce and submit shop drawings for the inspection of the Project Manager prior to any installations as required in the General conditions of the contract.

3.1.9 Copies of all shop drawings shall be submitted to the Project Manager for approval. Thereafter the contractor shall submit copies of approved working drawings.

3.1.10 The form (transparencies/paper copies) and number of sets of shop drawings to be submitted to the Project Manager shall be as specified in the General Conditions of the Contract.

3.1.11 The Contractor shall prepare and submit complete „as-installed" drawings of all installations for the inspections of the Project Manager. All „as-installed" drawings have to be approved by the Project Manager.

3.1.14 The Contractor shall be responsible for the work, materials and equipment provided/executed under the contract. The Contractor shall guarantee that all materials and equipment of the systems are suitable and of sufficient capacity to meet the specified performance requirements set for them in the related design documents. The Guarantee and Maintenance period shall be as stated in the Particular or Special Conditions of Contract.

3.1.15 Electrical materials shall be stored in locked rooms or containers in their original packing. Light fixtures, sockets, switches, boards and the like shall be stacked on shelving, ensuring that no damage is likely to occur by stacking one over the other. Different materials shall be stacked at different locations.

3.1.16 The Contractor shall comply with all statutory requirements and regulations issued by any Rwanda Authority within whose area of jurisdiction the project site is located.

3.2 ELECTRICAL WORK

The scope of the electrical work to be carried out by the Contractor shall be to repair any broken electrical installations as a result of driveway paving activities. Having proceed with care in order not to damage underground installations, the contractor shall inform the project manager if there is any repair required for the underground installations and shall only proceed with the repair after approval of the Project Manager.
He shall, in addition, advice on how to gather existing installations in ducts and shall provide technical recommendation in this regard. Potential ducts were proposed in technical drawings and, if approved, they shall facilitate maintenance activities in the future.

3.4 CLIMATIC CONDITIONS/SPECIAL REQUIREMENTS FOR EQUIPMENT

3.4.1 All materials and equipment shall be capable for continuous and prolonged operation in the prevailing climatic conditions of Rwanda. When selecting materials and equipment, the effect of sunshine, thunderstorms and the impurities within the air shall be taken into account.

3.4.2 Particular attention is to be paid to the effects of high or low altitude. Low density of air decreases insulating and heat transfer capacities of all electrical equipment. Consult manufacturers of all materials and equipment to obtain valid de-rating factors.

3.5 ELECTRICAL SUPPLY

3. 5.1 All electrical equipment, accessories and fittings shall be designed and manufactured to operate continuously in the electricity supply system of Licensed Service Provider main supply or emergency supply from the stand-by diesel generating set having the following characteristics:

a) Voltage 400/230 volts

b) Phase, PME (Protective Multiple Earth) system

c) Frequency 50 Hz

d) Neutral Solidly earthed

3.6 STANDARDS AND SPECIFICATIONS

3.6.1 The whole of the Electrical works shall be carried out in compliance with:

a) Regulations for Electrical Installations and Equipment in Buildings;

b) The latest Regulation issued by the Rwanda Standard Board, REG and RURA ;

c) The relevant Rwanda Standards code of practice and
d) Provisions of the recent version of Rwanda Building Code

3.6.2 Except where otherwise indicated in the specification, the contract works and all manufactured items shall comply with the relevant BS or RS as appropriate. In each case the latest edition of such specifications shall apply. Should it be necessary to order equipment covered by other National or International Standards, the approval of the Project Manager must be obtained, in writing, before completing the tender documents.

3.6.3 The Contractor shall submit for the Project Manager"s evaluation standards, catalogues, manuals and drawings of all proposed materials and equipment to present the proposed equipment. The contractor shall also, prior to any procurement, obtain the Project Manager"s approval for any departures and deviations from the final design drawings and specifications.

3.6.4 Where standards to which equipment and material must comply are cited, equipment and materials meeting other approved standards may be accepted. Where materials, appliances and fittings, patented or otherwise, are prescribed, or the names of manufacturers are given, the intent is only to establish the quality and required services. Substitutes of equal quality to that specified shall be accepted subject to prior approval by the Project Manager. Such proposal by the contractor shall be accompanied with

sufficient evidence and comparison table to demonstrate that, the required critical parameters are of equivalent standard.

3.6.5 No order shall be placed by the Contractor for major equipment unless written approval of the Project Manager has been obtained.

3.6.6 All materials shall be new, meet the requirements set for them in this specification and in the General Conditions of the Contract and they shall be approved according to the contract regulations.

3.6.7 Unless otherwise indicated, the Contractor shall obtain similar types of electrical equipment from the same manufacturer wherever practicable. The components within any equipment shall as far as possible be produced and assembled by the same manufacturer.

3.6.8 The Project Manager has the right to reject material or equipment which does not comply with requirement of the specification. In such case the Contractor shall provide other materials or equipment that comply with the specification.

3.6.9 All electrical equipment shall be provided with suitable means of suppressing radio frequency interference fully in accordance with various requirements stipulated in relevant international standards. Especially for rotating equipment and for dimmer systems shall be provided further radio interference suppression confirming these equipment will in no way cause interference with the radio communication or any other telecommunication, extra low voltage or control system.

3.15.20 **Scope of commissioning Works**

The Contactor shall supply, deliver, install, set to work, test, commission and hand over to the Employer any repaired electrical system.

3.19 TRAINING OF CLIENT'S PERSONNEL

3.19.1 The Contractor shall upon the request of the Employer , as a separate item, carry out training of a number of persons who will be selected by the Project Manager for the correct and careful operation, control and maintenance of all the electrical services provided under the Contract before the final talking over of the project.

3.19.2 The training shall be carried out by the qualified commissioning staff of the Contractor for each particular service and shall be continued throughout the contract period till the final taking over of the project, if the General Conditions of the contract do not call for more extended period or as mutually agreed between the Client and the Contractor.

3.20 INSPECTION, TESTING AND COMMISSIONING

3.20.1 On completion of the electrical installation, the contractor shall, in the presence of the Project Manager or his representative, test the installations as required by the Project Manager and the local concerned authorities to demonstrate compliance with the IEE Wiring Regulations Sixteenth Edition and Regulations for Electrical Installations and Equipment in Buildings.

3.20.4 The Project Manager shall be given full opportunity to witness all tests and shall approve all tests. He will have the right to ask for specific tests results to be repeated. The Contractor shall provide accurate instruments and apparatus and all labour required to carry out the above tests. The instruments and apparatus shall be made available to the Project Manager to enable him carry out such tests as he may require.

PART THREE – EXECUTION

C.3.1 Site preliminaries

A. Contractor shall prepare surface of the site in order to install site office, PVC toilets and storage area of materials if any. All preparations and installations shall be as planned by the contractor and approved by the project manager. Negotiations with embassy officials shall be conducted to see if existing houses cannot be used for offices and toilets.

B. Connect temporary electricity and water to office and toilet. All materials shall be approved by the project manager.

C. Provide various office equipment such as two office desks, four chairs and shelves. Office equipment shall be approved by the project manager.

D. Cover all HVAC air intake points, goose necks, and vents with duct tape and polyethylene sheeting. Shutting down the HVAC may be necessary during the work so as not to affect the equipment.

E. Provide environment protection during and after the works, first aid post and Corona virus protective measures, personal protective equipment for the employer's representative, consultants and workers.

F. Provide and fix the project sign board.

C.3.2 Preparatory works

A. Conduct geotechnical investigations to locate quarries and borrow sites of construction materials with standard quality. Refer to lab report produced during the feasibility study for reference.

B. Conduct land survey to verify if all levels are accurate, verify and print shop drawings.

C. Provide and fix site signaling to direct traffic during the construction period.

C.3.3 Demolition

A. Extract roots likely to damage the road pavement inside the perimeter of driveway. Where possible extract roots 50cm offset from the driveway's edge on both sides and proceed with care in order not to damage the tree or underground installations.

B. Demolish existing pavements, tarmac surfacing, curbstones, manholes, sidewalks and stormwater drain, proceed with care not to damage underground installations. Consult embassy officials to locate the underground installations. Minimize the quantity of dust produced during demolition.

C. Transport and stockpile the waste in approved dumpsites. Take all necessary measures to minimize the quantity of dust produced by this process.

C.3.4 Earthworks

A. Excavate to reach the subgrade level; 430mm, 450mm below project levels for driveway and basketball court respectively.

B. Level the subgrade surface, water the surface and compact to 95% OPM min. This item includes also the compaction of natural gravels in areas where roots are extracted and the loosening of subgrade and sand improvement where necessary as directed by the project manager. Low-vibration compactors such as vibrating baseplate with 15-20cm lift thickness are recommended.

C. Excavate for trenches 1.2m deep from the project level, 50cm wide from reduced levels for ducts. Backfill the trench and compact to the required density.

C.3.5 Construction of driveway and basketball court

C.3.5 Construction of driveway and basketball court

A. Construct ducts and manholes as detailed in drawings.

B. Spread, water and compact 30cm in layers of 150mm of driveway base, 20cm of basketball court base to 95% OPM setting the right project levels. Low-vibration compactors such as vibrating baseplate are recommended.

C. Supply and lay curbstones type 1 and 2

D. Supply and spread well graded and washed river sand under concrete pavers. Sand shall comply with ASTM C33 specifications.

E. Supply and lay 40Mpa concrete pavers in approved pattern by the project manager. This item includes also the filling of empty spaces between curbstones and pavers with concrete C25 at the driveway edges where necessary and final compaction of pavers as specified. This task includes also compression lab tests of pavers and reporting to the project manager.

F. Cast concrete C25 for basketball ground slab, water drain and root barrier.

G. Repair, replace any broken tile, structure, masonry… as a result of construction activities

H. Clean up the site removing all construction waste and stockpile it in approved dump sites.

C.3.6 Construction of stormwater drainage

A. Excavate for drainage pipe trench (50cm of width and 90cm of depth).

B. Supply and lay PN16 Φ200mm PVC pipe in trench.
Supply and spread sand around the drain pipe in trench.

C. Excavate for manholes including maintaining and supporting sides and keeping free from water, mud and fallen materials.

D. Construction of manholes MH1 – 5

E. Excavation and construction of secondary soakpit

F. Garden replanting in all affected areas

G. Remove all construction waste to approved dumpsites

PART FOUR – SCHEDULE

C.4.1 PERIOD OF PERFORMANCE:

A. Solicitation & Award of Contract:	
1. Pre-Proposal Site Visit	30 days prior to Award
2. Award	Zero Day
B. Pre-Construction Submittals:	
1. Insurance & Bonding:	14 days after Award
2. Crew Information:	10 days
3. OBO & Embassy Review:	21 days
4. Schedule & Product Data:	30 days
5. OBO & Embassy Approval:	30 days
C. Material Procurement:	
1. Material Order	5 days
2. Shipping / Transport	4 days
3. Customs	0 days
D. Mobilization & Construction:	
1.Site installation	10 days
2. Cover all HVAC air intake points, goose necks, and vents with duct tape and polyethylene sheeting. Shutting down the HVAC may be necessary during the work so as not to affect the equipment	2 days
2.Demolition of pavement, excavation for drainage pipe trench and secondary soakpit and removal of waste	21 days
3.Compaction of road and basketball court base	21days
4.Construction of ducts	7days
4.Spreading of sand laying under concrete pavers	3 days
5.Laying of drainage pipe, pavers and casting of ground slab	30 days
6.Garden replanting where required and final Cleanup	10 days
E. TOTAL PERIOD of PERFORMACE:	218 days

F. Winter/Rainy Season: March – May and October - December

C.4.2 PRE-PROPOSAL SITE VISIT

A. In order to provide a realistic cost proposal for construction of driveway and drainage system, a pre-proposal site visit may be necessary to assess and verify the requirements, restrictions, and existing conditions that will impact execution of this Work.

B. Contractor shall proceed with care during excavation to protect underground installations

C.4.3 PROPOSAL SCHEDULE:

A. Proposals shall be evaluated based on total fixed cost and shall include materials, labor, project start-up expenses and worker incidentals, overhead, profit, taxes, and DBA Insurance as a complete project.

1. Cleared Labor
2. Un-cleared Labor
3. Mobilization Expenses
4. Materials (provide breakdown)
5. Overhead & Profit
6. Taxes
7. VAT (if applicable)
8. DBA Insurance

PART FIVE – DRAWINGS

END OF SOW