TENDER FOR REFURBISHING OF SESCO CANTEEN AT LG FLOOR, WISMA SESCO, PETRA JAYA, KUCHING.

INSTRUCTIONS TO TENDERER

1. The Tenderer is to note that this is a Lump Sum Contract. The Tender shall be signed with all blanks in the Form of Tender, Summary of Tender, Schedule of Rates and Appendices filled in.

2. No alteration is to be made in the Form of Tender, Summary of Tender, Appendices or Schedule of Rates except in filling in the blanks as directed. If any such alteration be made or if these instructions be not fully complied with, the Tender may be rejected.

3. If the Tenderer should wish to submit for consideration an alternative method of construction or other variation, he shall in all cases submit a Tender in accordance with Paragraph 2 above, and in addition shall submit an alternative proposal, clearly stating the omissions and additions together with the Tenderer's detailed estimate which would give effect to the alternative.

4. If the Tenderer has any doubt as to the meaning of any portion of the Specification, the General Conditions of Contract, he shall contact the Company in writing at the following address:-

   THE CHIEF EXECUTIVE OFFICER,
   SARAWAK ENERGY BERHAD,
   P. O. BOX 149,
   93700 KUCHING,
   SARAWAK,
   MALAYSIA.

   Fax. No: 082-481144

5. If the Employer discovers errors or omissions in any tender, he will require the same to be corrected but in such cases a compensating adjustment by means of a Lump Sum will be made so that the Tender Price remains unaltered. Any arithmetical adjustments made by the Employer in the Tender will be stated to the Tenderer if the Employer makes an offer to accept the Tender.

6. The Tenderer will be deemed to have visited the site to ascertain local conditions under which the works are to be executed and thus the Tender Price must include all incidental and contingent expenses. No claims will be entertained on the ground of lack of knowledge of the site conditions or any difficulty that may arise in respect with the entirety of the work specified.

7. The Tenderer's particular attention is drawn to the fact that the Tender Price must include for all costs associated with labour including the cost of any incentives necessary to attract and retain the necessary labour on site to meet the requirements of the programme stated in the tender.

The Tenderer's attention is further directed to the fact that the Tender Price must include for all increases in the cost of labour and materials.

8. The Employer will not be responsible for or pay any expenses or losses which may be incurred by the Tenderer in the preparation of his Tender.

9. When the Employer has decided on a Tender which it is willing to accept, a letter of acceptance will be sent to the Tenderer who submitted the Tender, and it will state the terms on which the acceptance is given.

10. The Canteen is operational during office hours therefore all the works are to be carry out after office hours and should not cause disturbance to the operator or user of the Canteen.

11. Sufficient hoarding board and sign to be put up throughout the construction period.

12. The Employer does not bind itself to accept the lowest or any tender, nor to assign any reason for the rejection of any tender.

TENDER FOR REFURBISHING OF SESCO CANTEEN AT LG FLOOR, WISMA SESCO, PETRA JAYA, KUCHING.

SUMMARY OF TENDER

(A) PREAMBLES TO TENDER

(1) The Tender is to note that this is a Lump Sum contract. Tenderers are required to price and complete the Summary of Tender all in accordance with the Contract Document specified in Clause 1.6 of the Project Specification.

(2) Tenderes are required to pay particular attention to the Project Specification especially Safety Requirement.

(3) The Company reserves the right to delete, add or substitute item of works according to the rates tendered here in.

(4) Tenderers are required to submit catalogues or brochures and literature of building materials specified or proposed as and when requested. Samples are also required to be submitted for approval. Upon approval are set of catalogue and samples of the approval materials when be kept at the site office.

(5) Tenderers shall allow for provision to the Engineer comprehensive installation details and shop drawings for all sections of works as deemed necessary. Three sets of shop drawings are to be submitted for approval, are set to be duly marked by the Engineer as approved and the Tenderer shall then commence works within 14 day, of delivery of the corresponding approved shop drawings, unless directed otherwise by the Engineer or except return of the approved shop drawings.

(6) The Tenderer shall be responsible for carrying out the whole of the works, provisions and requirements of the contract or seeing to that they and carrying out by all concerned, in a thoroughly safe and satisfactory manner and in particular shall strictly confirm to the requirements of any by- laws, regulations, orders and advices relating to the safety of person, on or about site, made of any public authority and government having jurisdiction in the matter.

(7) The Tenderer should provide a site office for SESCo's supervisory staff. Amenities like furniture, fan, a cellular phone and a digital camera shall also be provided.

(8) The Tenderer should allow for a progressive site meeting on site at least once a month. All minutes of meeting are to be recorded. A progressive works programme and report with sufficient photographs are to be submitted before each meeting.

(9) The Tenderer should put up hoarding board with sufficient signs.

(10) The existing 8 units of barracks together with the foundations, pipings, sewage systems are to be demolished. The dismantled materials belong to SESCo and any materials shall be retained on site as approved by Station Manager (Batang Ai). It is the responsible of the contractor to dismantle the material in proper manner and orderly stored in the destinated space as directed by site supervisor. Any balance materials are to be removed from site by the contractor.

SECTION 1 OCCUPATIONAL SAFETY AND HEALTH REQUIREMENT FOR CONTRACTOR

1 PURPOSE

This document “Occupational Safety and Health Requirements for Contractors” is provided for Contractors who wish to perform work for Sarawak Energy Berhad (SEB). The document outlines the minimum Occupational Safety and Health (OSH) standards that SEB expects the Contractor to achieve when performing contracting works in SEB’s project or operation. SEB only engages Contractors who are able to demonstrate sufficient competency, knowledge and have suitable qualifications to execute the work safely. Contractor must comply with all the minimum requirements for safe work as specified in the specifications below and to do so far is practicable in order to achieve the key objective in ensuring the safety of Contractor themselves, members of the public, SEB personnel and property and interested party who are affected or involved in the contract. SEB reserves the right to issue Improvement Notice or Stop Work Order and / or penalise the Contractor and / or terminate the contract to the Contractor if safety cannot be assured due to non compliance.

2 INTRODUCTION

This document requires for Contractors, Vendor and stakeholders who are involved, to fully comply with Occupational Safety and Health Act 1994 & Regulations including other relevant Malaysian / recognised international statutory requirements, all relevant SEB Safety and Health Rules & Procedures. It shall be a requirement for Contractor to develop an adequate Project Legal Register to ensure all the applicable legal requirements are identified and fully complied with according to the specified requirements.

The contractor must do as far as practicable in conducting Hazard Identification Risk Assessment and Risk Control to ensure optimum safety level can be achieved before commencing work at site and / or during the progress of the project implementation.

The contractor is also to ensure that all their sub-contractor(s) or agents comply with the above requirements. Any rules and regulations enforced by SEB shall be adopted by the Contractor who shall be responsible for ensuring compliance by their sub-contractor(s) and subcontractor's employee working at the site. The Contractor shall also be responsible and liable on matter concerning Occupational Safety and Health in relation to any subcontractors employed without any formal written contract. This document shall be included as part of the tender documentation sent to bidders, and shall form the contractual agreement between SEB and the Contractor.

AII potential Contractors shall be responsible for the inclusion of adequate tender prices for all necessary expenses in order to comply fully with the condition specified in this “Occupational Safety and Health Requirements for Contractor”.

The contractor shall be liable for and shall indemnify SEB against any liability, loss, claim or proceedings whatsoever arising under any statute or common law on his part or on the part of his subcontractor in respect to personal injury or death of any person whosoever or damage to any property in the course arising out of or caused by carrying out the works, unless due to any act or neglect of SEB. AII clauses in this document are applicable for all Contractors and shall supersede in event of any conflicting (if any) regulations and rules involving the Occupational Safety and Health issues that was stated in other sections of the Tender Documents. However, some clauses in this document may be exempted subject to the discretion by SEB.

3 DEFINITION

Some of the terms or words used in this document are defined as follows and others not defined here shall follow their said act and regulation.

"ACCIDENT" means an event that:-

(a) Causes any person to be harmed or
(b) In different circumstances, might have caused any person to be harmed.

"APPROVED" means certified by SIRIM or DOSH or by recognised international accreditation bodies.

"CONTRACTOR" means the person or persons, firm or company, whose Bid has been accepted by the Employer and includes the Contractor's personnel representatives, successors and permitted assignees.

"CONTRACTOR'S PERSONNEL" means workers agents employed by the contractor or sub-contractor to do work for gain or rewards.

"HARM" means illness, injury or both and "to harm", "harmed" and, "unharmed" have corresponding meanings.

"HAZARD" means an activity; arrangement, circumstances, event occurrence, phenomenon, process, situation or substance (whether arising or caused within or outside a place of work) that is an actual or potential cause of harm; and "hazardous" has a corresponding meaning.

"OCCUPATIONAL HEALTH" means any illness/sickness arise from workplace or work activities.

"SUB-CONTRACTOR" means any nominated Sub-Contractor or any person (other than the Contractor) named in the Contract for any part of the Works or any person to whom any part of the Contract has been sub-let with the consent in writing of the Engineer, and the Sub-Contractor's legal representatives, successors and permitted assignees.

"Risk" means a combination of the likelihood of an occurrence of a hazardous event with specified period or in specified circumstances and the severity of injury or damage to the health of people, property, environment or any combination of these caused by the event.

"SEB" means Sarawak Energy Berhad.

"SESCO" means Syarikat SESCo Berhad.

"CAC" Competency and Authorisation Council

"DOSH" means Department of Occupational Safety and Health, Malaysia.

"CIDB" means Construction Industry Development Board.

"OSHA" means Occupational Safety and Health Act

"FMA" means Factories and Machinery Act

"EQA" Environmental Quality Act

"SAFE" means -

(a) In relation to a person, means not exposed to any hazards; and

(b) In every other case, means free from hazards and "unsafe" and "Safe" have corresponding meanings.

"PLANT" includes-

(a) Appliance equipment fitting, furniture, implement machine, machinery tools and vehicle.

(b) Part of any plant, the controls of any plant and anything connected to any plant.

"MACHINERY" means an engine, motor, or other appliance that provides mechanical energy derived from compressed air, the combustion of fuel, electricity, gas, gaseous products, steam, water, wind or any other source and includes-:

(a) Any plant by or to which the motion of any machinery is transmitted and

(b) A lifting machine / a lifting vehicle, a machine whose motive power is wholly or partly generated by the human body and tractor.

"SITE" means the lands and other places through which the Works are to be executed or carried out, and any other lands and places provided by the Employer for the purposes of the

Contract.

"HIRARC" means Hazard Identification Risk Assessment and Risk Control

"PRACTICABLE" means practicable having regard to

(a) The severity of the hazard or risk in question;

(b) The state of knowledge about hazard or risk and any way of removing or mitigation the hazard or risk;

(c) The availability and suitability of ways to remove or mitigate the hazard or risk: and

(d) The cost of removing or mitigating the hazard or risk;

"JOINT SAFETY AND HEALTH COMMITTEE" is defined as the Committee which consist of the Project Manager of SEB, the contractor's Project Manager and the SHO employed by the contractor as well as representatives from both SEB and the contractor.

4 GENERAL RULES AND REGULATIONS

In carrying out the contract, contractors have to comply with all relevant Malaysian/International Acts, Regulations, Statutory Requirements passed by the Malaysian Government and SEB Safety Rules & Procedure, etc. which shall include but not limited to the followings:

(a) Occupational Safety and Health Act (OSHA) 1994 and Regulations made under the act.

(b) Factories and Machinery Act 1967 and Regulations made under act.

(c) The Electricity Ordinance - Chapter 50 (Amend 2007), The Electricity Rules 1999, The Electricity (State Grid Code) Rules 2003 and Rules made under the ordinance.

(d) Petroleum (Safety Measures) Act 1984 and Regulations made under the act

(e) Environmental Quality Act 1974 and Regulations made under the act

(f) Fire Services Act 1988 and Regulations made under the act

(g) Atomic Energy Licensing Act 1984 and Regulations made under the act

(h) Uniform Building By-Laws 1984

(i) Employees Social Security Act 1969 and Regulation made under the act.

(j) Construction Industry Development Board Act 1994 (Act 520)

(k) Road Transport Act 1987

(l) SEB Electrical Safety Rules, SEB Mechanical Safety Rules, SEB Competency And Authorisation Policies, Procedures And Guidelines.

(m) Any other applicable legal requirements enforced in Malaysia.

5 CONTRACTOR'S RESPONSIBILITY

5.1 General Requirement

In line with OSHA 1994 it shall be the duty of the Contractor to ensure, so far as is practicable, the safety, health and welfare at work of all his employees and other persons, not being his employees.

5.2 Occupational Safety and Health (OSH) Management Manual

The Contractors shall develop an adequate Occupational Safety and Health Management Manual for the project contract which shall comply with the legal requirements in Malaysia and all the requirements specified in this document. The Occupational Safety and Health Management Manual shall be submitted to SEB for approval prior to commencement date of the contract work.

The OSH management Manual shall include but not limited to the following:

(a) Scope & Introduction

(b) OSH Policy

(c) OSH Key Performance Indicators and Targets

(d) Organization Structure Chart, Roles and Responsibilities (Names and job description of key personnel who are responsible for ensuring the implementation of safety must be

clearly defined)

(e) Legal Risk Register

(f) Hazard Identification Risk Assessment and Risk Control (HIRARC)

(g) Accident / Incident reporting and investigation procedure

(h) Chemical Safety Data Sheet (CSDS)

(i) Emergency Response Plan (should cover all possible scenario such as but not limited to examples Fire, Tower Collapse, Land Slide, etc.)

(j) Safe Work Procedure (SWP) (To cover all site activities such as but not limited to equipment handling, pilling, tools, specific high risk job, etc.)

(k) Job Safety Analysis (JSA) (To cover for all activities)

(l) Registration certificates (DOSH, CIDB and other local authority concerning the construction site / equipment.)

(m) Induction Training (To include CIDB Registration for Construction workers and in house training for new workers)

(n) Employees criminal screening and work permits

(o) OSH program and activities (safety awareness toolbox talk, training, safety checklist, safety inspection and auditing etc.)

(p) Site Safety Rules

(q) Training and Competency

(r) Permit To Work System

(s) Personal Protective Equipment

(t) Any other matter not mentioned in the above.

5.3 Occupational Safety and Health Training

It shall be the responsibility of the Contractor to identify the training needs of all their employees and workers and to ensure that they attend the required training programme.

(a) The Contractors must ensure their subcontractors, vendors and any personnel working in the constructions projects possess valid CIDB Green Card for the whole duration of the contract. All cost incurred to obtain the CIDB green card shall be borne by the Contractor.

(b) The Contractor shall ensure that the relevant workers are trained and qualified for any specific competency as required by the Law or SEB.

5.4 Occupational Safety and Health Promotion

Contractor shall conduct activities such as but not limited to the issuance of regular safety reminders in the form of fliers, posters, banners and notices; implementation of safety suggestion box scheme, video presentation, safety week campaign etc to create safety awareness among the construction workers.

5.5 Occupational Safety and Health Meetings

(a) The Contractor shall establish Occupational Safety and Health Committee and shall ensure the meeting is held at least once a month at the project site office.

(b) The Contractor shall hold at least quarterly meeting with SEB personnel to discuss and resolve occupational safety and health issues.

5.6 Contractor to Conform to Laws etc.

The Responsibility of the contractor is to ensure the safety and Health of his employees as well as his subcontractor by abiding to the laws, statutory regulations and SEB rules, policies, procedures and guidelines. The Contractors shall ensure at all times that his subcontractor is informed of, understand and adhere to all laws, statutory regulations and SEB rules, policies, procedures and guidelines relating to safety and health.

5.7 Contractor's liability

The Contractor shall be solely responsible for any expenses incurred to implement Occupational Safety and Health requirement which shall include bearing the responsibility of any penalty imposed due to offence committed on the said acts and regulations.

The Contractor shall bear the risk of losses or extra cost incurred due to any interruption and / or delays to work resulting from fatalities, accidents, injuries and/or near-miss incidents

involving contractors and/or subcontractors and/or their workers, stop work orders issued by SEB or DOSH or other authorities.

5.8 Competency Requirements

The Contractor shall ensure that all the relevant workers are properly trained and have valid competency certificates to perform those works / services stipulated by the laws or guidelines / code of practices issued by DOSH or SEB requiring competency certification such as:

(a) Competent Persons with certificates issued by SEB CAC

(b) Scaffold Competent Person

(c) Competent Crane Operator

(d) Authorised Gas Tester and Authorised Entrant for Confined Space

(e) Working at Heights

(f) Others as defined by laws or instructed by SEB from time to time.

6 CONTROL AND SUPERVISION OF HEALTH AND SAFETY AT WORK

6.1 Contractor's Representatives

The contractor shall nominate a representative (s) to be in-charge and to coordinate the work with SEB personnel at worksite. The representative (s) shall remain at worksite at all times to supervise the scope of work awarded to them.

6.2 Safety and Health Committee

(a) The Safety and Health committee shall consist of at least a senior member of the main contractor's staff at the site, the site safety supervisor, all the contractor's safety supervisors and other site workers who are appointed as members.

(b) The Contractor shall ensure the Safety and Health Committee perform their function in accordance with the Occupational Safety and Health (Safety and Health Committee) Regulation 1996.

6.3 Safety and Health Officer

The Contractor shall employ a full time DOSH registered Safety and Health Officer (SHO) to work at construction site. The SHO shall perform the function as specified in Occupational Safety and Health (Safety and Health Officer) Regulation 1997 and be present during the Joint Safety and Health Committee Meeting.

6.4 Regular Site Meeting

The following regular site meetings shall be conducted:

i) Monthly Project Progress meetings with safety issues to be discussed as the first agenda.

ii) Weekly / Monthly Site Progress meeting which shall include Safety and Health issues,

iii) Joint Safety and Health Committee Meeting shall be held at least once in 3 months.

6.5 Accident / incident reporting and investigation

(a) The Contractors shall immediately notify SEB if any of the following incidents have occurred:

i) Accidents

ii) Dangerous Occurrences

iii) Fire

iv) Occupational Diseases /poisoning

v) Near-misses

(b) Depending on the type of incidents the Contractors shall be responsible for notifying and followed by submission of formal report on such incidents to Department of Occupational Safety and Health, Director of Electricity Supply Sarawak, Police Department, BOMBA, Department of Environment (DOE), Natural Resources and Environment Board Sarawak, Labour Department, Social Security Organisation (SOCSO), etc.

(c) The Contractor shall submit a preliminary report to SEB within 24 hours after the incident and followed by a full report within 7 days after the incident. A full accident / incident report shall have the following minimum content:

- Date and time of the accident / incident
- Detailed particulars of the victim (s) and / or the property damaged
- Description of how the accident / incident occurred (to provide evidences such as photographs and items)
- Analysis of the possible causes of the accident / incident
- Establishing the root causes
- Developing and implementing the control measures
- Determine who, how and when each of the control measures shall be implemented.

(d) The Contractor shall comply with the Occupational Safety and Health (Notification of Accident, Dangerous Occurrence, Occupational Poisoning and Occupational Disease (NADOPOD) Regulations, 2004 and other legal requirements.

(e) The Contractor shall implement all the control measures to prevent similar incident / accident based on the report produced and / or instructed by DOSH / Director of Electricity Supply / SEB within the timeframe given.

6.6 Safety Key Performance Indicator Board

The Contractor shall design a suitable outdoor Safety Key Performance Indicator Board for approval by SEB prior to installation at the project site. The size of the Safety Key Performance Indicator Board shall not be less than 1.2m (W) x 2m (L); creatively deigned and made of acceptable material. The information stated shall be in English, Bahasa Malaysia and language understood by majority of the site workers. It shall be prominently displayed at the site and be updated on weekly / monthly basics.

6.7 Site Safety Inspection and Auditing

The Contractor shall put in place an effective safety inspection programme and ensure that safety inspections are conducted on a regular basis at the work site to identify hazardous conditions, unsafe actions, and implement corrective actions. In addition the Contractor shall conduct their own site safety audit to ensure compliance to all legal requirements and SEB's guidelines, procedures, instruction and safety rules.

SEB will conduct planned and / or spot safety inspection on the construction site and the Contractor shall give full cooperation to SEB staff during such activities.

SEB will conduct safety audit based on the "Project Safety Audit" guidelines and the Contractor shall give their full cooperation to SEB staff to ensure a successful safety auditing exercise and the implementation of follow-up action to close all gaps identified.

7 SECURITY MEASURES

7.1 Guard House

A proper guard house shall be constructed by the contractor well equipped with basic facilities such as water and power supplies, a communication system, a toilet etc in order to ensure the safekeeping of the major project materials stored in the warehouse or storage area.

7.2 Security Company and Security Personnel

(a) The contractor shall engage licensed security company.

(b) The Contractor shall provide a 24 hours security guard to be stationed at the guard house to control the incoming and outgoing of workers and to ensure the security of the site during the whole duration of the contract.

(c) The Contractor shall ensure that all workers and vehicles entering and leaving the work sites or premises are checked by the security guard.

(d) The Contractor shall ensure that a dedicated logbook is used to record the names of personnel entering and leaving the site.

7.3 Workers Identification and Contractor Pass

(a) All personnel who need to enter SEB controlled premises must obtain valid security passes or contractor passes issued by SEB and must be worn at all time when working at the site. The passes are to be surrendered to SEB at the end of the employment or completion of the project.

(b) The Contractors who work inside SEB controlled premises shall observe all SEB security and safety requirements at all times.

(c) Contractor shall submit the following particulars for all workers under his employment (including sub-contractors) prior to work commencement:

i. Full name

ii. NRIC numbers (for citizen), and valid passport numbers and valid work permit numbers (for non-citizen)

iii. Date of birth

iv. Current residential address and contact phone number

v. Profession (or trade)

(d) For the purpose of issuance of Contractor Pass, the Contractor shall follow SEB procedures as outlined in the Competency and Authorisation Policies, Procedures and Guidelines and/or follow SEB Security requirement.

7.4 Use of Motor Vehicles

(a) All vehicle drivers shall drive carefully within the site compound and to abide by the speed limit set by the construction site office.

(b) Vehicles are only allowed to enter site for delivery of equipment or materials and should not be parked within the construction site longer than required.

(c) Vehicles shall not be parked in a way that will obstruct fire fighting equipment and it is advisable to practise a reverse parking policy to reduce the risk in the event of an accident.

(d) All vehicles used for construction work shall be in safe and good working condition.

(e) The contractor shall employ trained and certified mobile crane operators.

7.5 Fencing & Hoarding

i) The contractor shall ensure proper hoarding and fencing erected before commencement of site work following the minimum requirement.

ii) The worksite should be fully barricaded by protective hoarding so that the general public would be protected from work in progress. The hoarding should be able to protect not only public from dangers within the site but also to act as barriers or security to prevent entry of trespassers.

iii) The hoarding should not be less than 1800mm in height and continuous down to the ground. It should be properly designed and constructed in accordance with the specification of the local authority and should be maintained in good condition.

iv) There should be an adequate safety distance between the worksite and the hoarding.

v) If the distance from a public place to the building being constructed is such that there is the likelihood of falling materials striking pedestrian or vehicular traffic, a gantry is be required.

vi) During the erection of the hoarding, safe work procedures should be followed to ensure safety of the public.

vii) The entrance and exit of the worksite should be located in such a manner as to prevent danger and inconveniences to the public. Proper security should be maintained so as to prevent entry of unauthorized persons and public into the worksite.

viii) Suitable warning signs should be posted at conspicuous positions.

ix) No bills except warning signs should be allowed to be posted to the hoarding.

x) Arrangement should be made to prevent any parking or hawker activities at the surrounding perimeter of the hoarding when there is a high risk activity or operation being carried out that may cause a hazard to the surrounding.

xi) All building materials should be stored and handled well within the hoarded area.

xii) Structures of construction machinery should be located within the hoarded area such that if the structures were to collapse, the safety of the public is not affected.

xiii) Gates should be of suitable design and adequate strength.

xiv) For works within an existing live substation compound, worksite shall be fully barricaded by non conductive protective hoarding so that the general public and all personnel engaged to work in the worksite within the existing live substation compound would be protected from the live operational areas of the substation. The hoarding also serves to prevent the public and personnel engaged to work in the worksite within the existing live substation from entering the live operational areas of the substation.

7.6 Handling and mobilisation of Tools, Equipment and Materials

(a) The Contractor shall ensure that all equipment brought to site shall comply with Factories and Machinery Act (Building Operations and Works of Engineering Construction) Safety Regulations 1986, part 16 Hand and Power Tools.

(b) The contractors shall be responsible for the provision of their own equipments and shall ensure that all equipments are in a safe and good working condition.

(c) SEB reserves the right to conduct safety inspections or checking on the material, machinery or tools, etc used at the construction site and rejects any of those that are found to be unsafe for use.

(d) The Contractors are not allowed to operate or tamper with any equipment or apparatus belonging to SEB without prior consent.

(e) Any material or equipment that is required to be taken out from site, either for repair works or to be removed, shall posses a Material Exit Pass obtained from SEB, which shall have full description of the material or equipment, the quantity and reasons for taking the material / equipment out from site. The Material Exit Pass shall be signed by Contractor's selected approved authorized personnel. Only original copies of the Material Exit

Pass from SEB shall be accepted and submitted at the security gate upon leaving the site.

8 HOUSEKEEPING

Good housekeeping improves the working environment and motivates workers to work more efficiently to achieve higher productivity.

8.1 General requirements

(a) All materials in bags, containers, or bundles, and other material stored in tiers shall be stacked, blocked, interlocked, and limited in height so that it will be stable and otherwise safe against sliding or collapsing.

(b) When any material is stored in public thoroughfares, it shall be located so as to prevent the least possible hazard to, and interference with the traffic and the public. Unauthorised persons shall not be allowed on or around the material.

(c) Timber shall be stacked in a safe manner to prevent falling or tipping over and when unstacked all tiers shall be unstacked simultaneously.

(d) Unused timber shall have nails withdrawn before it is stacked unless it is to be burned without further handling.

(e) Aisles and passageways shall be kept clear to ensure free and safe movement of material handling equipment or workers. Such areas shall be kept in good repair.

8.2 Material Storage

(a) Material stored inside buildings under construction shall neither be placed within 1.8 metres of any hoistway nor inside floor openings nor within 3 metres of an exterior wall which does not extend above the top of the material stored.

(b) Employees who are required to work on stored material in silos, hoppers, tanks and similar storage areas shall be equipped with life lines and safety belts.

(c) Unused materials shall be segregated in storage.

(d) Bagged materials shall be stacked by stepping back the layers and cross-keying the bags at least every 10 bags high.

(e) Materials shall not be stored on scaffolds or runways in excess of supplies needed for immediate operations.

(f) Brick stacks shall not be more than 2.1 metres in height. When a lose brick stack reaches a height 1.2 metres, it shall be tapered back 50 millimetres in every 0.3 metres.

(g) When masonry blocks are stacked it shall be tapered back one-half block per tier above the 1.8 metres level.

(h) Timber shall be stacked on level and solidly supported sills and shall be so stacked as to be stable and self-supporting.

(i) Structural steel poles, pipes, bar stock, and other cylindrical materials shall be attached and blocked so as to prevent spreading or tilting.

(j) The contractors shall do so far as is practicable to ensure the risk of material storage management are controlled to an acceptable level.

8.3 Disposal of waste material

(a) Whenever materials are dropped more than 6 metres to any point lying outside the exterior walls of the building, an enclosed chute of wood, or equivalent material, shall be used. For the purpose of this sub-regulation, an enclosed chute is a slide, closed in on all sides, through which material is moved from a high place to a lower one.

(b) When debris is dropped through holes in the floor without the use of chute, the area on to which the material is dropped shall be completely enclosed with barricades not less than 1.2 metres high and not less than 1.8 metres back from the projected edge of the opening above. Signs warning of the hazard of falling materials shall be posted at each level. Removal shall not be permitted in this lower area until debris handling ceases above.

(c) All scrape lumber, waste material and rubber shall be removed from the immediate work area as the work progresses.

(d) Disposal of waste material or debris by burning shall comply with EQA 1974, Natural Resources and Environment Ordinance and Natural Resources and Environment (Prescribed Activities) (Amendment) Order, 1997 and other local authority

requirements.

(e) All solvent waste, oily rags and flammable liquids shall be kept in fire-resistant covered containers until removed from worksite.

(f) Waste materials shall not be dumped into rivers or on the site but shall be deposited in an approved off-site pit or disposal area.

9 WORKSITE FACILITTES

9.1 Sanitary Facilities and Health Programme

(a) The Contractor shall implement a programme of health education to ensure that all non-resident personnel working on the site are aware of health risks associated with living and working in Sarawak together with the necessary precautionary and/or protective measures.

(b) The Contractor shall provide sufficient toilet, washing and sanitary facilities at the Site. The facilities so provided shall be cleaned daily and appropriately maintained by the Contractor.

(c) All persons connected with the Works shall be obliged to use the toilets and sanitary facilities provided.

(d) Special precautions shall be taken by the Contractor to prevent the incidence of mosquito borne and other diseases. These shall include spraying with approved insecticides in the insides of all buildings under its control, and to avoid the formation of pools of water and other likely mosquito breeding places within and adjacent to the Works.

9.2 Canteen / Rest Room

(a) The Contractor shall provide adequate accommodation in which the employees may take their meal, spend their rest time, and shelter from bad weather. Any such accommodation should have a suitable floor, be furnished with suitable seats and table, and other furniture and equipment as to ensure the meals may be taken with reasonable comfort and sheltered from the weather.

(b) The Contractor shall ensure a suitable receptacle with a tight fitting cover is provided for rubbish, and it should be emptied and cleaned at suitable intervals.

(c) The Contractor shall provide adequate clean water and provision be made for boiling water to cater to the worker needs.

(d) The Contractor shall provide a separate rest room if at anytime there is 15 or more females being employed at one time.

9.3 Drinking Water

(a) The Contractor shall provide adequate supply of wholesome drinking water to all persons on the construction work site in accordance with the following conditions:-

i. It shall be readily accessible to all persons engaged in the work and clearly labelled as drinking water.

ii. A common drinking cup should not be used.

iii. If it is stored in a container, the container:-

- Should be clean and protected from contamination and heat; and
- Should be emptied and refilled from a wholesome source.

9.5 First Aid Facilities

The Contractor shall provide first aid facilities, appliances and requisites in accordance with Guidelines on First-Aid in the Workplace 2004 issued by DOSH.

10 PERMIT TO WORK

The Contractor shall establish and implement a formal written permit to work system for the purpose of controlling certain types of work which are identified as potentially hazardous. The permit to work shall be designed as a means of communication between site/installation management, plant supervisors and operators and those who carry out the work.

Example of permit but not limited to the following:

(a) Hot Work Permit

(b) Electrical Permit To Work

(c) Confined Space Work Permit

The Contractor shall do so far as is practicable to ensure adequate implementation of permit to work system to ensure the safety of workers and any other people who are involved in the construction site. Where applicable the Contractor shall comply with procedures or guidelines issued by SEB and / or DOSH concerning permit to work system.

10.1 Hot Work Permit

(a) The contractor shall establish and implement effective “Hot Work Permit” for any hot work including, but not limited to welding, flame cutting, brazing or any operations or processes that utilise or generate heat.

(b) The contractor shall enforce all safety precautions specified in the “Hot Work Permit” issued to the workers.

(c) The contractor shall display conspicuously the “Hot Work Permit” at the work site throughout the duration of the work.

(d) All records pertaining to “Hot Work Permit” shall be properly kept for inspection by SEB or DOSH.

10.2 Electrical Permit-To-Work

(a) The Contractor shall fully comply with Electrical Safety Rules (latest revision) issued by SEB/SESCO when using the Electrical Permit-To-Work.

(b) The Contractor shall ensure that the relevant Authorised / Competent Person employed are qualified personnel in accordance with the requirement as outlined in Competency And Authorisation Policies, Procedures And Guidelines.

(c) The Contractor shall comply with all procedures and safety precautions when “Electrical Permit-To-Work” is issued.

(d) The contractor shall display conspicuously the “Electrical Permit-To-Work” at the work site throughout the duration of the work. It shall be returned to SEB Authorized Person upon job completion.

(e) “Permit for Electrical Work” shall be enforced, controlled and implemented together with Isolation and Lockout System as defined in Electrical Safety Rules (latest version) issued by SEB / SESCO.

10.3 Confined Space Work Permit

(a) The Contractor shall develop and implement a safe procedure for work in confined space which in accordance with the “Industrial Code of Practice for Safe Working in a Confined Space 2010”.

(b) The Contractor must comply with the above Industrial Code of Practice for Safe Working in a Confined Space 2010 which defines a person whose upper body and/or head is/are within a confined space is considered to have entered the confined space and a safe procedure for working in confined space must be applied.

(c) "Permit for Entry into Confined Spaces" shall be used prior to carrying out work inside confined spaces including, but not limited to the following example of confined spaces:

i) Storage tanks, tankers, boilers, silos and other tank-like compartment usually having a manhole for entry;

ii) Open-topped spaces of more than 1.5 meters in depth such as pits or degreasers, which are not subject to adequate natural ventilation;

iii) Pipes, sewers, tunnels, shafts, and ducts, and similar structures; and any shipboard spaces entered through a small manhole, cargo tanks, cellular double bottom tanks, duct keels, ballasts, and oil tanks.

(d) The contractor shall ensure that adequate equipment provided, Authorised Entrant, Authorised Gas Tester and other supporting personnel are adequately trained for work in confined space.

11 ELECTRTCAL SAFETY

(a) Contractors shall make themselves thoroughly conversant and conform to the

Electricity Ordinance (Amend 2007), Electricity Rules 1999, State Grid Code 2003, IEE wiring regulation and SEB Electrical Safety Rules (latest revision) / procedures governing any work they may have to undertake in any electrical installation or system. Work must be carried out by competent personnel only.

(b) The Contractor shall implement all practicable safety measures and comply with all the legal requirements when installing and operating temporary generator set and other electrical installations. SEB shall reserve the right to conduct safety spot checks on these electrical installations or equipments and confiscate any unsafe electrical equipments and / or demand immediate implementation of corrective measures on unsafe practices found.

(c) Contractor shall make prior arrangement with the relevant SEB personnel for any site power supply requirements. Contractor shall not draw any electricity supply from the SEB supply system without prior approval from SEB.

(d) For work in confined space the power supply used to energise the inspection lamps or lighting shall be at 24 volts and below.

(e) All electrical faults occurred shall be reported immediately to SEB or their representative.

(f) The Contractor shall ensure temporary switchboard used at the construction site are of robust weatherproof construction, having locking device, adequate holes are provided for access of electrical wiring or cord are bushed to prevent damage to the cords and not located near flammable materials.

(g) The Contractor shall ensure all electrical appliances and current-carrying equipment having provisions made for earthing are properly earthed with the following impedances:

i) Equipment rated 500kVA and below: Below 10 Ohms

ii) Equipment rated 501kVA to 1000kVA: Below 5 Ohms

iii) Equipment rated more than 1000kVA: Below 3 Ohms

In cases where there are excessive ground resistance values, Contractor is to notify SEB promptly and include recommendations to reduce ground resistance.

The Contractor shall perform the necessary earth impedance tests and submit to SEB on a monthly basis, ground impedance reports for the applicable temporary current carrying / generating equipment on site. Contractor shall note that such tests may be subject to surveillance by SEB/SESCO.

(h) The Contractor shall ensure all temporary electrical installations in building and engineering construction worksites are provided with earth leakage circuit breakers / residual current circuit breakers. Contractor shall demonstrate to SEB whenever required that these devices are in working order. Any faulty devices shall be immediately replaced.

(i) The Contractor shall ensure that only approved non-conductive ladder can be used for electrical work.

(j) The Contractor shall ensure compliance to Regulation 16 of FMA, Building Operations and Works of Engineering Construction (Safety) Regulations 1986 and implement any other practicable measures to control electrical hazards at the construction site.

(k) The Contractor shall ensure that all electrical clearances are met when working within a live substation. For transportation of materials or setting up of mobile cranes within a live substation, reference shall be made to *Clause 16.1 x – Contractor's Equipment.*

12 FIRE PREVENTION

(i) The contractor and all his employees shall take all reasonable precautions to prevent outbreak of fire at all times.

(ii) The contractor shall provide adequate fire equipment in their office, site storage and own work areas. The contractor shall also provide Fire Fighting training for their employees.

(iii) In the event of an outbreak of fire the contractor and all of their employees shall assist in fighting such a fire. The contractor shall acquaint all their employees together with any subcontractor with the requirement.

(iv) Paints, thinner and other flammable materials are to be issued in small quantities at worksite. Such materials must be removed and kept under proper storage after the day's work.

(v) Flammable gas cylinder must be secured and chained in upright position.

(vi) Hot Work Permit shall be obtained before starting any work, which involves the use of

local ignition source capable of igniting flammable combustible materials.

(vii) Smoking shall be strictly prohibited in area designated to be non-smoking.

(viii) For places where flammable and combustible liquids, vapours, chemical and gases are stored or handled, all personnel shall be prohibited from carrying matches, lighters and others park-producing devices.

(ix) Contractor shall not defeat existing fire fighting system in a building or at worksite during their work.

(x) Fire fighting equipment shall be checked regularly to ensure that they are ready for any emergency.

(xi) Every designated employee must be proficient in the method of handling fire-fighting equipment that are installed at the site.

(xii) All fire incidents must be reported and investigated by the SHO or the person in-charge.

(xiii) Fire drills and fire prevention training shall be carried out on a regularly basics.

(xiv) Fire fighting procedures and safety measures shall be established and displayed in strategic locations.

13 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The Contractor shall assess the need for PPE based on risk assessment. The type of PPE can be selected according to the effectiveness of personal protection, availability and suitability for the wearer.

The Contractor shall provide adequate PPE free of charge to his workers and visitors at the site. It shall the responsibility of the Contractor to ensure that his employee wear PPE at all times. PPE Mandatory signage such as Hard Hat, Safety Shoes, Safety Harness, Hearing Protection, No Smoking and No Flame, etc. shall be placed at the designated areas.

The Contractor shall enforce strict general rules to prohibit any worker or visitor from entering the construction site if he / she failed to wear the minimum PPE requirements such as safety helmet, safety shoes and reflective vest. Other PPE requirements shall be enforced based on the specific requirements of the task or activities.

13.1 Head Protection

The Contractor shall ensure everyone one working at the construction site wear a proper Hard Hat or Safety Hat especially for protection against hazard from falling, flying or fixed object or/ and electrical shock.

13.2 Eye and Face Protection

The contractor's personnel shall wear suitable and approved eye and / or face protection equipment when carrying out processes or operations but not limited to the list provided below:-

(a) Cleaning by high pressure water jets

(b) Striking masonry nails (by hand or power tool)

(c) Work using a hand-held cartridge tool

(d) All work on metal involving the use of a chisel, punch or similar tool by means of a hammer or power tool

(e) The chipping of paint, scale, slag, rust or corrosion from metal and other hard surfaces by a hand or power tool

(f) Driving in or on of bolts, pins or collars to structure or plant by a hammer, chisel, punch or portable hand tool

(g) Shot cleaning of buildings or structures

(h) Shot blasting of concrete

(i) The use of power driven high speed metal cutting saws, abrasive cutting off wheels or discs

(j) Injection by pressure of liquids into buildings or structures which could result in eye injury

(k) Breaking up the metal by a hand or power driven hammer or tup

(l) Breaking, cutting, dressing, carving or drilling by a hand or portable power tool of any of

the following:-

i. Glass, hard plastics, concrete, fired clay, plaster, slag, or stone or similar materials or articles consisting wholly or partly of them

ii. Bricks, tiles or block of brickwork, stonework or block work (except wooden blocks)

(m) Use of compressed air to remove swarf, dust, dirt or other particles

(n) Coiling wire and similar operations where there is a risk of eyes injury

(o) Cutting wire or metal straps under tension

(p) Oxy gas welding

(q) Hot cutting, boring, cleaning, surface, conditioning or spraying of metal by an air gas or oxy gas burner

(r) Instruments such as lasers which produce light radiation which can cause eye injury

(s) Truing or dressing abrasive wheels

(t) Dry grinding of materials by applying them by hand to wheel, disc or band or by applying a power driven portable grinding tool to them

(u) Machining of metals including any dry grinding process not elsewhere specified

(v) Electric resistance and submerge electric arc welding of metals

(w) Any other process or operations as may be specified by SEB

13.3 Hearing Protection

The contractor shall comply with the Factories and Machinery Act (Noise Exposure) Regulations 1989. Employees who are working in an environment liable to be exposed to a continuous noise level equivalent or exceeding 85 dB (A) shall wear an approved hearing protection.

13.4 Respiratory Protection

The contractor's personnel shall wear suitable and approved respiratory equipment when carrying out any processes or operations but not limited to the list below: -

(a) Fogging of Premises

(b) Space and tent fumigation

(c) Work in confined spaces

(d) Spray Painting

(e) Grit blasting

(l) Work which generates dust, vapours, fumes, gases and irritants that is injurious to health

13.5 Body Protection

The Contractor shall ensure proper body protection equipment is provided and worn by all the relevant workers when they may be exposed to hazard such as electrical flashover, fall from height, injuries, fire radiation and chemical burn.

(a) Safety Harness

For all workers who are exposed to the risk of fall from a height of more than 2 meters must wear a proper safety harness and the required accessory.

(b) Fall Arrest System

Fall arrest system should only be used in situation when it is not reasonably practicable to use either temporary platform or guardrails at working heights of 2 meters or more. Working height is the distance form the walking/working surface to a lower level. The fall arrest system and accessories provided shall be but not limited to the list below:-

i) Full Body Harness

ii) Safety Helmet for working at height

iii) Double Lanyard

iv) Safety Line (proper rope with accessories)

v) Mobile Fall Arrest

(c) Reflective Vest and Traffic Kits

Workers who are exposed to traffic hazard for example when working on road or near work site shall be provided with reflective vest and a traffic safety kit (safety sign, safety triangle, cone, blinker light and baton).

(d) Protective clothing

Workers who are exposed to corrosive or harmful substance shall be provided with liquid proof protective suit, hood, apron, legging, glove and other protection wear suitable for the nature of substance and the risk involved.

13.6 Hand Protection

The contractor's personnel shall wear suitable approved hand protection equipment when carrying out any processes or operations but not limited to as specified below:-

a) Handling sharp objects

b) Handling acids, alkalis or other corrosive liquids

c) Handling pesticides or other toxic substances

d) Handling hot objects

e) Handling cold objects

f) When dealing with works that may cause electrical shock

13.7 Foot Protection

The contractor's personnel shall wear safety shoes suitable for the type of works to be carried out such as but not limited to the list below:-

(a) Steel toe cap shoes when handling medium to heavy loads and walking at the construction site.

(b) Rubber soled shoes when working with electricity

(c) Anti static shoes when working in areas that have flammable vapour in the atmosphere.

14 HIRARC

The contractor shall do as far as practicable to ensure adequate Hazard Identification Risk Assessment and Risk Control process are effectively implemented throughout the project cycle. The Contractor shall comply with the Guideline for Hazard Identification Risk Assessment and Risk Control issued by DOSH in 2008 as a minimum standard requirement.

15 SIGNAGE NOTIFICATION AND BARRIERS

Contractors are required to follow Malaysia Standard MS 981 for colour coding and Arahan Teknik (Jalan) 2C/85 wherever applicable. Standard symbolic safety signs and notices shall be prominently displayed at the required /designated areas for example labelling of hazardous substances, PPE requirement, traffic sign, live conductors etc.

Labelling of hazardous substances shall comply with Use and Standard of Exposure of Chemical Hazardous to Health (USECHH) Regulations 2000 and Classification, Packaging and Labelling (CPL) Regulations 1997. Proper non-conductive barrier with signage is to be used to isolate area with live electrical equipment from construction area.

16 CONTRACTOR'S EQUIPMENT

The Contractor is responsible for ensuring all equipment brought to site are in good and safe working condition and comply with relevant legal requirements.

16.1 Hoisting and Lifting Equipment

(a) All hoisting and lifting equipment such as tower crane, mobile crane, derrick crane, goods hoist, passenger hoist, gondola and access platform to be used shall possess valid certificate of fitness from DOSH.

(b) The tower crane, mobile crane and derrick crane operator shall be registered with DOSH.

(c) The contractor for erecting, dismantling, and maintaining of tower crane, gondola, material hoist, passenger hoist, access platform shall be registered with DOSH.

(d) Every process of erection, dismantling, and maintenance shall be carried out strictly by the competent person and in accordance with the manufacturer's instructions. The

manufacturer should provide all specification for erection, dismantling and maintenance.

(e) Every overhead structure, crane, hook, block, spreader, strong back, sling and other appliance for lifting a load should be of sound construction and in every way suitable for the purpose.

(f) Selection of cranes should be suitable for the intended use. It should also take into consideration the nature of the worksite or the position in which the crane is to be set up.

(g) Attention should be given to the slewing radius of the crane at the maximum luff of the jib to ensure that there are no obstacles to the slewing such as overhead power line, nearby structures or other cranes and proximity hazards to public access areas.

(h) No part of the crane should extend beyond the hoarded or fenced up area of the worksite.

(i) The worksite should be fully enclosed by means of hoarding or fencing or cordoning before erection of tower crane can be carried out. This is to protect the general public from any hazards during the work in progress.

(j) Lifting operation using cranes should comply with the following:

i) The crane is maintained in a safe working condition;

ii) operator, slinger and rigger should have adequate ability, knowledge, or authority;

iii) no lifting of load should be carried out outside the hoarded or fenced up area of the worksite. If lifting operation were to be carried out outside the hoarded or fenced up area of the worksite, written approval from the local authorities shall be obtained. Working area should be cordoned off and means for public control such as setting up of warning signs, warning lights to direct public or traffic away from it and controlled by a designated person shall be provided.

(k) Danger zone should be established before any lifting operation, erection, jacking or climbing and dismantling of crane is carried out. The perimeter of the danger zone must be cordoned off. If danger zone extend beyond the worksite hoarding or fenced up area, means for public control such as setting up of warning signs, warning lights to direct public or traffic away from it and controlled by a designated person shall be provided.

(l) For mobile cranes, the following steps should be followed to ensure the stability of the mobile cranes during the operation:

i) all outriggers should be fully extended;

ii) All jacks should be placed upon adequate footings and packing. Care should be taken to ensure that there is adequate bearing surface under the packing, especially where the ground is soft or backfilled;

iii) The crane should be levelled and all outriggers beam packed in case of rebound, close to the ends of the outrigger beams. Anchor pins should be inserted where provided in chassis and outriggers;

iv) the base timbers of any packing, i.e. those timbers resting on the ground, should be closely packed, and should cover as large area as necessary to safely transmit their load to the ground;

v) all timber packing should be sound, free from defects, of ample and adequate strength;

vi) The base layer packing should be of sufficient length, width and thickness to cover the area required. These should be closely laid over a levelled and consolidated area; and

vii) Packing should not be removed until all operations are completed.

(m) All safety devices shall be checked and tested and be in good working condition prior to operating the crane.

(n) Crane operator shall have full visibility and assisted by trained signalman during the operation of the crane or movement of a load.

(o) Where a crane is not controlled from the ground, but from an elevated cab, hand signaling or voice communications should be established between the operator and a trained signalman on the ground.

(p) The weights of materials to be lifted should be specified, and responsibility assigned for checking loads. Overloading shall not be allowed.

(q) Materials should be suitably packed before delivery to the worksite to ensure safe lifting by the crane. Special precautionary measures should be established and practiced for

exceptional lifting operations, such as lifting large panels, which may be blown about by wind, or tandem lifting by two or more cranes.

(r) No loads shall be carried over personnel, public thoroughfare, roads, neighboring building or cast in an attempt to get them down at a point which is beyond the crane's normal reach.

(s) Standards and codes relating to proximity of power-lines should be adhered to prevent electrocution due to electricity.

(t) Tampering with any limit switch should be prohibited and loads should never be left suspended without control.

(u) Lifting operations should be ceased during adverse weather conditions and flood lights installed at elevated crane structures should not pose a nuisance to the public.

(v) All hoisting equipment brought to site shall be in a safe and good working condition. SEB reserves the right to inspect and order the Contractor to remove any equipment found to be in unsafe condition.

(w) Maintenance and repair on hoisting, lifting equipment and appliances should be performed by trained persons and in compliance with the manufacturer's requirements.

(x) For setting up of mobile cranes or transportation of materials within a live substation, Contractor is to submit to the satisfaction of SEB, a proposed Lifting Plan with sketches containing the following information:

i) Route of vehicle/crane movement,

ii) Vehicle/crane dimensions and weight,

iii) Location of offloading or hoisting

iv) Boom arm swinging radius,

v) Boom arm hoisting height,

vi) Weight and dimensions of materials to be hoisted,

vii) Material final laydown area,

viii) Electrical clearances between vehicle/crane to all nearest current carrying live equipment.

ix) Any other additional information required by SEB.

Works shall only commence upon approval from SEB. All approvals/grants/sign offs on Lifting Plans shall not relieve the Contractor from full compliance with Contract Health and Safety requirements, specifications and the applicable statutory laws.

16.2 Generator Set

The Contractor shall ensure that all generator sets to be installed at the construction site comply with the legal requirements specified in the Electricity Ordinance (Amend 2007), Electricity Rules 1999 and the Factories and Machinery Act 1967.

16.3 Air Receiver

The Contractor shall ensure that all air receiver or pressure vessel installed on the construction site comply with the legal requirements as stated in the Factories and Machinery Act 1967. The contractor shall ensure that all pressure vessels are inspected by DOSH and copy of PMT certificate displayed at the vicinity.

17 WORKING ENVIRONMENT

17.1 Area of work

The contractor shall be responsible for the safety within their working area. Before the commencement of work, approved barriers/hoarding and safety signboards shall be erected and prominently displayed. Horseplay, loitering and straying from assigned place of work are prohibited. Adequate lighting and ventilation shall be provided whenever required. Contractor shall make the site safe at all time as not to endanger public.

If work involves working within an existing live substation, all temporary structures such as site office, storage yard, fabrication yard and etc shall not be located within the existing substation compound. By default, access into the existing substation compound shall only be allowed for construction purposes within the barricaded area as approved by SEB / SESCO and only during working hours as described in the Tender/Contract documents. Entry into the existing

substation compound outside working hours shall not be granted without prior approval from SEB / SESCO.

17.2 Confined Space Entry

(a) The Contractor shall be responsible for determining if the construction site or the facility where the contract work is located has any confined space in accordance with the definition as stated in the above 10.3 (c).

(b) If the workplace contains confined spaces, the Contractor shall inform his employees and any other persons, by posting danger signs or by any other equally effective means, of the existence and location of the confined space, and the danger posed by them, especially when work is being executed. A sign reading "DANGER - CONFINED SPACE DO NOT ENTER" in both Bahasa Malaysia and English or using other similar language would satisfy the requirement for a sign.

(c) If the Contractor decides that his employees will enter confined spaces, the employer shall develop and implement a written confined space entry procedure. This procedure shall comply with the “Industrial Code of Practice for Safe Working in a Confined Space 2010” issued by DOSH and shall be made available to the employees.

(d) If the Contractor decides that its employees will not enter confined spaces, the Contractor shall take effective measures to prevent his employees and any other persons from entering the confined spaces.

17.3 Working at Height

(a) The Contractor shall ensure that the risk associated with working at heights is assessed and controlled to prevent the fall of workers and / or fall of materials and other objects that can lead to serious injury to personnel.

(b) The Contractor shall ensure that appropriate and approved safety harness with accessories such as full body harness, half body harness, safety lines, double lanyard etc) are worn when working 2 metres or more above ground.

(c) Safety nets shall be erected to protect worker from falling and also to protect people below from falling objects.

(d) Gondolas shall have valid Certificate of Fitness issued by Department of Occupational Safety and Health (DOSH) and the personnel involved in working at heights must have attended training conducted by either Institute Latihan Ahmad Shah, National Institute of Safety of Health or other accredited training provider.

(e) The Contractor shall implement measures in accordance with the “Guidelines for the Prevention of Falls at Workplaces” issued by DOSH in March 2007.

17.3.1 Scaffolding

(f) The Contractor shall ensure all scaffoldings are of approved type and erected in accordance with Factories and Machinery (Building Operations and Works of Engineering Construction) (Safety) Regulations, 1986.

(g) The Contractor shall ensure all the requirements concerning the erection of scaffolding include but not limited to the following:

i) Every scaffold and every part thereof shall be of good construction made of suitable and sound material and of adequate strength for the purpose for which it is used.

ii) Every scaffold shall be properly maintained and every part thereof shall be kept so fixed, secured or placed in position as to prevent as far as practicable accidental displacement.

iii) Every scaffold which is more than 3 meters high shall be erected or be substantially altered or be dismantled under the direct supervision of a scaffold competent person.

iv) Every metal tube scaffold exceeding 40 metres in height and every other scaffold exceeding 15 metres in height shall be constructed in accordance with the design and drawings of a Professional Engineer.

v) Every scaffold shall be securely supported or suspended and where necessary sufficiently and properly braced to ensure stability.

vi) All structures and appliances used as support for scaffold and working platform shall be of sound construction, have a firm footing or be firmly supported, and shall where necessary be sufficiently and properly braced to ensure stability.

vii) Every scaffold shall be duly inspected, tagged and signed off by a competent person prior to any utilization. Such sign off of the said scaffold is valid for seven (7) days

whereby at the lapse of this period, should further utilization is required; the said scaffold shall be re inspected by a competent person to verify the safety integrity of the structure. All approvals / grants / sign offs on scaffold erection works shall not relieve the Contractor from full compliance with Contract Health and Safety requirements, specifications and the applicable statutory laws.

viii) Scaffold used in a Live substations should be made of nonconductive material. All conductive parts of an erected scaffold shall be solidly earthed with an earth electrode of appropriate cross sectional area.

17.4 Working Over/ Near Water

The Contractor shall ensure the associated risks are assessed and adequate control measures are implemented when their employees are required to work at the jetty, inside water tanks and other water retaining structures to prevent loss of lives due to drowning as the result of falling into the water. If working platform is to be constructed over water it must be safely constructed with fencing erected at all edges to eliminate the risk of people falling into water. Personal buoyancy aids and other PPE shall be worn by the workers when there is a risk of drowning and appropriate rescue equipment must always be made readily available.

17.5 Working at night or Near Traffic Passageway

The Contractor shall provide adequate equipment such as but not limited to the following when their employees are required to work at night or near traffic passage way:-

i) Lighting the compound

ii) Reflective vest for the worker

iii) Blinker

iv) Safety Cone

v) Barricade

If required the Contractor must obtain approval prior to commencement of work from the Police, Highway authorities and others. The contractor shall comply with the Arahan Teknik (Jalan) 2C/85.

17.6 Lighting and Ventilation

Illumination sufficient for maintaining safe working conditions shall be provided wherever persons are required to work or pass. For passageways, stairways and landings, the illumination shall be not less than 50 lux. Explosion proof light fittings must be used in areas where flammable gas may be present.

17.7 Excavation and Shoring

The Contractor shall ensure the following and any other additional control measures are taken:

i) No employee shall be permitted to enter any excavated area unless sheet piling, shoring or other safeguards that may be necessary for their protection are provided

ii) The excavation site and its vicinity shall be checked by a designated person after every rainstorm or other hazard-increasing occurrence and the protection against slides and cave-ins shall be increased, if necessary.

iii) Temporary sheet piling installed to permit the construction of a retaining wall shall not be removed until the wall has developed its full strength.

iv) Where banks are undercut adequate shoring shall be provided to support the overhanging materials.

v) Excavated materials and other superimposed load shall be placed at least 610 millimetres from the edge of open excavation and trenches, and shall be so piled or retained that no part thereof can fall into the excavation, or cause the banks to slip or cause the upheaval of the excavation bed.

vi) Banks shall be stripped of loose rocks or other materials which may slide, roll or fall upon persons below.

vii) Open sides of excavations where a person may fall more than 3 metres shall be guarded by adequate barricades and suitable warning signs shall be put up at conspicuous positions.

viii) No employee shall be permitted to work where he may be struck or endangered by an excavating machine or by material dislodged by it or falling from it.

ix) Planks used as sheet piling shall be at least 50 millimetres thick. The maximum spacing between wales shall be such as to keep the planks within their safe

bending stress. Shores and braces shall be of adequate dimensions for stiffness and shall be so placed as to be effective for their intended purposes. Each end of each wales piece shall be separately braced,

x) Earth-supported shores or brace shall bear against a footing of sufficient area and stability to prevent their shifting.

xi) The Contractor shall comply with the “Guidelines for Public Safety and Health at Construction Sites” issued by DOSH in 2007.

xii) All excavations shall posses an Excavation Permit obtained from SEB, which shall have full description of the following:

- Locality on site
- Size and depth of area to be excavated
- Shoring and barricading plan
- Excavation start date
- Excavation backfilling date (up to a maximum of 30 days from Excavation start date)

The Excavation Permit shall be signed by Contractor’s selected approved authorized personnel. The Excavation Permit shall then be submitted to SEB for review and within seven (7) days SEB shall confirm either the approval or rejection of the said permit. Rejected permits shall be resubmitted as per SEB’s comments. Excavation works shall not commence without any approved Excavation Permit duly signed off by SEB authorized personnel. It is therefore the Contractor’s responsibility to be fully aware of the review and approval period required for works involving excavations.

Upon completion of the backfilling works, Excavation Permits shall be closed and signed off by SEB and Contractor’s authorized personnel and copies shall be submitted to SEB.

17.8 Welding, Cutting and Grinding

(a) The Contractor shall ensure an appropriate "Hot Work" permit is issued before commencing such work in area other than the designated workshop where there is risk of fire or explosion.

(b) Always check equipment before commencing any job and ensure that they are in safe working order.

(c) All gas cylinders shall be secured and placed in an upright position at all times.

(d) All gas cylinders shall be installed with an approved "Flash Back Arresters'.

(e) Welding face shields and other PPE shall be used when performing a welding.

18 HAZARDOUS MATERIALS

18.1 Use and Handling of Hazardous Materials

The Contractor shall ensure that all hazardous material are handled and disposed in accordance with the Use and Standard of Exposure of Chemical Hazardous to Health (USECHH) Regulations 2000 and Classification, Packaging and Labelling (CPL) Regulations 1997.

18.1.1 Storage

As a general principle, hazardous materials stores shall be kept well ventilated, dry, cool and tidy. Hazardous materials of different categories shall be stored separately and the storage room be locked at all time.

18.1.2 Labelling and Relabelling

All hazardous materials shall be properly labelled and affixed with warning signs indicating the potential hazards in accordance with the statutory requirements. Warning notice shall also be affixed to dangerous goods, stores, and vehicles carrying hazardous materials indicating the classification and hazard of the hazardous materials.

When the hazardous materials is transferred to another container other than that in which it was originally supplied, the container must be relabelled with the chemical name or the trade name in accordance with the original labelling.

18.1.3 Packaging and Transportation

All hazardous materials shall be properly contained and packaged inclusive of relevant documentation before being transported. Appropriate fire fighting equipment and PPE shall be kept in vehicles carrying hazardous materials for emergency use. Personnel who accompany the vehicle transporting hazardous goods must be aware of the risk and know what to do in case of an emergency.

18.1.4 Handling

The Contractor shall ensure that all personnel who handle or supervise handling of any hazardous materials have a sound knowledge of the potential hazards and are able to take the appropriate actions in case of an emergency. If required the appropriate PPE must be worn by the personnel handling and / or supervising the works.

18.1.5 Emergency

The Contractor shall ensure all personnel involved in the handling, transport, storage or use of hazardous materials are familiar with the emergency procedure in handling possible emergency situation such as fire, explosion, accident, spillage and leakage. Written emergency response procedures shall be provided and regular drill or exercise shall be conducted to assess their effectiveness.

18.1.6 Disposal

The Contractor shall ensure that any disposal of hazardous material is done in strict compliance with the applicable legal requirement and all practicable control measures must be implemented to prevent an accident or negative impact on the environment.

18.1.7 Information, Instruction and Training

The Contractor shall ensure the relevant employees who may be exposed to such hazardous materials are provided with adequate information, instruction and training. All training programmes shall be documented and kept for inspection by DOSH or SEB.

18.2 Handling of Isotopes and Radiographic equipment

The Contractor shall comply with the Malaysian Atomic Energy Licensing Act 1984 [Act 304]. Only certified personnel holding valid competency certificate issued by Lembaga Perlesenan Tenaga Atom (LPTA) Malaysia are allowed to handle radiographic isotopes and operate equipment for radiography work.

Only specialised contractors approved by DOSH are allowed to undertake Non Destructive Testing (NDT) work involving radiography and handling of radioactive isotope. Valid certificate indicating the strength and type of isotopes shall be presented to SEB. The contractor shall submit Safety Document and Radiographic Work Procedure to SEB prior to commencement of work.

The contractor shall obtain approval from SEB before bringing isotope into SEB premises or project sites. A minimum of 24 hours advance notice shall be given prior to conducting Radiographic Test at site and the affected area shall be cordoned off. Radiography work sign and beacon light shall be displayed prominently when radiography work is in progress. Method of storage of isotope and the person in charge shall be made known to all parties involved. If the isotope is required to be stored at site, the “Bomb Pit” must be constructed, inspected and approved by LPTA.

19 PILING

The Contractor shall implement the following measures and any other additional measures to control the risk due to piling activities:-

(a) Pilings should be handled by trained personnel.

(b) In view of the prevailing need to conserve the environment and protection of public health, piling machinery that generate excessive vibration, noise, smoke or other pollutants should not be used in build-up areas.

(c) Where there is any question of stability of structures adjoining areas to be piled, such structures shall be supported where necessary by underpinning, sheet piling, shoring, bracing or other means in accordance with the design of a Professional Engineer to prevent injury to any person.

(d) All pile-driving equipment shall be inspected daily by a designated person before the

start of work and every defect shall be immediately corrected before pile-driving commences.

(e) Reasonably practicable measures shall be taken to warn persons not to approach within 50 metres of a pile under test.

(f) Before placing or advancing a pile driver, the ground shall be inspected by a designated person and, where necessary for firm and level footing, timber shall be placed. After placing or advancing a pile driver, inspection and correction of the footing shall be made, when necessary, to maintain stability.

(g) Noise impact can be reduced at the source e.g. by introducing nonmetallic dolly between the hammer and the driving helmet and installing acoustic enclosure which encloses the hammer and the complete length of the pile being driven.

(h) For continuous noise such as from diesel engine, the noise can be reduced by introducing a more effective exhaust silencer or designing an acoustic canopy to replace engine cover.

(i) All mechanical equipment and plant should be well maintained throughout the piling work.

(j) The Contractor shall comply with Factories and Machinery (Building Operations and Works of Engineering Construction) (Safety) Regulations, 1986 concerning piling operation.

20 ENVIRONMENT OBLIGATION

The contractor shall implement control measures to prevent negative impact to the environment and shall comply with the Environmental Quality Act 1974, other relevant local legal or council requirements and SEB environment policy.

20.1 Compliance with environmental legal requirements

The Contractor shall comply with but not limited to the list of legal requirement listed below:-

(a) Environmental Quality Act, 1974 (Act 127) and subsidiary legislation made there under;

(b) Natural Resources And Environment Ordinance, 1993 and subsidiary legislation made there under;

20.2 Environmental aspect and impact

The Contractor shall conduct an adequate assessment on the environmental aspect and impact due to the construction activities and to as far as practicable implement mitigation measures to prevent or minimise the impact on the environment.

20.3 Disposal and Spillage

The Contractor shall ensure storage, disposal and control of spillage of any chemical, oil or hazardous material in accordance with the legal requirement. The Contractor shall be fully responsible and liable for clean-up works and / or payment of any compensation and / or penalty for any spillage, to the requirements of the authority.

20.4 Removal of Trees and Ground Vegetation

(a) During the course of work, the contractor shall not remove or damage any tree or vegetation in the surrounding area without approval from the relevant local authorities.

(b) Felling of trees should be done by trained personnel to ensure safety of the workers and public and prevent damage to public property.

(c) Adequate HIRARC shall be conducted.

(d) If the work involved requires the removal of ground cover, the contractor shall ensure that all steps are taken to minimise/ eliminate soil erosion.

(e) Slopes with exposed soil that are susceptible to erosion must be covered with plastic sheets.

(f) Arrangement should be made to prevent landslides, sinkhole and flooding or other unstable ground condition. These arrangements should conform to the requirements of relevant authorities.

(g) Controls measures shall be taken to prevent any sediment runoff from entering the public or SEB drainage system.

(h) Care should be taken to protect existing underground and overhead utilities (if any) especially electric cables to avoid any undue accident during site clearing work if relocation of such services are not possible.

20.5 Control of air pollution

The Contractor shall implement appropriate control measures to prevent or minimise the air pollution due to dust particles produce by the construction activities such as but not limited to the list below:-

(a) To provide washing facilities to remove soil stuck to the tyres of all vehicles leaving or entering the construction site.

(b) Every measure should be taken to suppress any dust generated by the vehicles such as spraying of water on dusty roads to prevent dust from becoming airborne due to passing vehicle.

(c) Open burning at the construction site is prohibited and can only be done after seeking approval from the relevant authority.

(d) The Contractor shall conduct measures to prevent or minimise air pollution due to the construction activities.

20.6 Control of Noise

(a) All work shall be carried out without unreasonable noise and disturbance. The Contractor shall indemnify SEB and SEB's Representatives against any liability for damages on account of noise or other disturbance created while or in carrying out the Works and from and against all claims, demands, proceedings, damages, costs charges and expenses whatsoever in regard or in relation to such liability.

(b) The Contractor shall ensure that all equipment and machinery are in proper working condition so as to minimise the amount of noise generated. SEB may require the Contractor to replace any machinery that to his discretion is emitting excessive noise.

(c) The Contractor shall comply with the "Planning Guidelines For Environmental Noise Limits And Control" issued by Department of Environment, Malaysia in 2004 that specify the limit of noise level emitted from a construction site in the various receiving land use categories.

21 WASTE AND SCRAP MANAGEMENT

Scrap refers to plants, part of plants, equipment, piping, and cables etc. The contractor shall be responsible for the removal, proper storage and security of all scrap and waste materials resulting from their works. All accumulated waste materials resulting from the works shall be disposed regularly. Waste material shall not be disposed by burning. Any oil or other harmful waste shall not be allowed to discharge into the drain. The contractor shall be responsible for the removal of the accumulated debris from his work site to the dumping ground approved by the Local Authorities. The contractor shall seek approval from DOE and shall provide evidence to SEB when disposing the Scheduled Waste. All Scheduled Waste shall be disposed of by licensed contractors.

22 EMPLOYMENT

The contractor shall be responsible for arranging whatever documentation deemed necessary for the entry and residence of employees to be brought into Malaysia for the purpose of the contract. The Contractor shall be responsible for ensuring that all these employees comply with Employment Act 1955 (Amend 2006) and other Statutory Regulations / Requirements.

The Contractor shall fulfil all the obligations to provide adequate site office space, accommodation and medical facilities for all his employees in accordance with their contractual agreement, the above Employment Act and other Statutory Regulations / Requirements. The Contractor shall be responsible to ensure good discipline and safety attitude of all personnel employed by them.

23 EMERGENCY RESPONSEP PLAN (ERP)

(a) The Contractor shall prepare and implement an adequate ERP specific for the construction site. The Contractor shall conduct the necessary training and emergency drill at least once a year.

(b) At a minimum, an emergency response plan must include but not limited to the following:

i. Identify what are the possible emergencies

ii. A preferred method of reporting fires and other emergencies

iii. An evacuation policy and procedures

iv. Emergency escape procedures and routes assignments such as floor plans, workplace maps, and safe refuge area

v. ERP organisation structures with the individual names, telephone number, duties and responsibilities.

vi. Procedures for employees who need to perform specific task like shutdown of critical plant operations, perform fire fighting, etc.

vii. Rescue and medical duties of personnel

viii. Providing an updated list of key personnel to be notified in the event of an emergency during off-duty hours.

24 ENFORCEMENT

(a) The Contractor shall comply with the all the requirements stated in this "Occupational Safety And Health Requirement For Contractor", all the applicable legal requirements of this country, local authority regulations, SEB's safety rules, instruction and do so far as is practicable to in implementing any additional measures to ensure the safety and health of their employees, SEB's staff, public and anyone who may be affected by the project contract activities.

(b) SEB will conduct safety inspection and audit on the construction sites and/or the Contractor Office. SEB will use the "Project Safety Audit" document as a guideline to conduct the audit and the Contractor is advised to use it as a guide for their internal pre audit preparation.

(c) SEB shall issue Improvement Notices or Stop Work Order to Contractor for any non compliance to "Occupational Safety and Health Requirement for Contractor", legal requirements of this country, local authority regulations, SEB's safety rules and instruction and / or when unsafe actions and unsafe conditions are discovered and / or based on the outcome of the "Project Safety Audit" conducted.

25 PENALTY FOR NONCOMPLIANCE

(a) SEB shall reserve the right to penalise the Contractor for any noncompliance with "Occupational Safety And Health Requirement For Contractor", all the applicable legal requirements of Malaysia, local authority regulations, SEB's safety rules and instruction committed by their employees and / or subcontractor and / or agent in as follows:

i. For first noncompliance, SEB shall issue a letter of warning and the Contractor shall implement the corrective actions within the specified period of time.

ii. For second repeating noncompliance or failure to implement the corrective action within the specified period of time given in (i), the Contractor shall be issued with a letter of warning and SEB shall reserve the right to penalise the Contractor not exceeding Five Thousand Ringgit Malaysia (RM5,000) for every noncompliance or failure to implement the corrective action within the specified period. SEB shall determine and deduct the actual amount of the penalty from the monthly payment of contract claim to the Contractor.

iii. For the third repeating noncompliance or failure to implement the corrective action within the specified period of time given in (ii), the Contractor shall be issued with a letter of warning and SEB shall reserve the right to penalise the Contractor at a minimum of Five Thousand Ringgit Malaysia (RM5,000.00) but not exceeding Fifty Thousand Ringgit Malaysia (RM50,000) for every noncompliance or failure to implement the corrective action within the specified period. SEB shall determine and deduct the actual amount of the penalty from the monthly payment of contract claim to the Contractor.

iv. For the fourth repeating noncompliance or failure to implement the corrective action within the specified period of time given in (iii), SEB shall reserve the right to terminate the contract with the Contractor and penalised him for the amount not exceeding RM50,000.00 for every non compliance.

SYARIKAT SESCO BERHAD

GENERAL CONDITIONS OF CONTRACT

- SESCO GCC Rev. 0/93 -

SECTION 1 – PRELIMINARIES

1.1 GENERAL

This Specifications is to be read in conjunction with the Agreement Form, Contract Drawings and the SESC0 General Conditions of the Contract (SESCO GCC Rev. 0/93). The Contractor is to pay particular attention to Clauses No.24(1) (Accident or Injury to Workman) and No. 24(2) Insurance Against Accident, Etc. to Workman) of the SESCO General Conditions.

Notwithstanding the sub-division of the Specifications under different sections and headings, every part of it is to be deemed supplementary to every other part and is to be read with it so far as it may be practicable to do so, or where the context so admits.

1.2 DEFINITION

In this Contract (as hereunder defined), the following words and expressions shall have the meanings hereby assigned to them except where the context otherwise requires :-

(a) "Engineer" means the Chief Executive Officer of the Sarawak Energy Berhad.

(b) "Company" means the Sarawak Energy Berhad.

(c) "Company's Representative" means the person or persons for the time being duly authorized by the Engineer in-charge of the Contract.

(d) "Contract" means the Conditions of Contract, Specifications, Drawings, Schedule of Rates (if any), Tender and Contract Agreement.

(e) "Contractor" means the person or persons, firm or company whose tender has been accepted by the Engineer and includes the Contractor's personal representatives, successors and permitted assigns.

(f) "Works" means the works to be executed in accordance with the Contract.

1.3 SCOPE OF CONTRACT

This contract is for the provisions of all materials, labours, plants, tools and of general builder services for the erection and completion, including all finishes and services, etc. all in accordance with the Project Specification, Drawings and Contract Documents as listed below :-

a. Provide PPE equipment for all staff and workers on site and to be complied with Safety & Health Requirement attached.
b. Demolish existing vinyl floor tile, ceramic floor tile, partition, door, lightbox, kitchen stove, piping & etc.
c. Replacement of 600 x 600mm homogeneous floor tile in Dining Area and 300 x 300mm homogeneous floor tile for Kitchen & Cooking Area.

d. Extension of stainless steel handrail up to Cashier Counter.
e, New Cashier Counter with aluminium drawer & cabinet to Engineer's approval.
f. New Drink Counter with aluminium shelf & sliding door to Engineer's approval.
g. New roman blind for high level window.
h. New brickwall with wall tile finish (Kitchen Area) & poster finish (Dining Area).
i. Supply and install approve type of posters as indicated in the drawing.
j. New 50mm dia heavy duty waste pipes are to be concealed before laying tiles.
k. Replacement of double-leaf h.w. door at loading area. 8 pieces 200mm H x 2mm thick door guard (Model PPC 200), or equivalent, to be installed on the door panel.
l. Refurbish of existing main door at Main Entrance to Engineer's approval. 8 pieces 200mm H x2 mm thk door guard (Model PPC 200), or equipment, to be installed on the door panel.
m. Clean and minor touch up of existing washing basin and sanitary system.
n. Clean and polish of existing food counter/band-marie with approved type of chemical agent.
o. Repair/replace defected ceiling.
p. Rectify the leakage at the window.
q. Painting works for internal plastered wall.
r. Replacement of 4,180mm long stainless steel cooking stove c/w heavy duty type 3-ring Burners, 25mm dia stainless steel high pressure gas pipe, 6 mm dia high pressure gas controller valve & etc to match existing.
s. Cleaning of filter & cooker hood to specialist detail.
t. Replacement of 2 nos. aluminium doors c/w concealed floor spring & etc.
u. General cleaning from time to time & touch up where necessary.

1.4 LOCATION OF SITE

The site is situated at the Lower Ground Floor in Wisma SESCo, Kuching

1.5 NATURE OF CONTRACT

This Contract is a Lump Sum firm price contract.

(a) Contract Drawings

All work is to be carried out strictly in accordance with the drawings. The Contractor shall refer the matter to the Engineer if there is anything, any dimension, etc. not clear or illegible before proceeding with that part of the work.

The list of Contract Drawings is as shown at the end of the Project Specification.

(a) Specification

The Project Specification is to be read in conjunction with the drawings and it is to be applied to the whole of the works. .

(c) Discrepancies Between Documents

The Contractor is to refer to the Engineer before work is carried out if any discrepancies are found in or between the Project Specification, Drawings or Instructions issued.

Written or figured dimensions on the drawings are in all cases to be preferred to scale dimensions and large scale details are to take preference over smaller ones and where these have been inevitably omitted the Contractor is to refer same to the Engineer.

1.6 CONTRACT DOCUMENTS

The following documents shall form part of the Contract:

(a) Form of Tender

(b) Instructions to Tenderers

(c) Summary of Tender

(d) Appendix A - Appendix to The Agreement

(e) Appendix B - Schedule of Basic Rates for Labour and Machinery

(f) Appendix C - Schedule of Plants

(g) Appendix D - Schedule of Sub-Contractor

(h) Appendix E - Information to be Supplied by Contractor

(i) Appendix F - Schedule of Site Staff

(j) Appendix G - Schedule of Manufacturers

(k) Appendix H - Schedule of Suppliers

(l) Appendix I - Recent Contracts

(m) Schedule of Finishes

(n) Schedule of Rates

(o) Safety And Health Requirement

(p) General Conditions of Contract (SESC0 GCC Rev. 0/93)

(q) Project Specification

1.7 ENTIRETY OF CONTRACT

Any matter of construction and workmanship which are fairly and obviously intended but which may not be definitely referred to in the specifications or drawings and which are usual in sound building construction practice and essential to the works are to be considered as included in this contract.

1.8 DAMAGE FOR NON-COMPLETION

If the Contractor fails to complete the works within the time stated in his Form of Tender or within any extended time fixed under the General Conditions of Contract, the Contractor shall pay the sum stated in Appendix A to the Form of Tender as liquidated and ascertained damages during the period when the works shall remain uncompleted.

1.9 PROGRESS OF WORKS

The Contractor shall supply six (6) copies of his detailed work programme to the Engineer for approval before work commences. On receipt of approval to the programme, the Contractor will be expected to adhere to the programme and all changes to the programme must be approved by the Engineer.

1.10 EMPLOYEES' PROVIDENT FUND

The Contractor shall comply with all the Provisions of the Employees' Provident Fund Ordinance 1951 (F.M. Ordinance No. 21 of 1951 as amended and with the provisions of all Regulations and Rules from time to time made thereunder and in particular be responsible for the payment into the E.P.F. of all contributions required under that Ordinance in respect of all persons employed by the Contractor or any authorized Sub-Contractor in and for the performance of this Contract.

1.11 ORDERS OF ESSENTIAL MATERIALS

The Contractor is required to place his order for materials and goods at the earliest possible dates after signing the Contract arid he will be held responsible for any delay occasioned through any failure to do so.

The Contractor is to produce copies of the Orders as and when required to do so. A "Schedule of Material Arrival" must be submitted to the Corporation as early as possible.

1.12 SURETY

Provide Surety for the performance of the Contract amounting to ten (10) percent of the Contract Sum. The Surety must be either in the form of guarantee with a bank or in cash. A bank guarantee shall be stamped and registered at the Contractor's expenses by using the standard FORM PUR/5 provided.

1.13 OFFICE FOR ENGINEER'S REPRESENTATIVE

The site office should be constructed as detailed in the standard site office drawing and including all furniture, cabinets, lightings, air conditioning, water plumbing and toilet fittings, etc. All doors to be lockable with dead lock.

1.14 INSURANCES

The Contractor shall indemnify the Company by paying for or caused any Sub-contractors or nominated Subcontractors to pay for the following insurances during the duration of the Contract :-

(a) Workmen Compensation Insurance to cover up to Practical Completion plus up to Defects Liability Period up to 3 occasional workers.

(b) Public Liability Insurance, to cover up to Defects Liability Period.

(c) Fire, etc. Insurance, to cover up to Practical Completion.

The amount to be insured are detailed in Appendix A.

1.15 COMMENCEMENT OF WORKS

Commencement of works on the Contract shall not be allowed until the provision of Clause 1.12 and 1.14 in respected of Surety and Insurance has been compiled with.

1.16 FOREMAN

The Contractor is to keep a qualified foreman on the works during all the working hours to whom instructions may be handed in the absence of the Contractor.

1.17 PRACTICAL COMPLETION

Practical Completion shall commence on the date when Occupational Permit from the relevant authority is obtained.

1.18 SAMPLES

The Contractor is to submit samples free of charge of materials and goods to be incorporated into the permanent work whenever called for by the Engineer.

1.19 SPARE MATERIALS

The Contractor is to supply the Corporation, on completion of the project, two (2) percent of the installed quantity of the following materials for spare:

(a) Floor Tiles (Vinyl and Ceramic)

These materials shall be supplied in perfect conditions and in original packing and the cost is deemed to have been included in the Tender Prices.

1.20 SITE STORAGE

The Contractor is to provide site storage space to store the materials/equipment. These stores shall be made accessible to the Engineer and his representative at all times. The cost incurred by these stores shall be deemed to be included in the pricing.

1.21 SITE PREPARATION

The Contractor shall allow for forming platforms, etc. to the required level.

1.22 HOARDING

The Contractor shall provide, erect and maintain proper vertical close-board hoardings to the whole of the street frontage up to 2 m high. Provide all necessary access doors in the hoardings, complete with locking facilities, etc. All hoardings, screens and protection shall be provided to the satisfaction of the Engineer and/or the authorities and they shall be removed at the completion of the project.

The hoarding is to be painted white with emulsion paint.

1.23 PUBLIC FOOTWAYS, ETC.

The Contractor shall ‘be responsible for maintaining and upholding the public roadway and foot paths and shall be responsible for and make good any damage to the same.

1.24 SIGN BOARD

The Contractor is to provide and fix in a position to be determined by the Engineer a framed sign board measuring 2.5 x 2 m of a required design and wording to be approved by the Engineer.

The wording on the board shall include name of the project, Consulting Architect, Contractor, Sub-contractor and Nominated Sub-contractor.

The board is to be removed on completion of the works.

1.25 ARTIFICIAL AND TEMPORARY LIGHTING, WATER, POWER, ETC.

The Contractor is to provide all artificial and temporary lighting and power required for the proper execution of the works (including safety-lights on any hoardings or gantries projecting on to or over the public road and/or footpath) and is to pay all charges in connection therewith. All temporary lightings are to remain on site until further notice from the Architect.

1.26 ADVERTISING

The Contractor under no circumstances will be allowed to use the hoarding or any part of the building for advertising purposes, but he will be allowed to exhibit his usual name board to the approval of the Engineer.

1.27 LEAVE WORK PERFECT

Remove all rubbish and superflows from the site of the Works with all reasonable speed from time to time as they occurred, and at completion, and finally leave the site clean.

Clean all public road, footpath and drains fronting and adjoining the site, all to the satisfaction of the Architect and relevant authorities.

1.28 DEMOLITION

1.28.1 Generally

The existing barrack, footings etc. together with existing surface water drains, concrete/bitumen pavements, etc. at the site are to be demolished.

Grub up all debris, including concrete footings, existing septic tank, manholes, etc. and remove from the site.

Generally, all demolition shall be carried out in a careful and systematic manner with minimum inconvenience to the public. Appropriate measures shall be taken as required by the local authorities.

Debris where arises shall be watered to reduce dust during demolition and again during leading operation for removal.

1.28.2 Existing Services

The contractor shall discuss with the Engineer before disconnecting, cut back, seal off, remove, alter or divert as necessary for the works of all existing services. All these works shall be deemed to be included in the pricing. The seal-off, disconnection, etc. shall be done strictly in accordance with the regulations, by-laws, etc. of the authorities concerned.

SECTION 2 - EXCAVATOR

2.1 EXISTING GROUND LEVELS

The Contractor is to obtain his own information regarding the exact ground level before tendering. No claims will be considered for inaccuracy in existing ground level.

Any error found by the Contractor in the existing ground levels shown on any drawing is to be referred to the Engineer for decision before any related work is commenced.

2.2 NATURE OF GROUND

The Contractor is to allow for excavation in ground of any nature with the exception of rock as defined below, for which additional payment will be made provided that he Engineer is notified at the time the excavation is carried out.

"Rock" means material which cannot be removed by changkol, spade, pick or by hand without the use of hammer and wedges, levers, explosives or similar means but does not include loose stones or boulders which can be removed without being broken up.

2.3 OBSTRUCTIONS

Any concrete, brickwork or other artificial obstructions met with during excavation are to be broken up and got out and removed from the site.

Roots and other natural obstructions met with during excavation are to be cut up and got out, and burnt or removed from the site. The cost of removing obstructions described above shall be allowed for in tenders.

2.4 EXPLOSIVES

No explosives are to be used for removal of work or for any other purposes without the permission of the Engineer. If permission is granted the Contractor is to be responsible for any damage or annoyance caused, and to take all precautions necessary to minimise this.

2.5 SAND OR BALLAST FROM EXCAVATIONS

Any sand, stone or other material arising from the excavations and not required for backfilling may be used for the purpose of this Contract if complying with the specified requirements for the material.

The Contractor is not to dig for such material beyond the limits of the required excavation, and is not to remove from the site any such material without Engineer's

2.6 FELLING OF TREES

Fell all trees as necessary for the execution of the works, grub up roots and fill in holes. Trees which are to be preserved will be indicated to the Contractor before any work commence.

2.7 SURFACE EXCAVATION

Excavate over area of buildings, roads, paths and other works, including areas to be filled, not less than 150 mm deep to remove top soil and vegetation. Remove from site excavated top soil and vegetation not suitable for incorporation in the work.

2.8 EXCAVATION GENERALLY

Excavate to reduced levels for basements, pile caps, septic tank, drain, etc. as shown on the drawings and get out. Any surplus excavated material not required for backfilling may be used for general filling on site if complying with specified requirement. The Contractor is to allow for any temporary spoil heaps required.

When so directed, surplus excavated material is to be removed from the site, and the Contractor is to obtain all necessary permission or licences and is to pay all fees. Cost of removal is to be included in the tender price.

2.9 INSPECTION OF EXCAVATIONS, ETC.

The Contractor is to give notice to the Engineer and to any other required authorities when the excavations are ready to receive foundations, drains, etc. These are not to be laid until the excavations have been approved and the depths noted. All mud shall be removed from the bottom of excavation or on the blinding layer before pouring structural concrete.

2.10 EXISTING SERVICES

Existing drains, electricity and water mains or other services which are not to be demolished must be carefully supported and protected.

The Contractor is to notify the Engineer in writing of any such services.

2.11 EXCAVATION BELOW REQUIRED DEPTH

The Contractor shall avoid excavating to a greater depths than shown on the drawings. The Contractor is to fill in to the correct level with Grade 15 concrete or compacted sand fill as directed by the Engineer.

2.12 PLANKING AND STRUTTING

Plank and strut or shore up the sides of all excavations as necessary, and carefully remove and clear away on the completion. The Contractor is to be absolutely responsible for the safety of the excavations. Sheet piling may be required for the construction of basement and imhoff tank and the Contractor is to make due allowance in his tender. Prior to commencing excavation the Contractors shall submit to the Engineer his proposals for supporting the sides of the excavation or cutting them to batter.

2.13 WATER IN EXCAVATION

All excavations and areas of the site where water accumulates, be it percolating or storm to be kept clear of water by pumping, baling or otherwise.

During the period of excavation, the Contractor to provide pumps of sufficient capacity to remove any water which may enter excavations, and will maintain the water level below the level of concreting work at all times.

Provide and maintain any temporary earth bunds or concrete surface water drainage channels with stumps and cascades which may be deemed necessary by the Engineer to implement the foregoing.

Remove temporary earth bunds, drainage channels, etc. when directed by the Engineer and make good after.

The Contractor to take such precautions, as may be deemed necessary or desirable by the Engineer and/or the Authorities for the prevention of breeding of mosquitoes and the Contractor to pay any charges made by the Authorities for anti-material measures.

2.14 FILLING

Return, fill in and well ram selected excavated material around foundations, etc. up to original ground level or as required. Filling to be carried out in layers not exceeding 150 mm and each layer shall be well rammed and consolidated.

All mud, rubbish, timbers and similar materials are to be removed before filling is carried out.

No filling is to be carried out until the foundations have been inspected and approved.

2.15 IMPORTED FILLING

Where excavated material is insufficient for the earth filling required the Contractor is to obtain this from borrow pits for which he is to obtain the necessary licences and pay all fees. The imported filling shall be of selected granular material to the approval of Engineer.

2.16 HARDCORE

Hardcore shall consist of clean, hard, dry, broken stone of approved gauge, well rolled and consolidated to the required thickness. The upper surface shall be blinded sand to receive concrete.

2.17 GRASSING AND TURFING

(a) Grass Species

The Contractor is to supply and turf with grass species “Axonopus Compressus Var Compressus” to level ground.

(b) Method

Grassing by seeding method will not be accepted and the Contractor must show to the Engineer his source(s) of turves before work commences.

(c) Top Soil

The area to be turfed should have adequate drainage and not be allowed to become waterlogged. In areas infested with weeds, spraying with weedicides is necessary. When all the weeds - have been eradicated, the entire area should be covered with good quality top soil to a depth of at least 100 mm (4”) (after settling).

Subject to approval by the Engineer, top soil may be obtained from soil heaps on site, but it must be free from live vegetation, rocks, stones and any other foreign matters.

(d) Preparation

In preparing the land for planting, all stones, rocks, pieces of wood, etc. must be removed and the surface levelled.

(e) Size of Sods

Grass shall be planted in the form of sod cut to approximately 100 mm x 100 mm (4” x 4”). The pieces of sod shall be planted at 300 mm (12”) centres.

(f) Fertilisers

At various intervals, appropriate fertilisers have to be applied to the planted sod as well as the interspace in order to effect a quick and vigorous growth of grass.

(g) Watering

If the planting of grass takes place during the dry weather condition, watering of the entire planted area is necessary.

(h) Maintenance

Any areas which fail before expiry of maintenance period are to be replanted at the Contractor's expense.

(i) Areas to be Turfed

All areas indicated as "Landscaped Area" to be turfed.

SECTION 3 - PILING

3. 1 GENERAL

3.1.2 Depending upon the prevailing soil conditions, piles may be required under foundations of structures as indicated in the drawings or as directed by the Engineer at site.

3.1.2 All foundation works related to piling shall be executed in accordance to the specifications laid down in BS CP 2004 “Code of Practice for Foundation”.

3.1.3 Approval

No approval or acceptance by the Engineer or his representative shall in any way relieve the Contractor of h is responsibility for the design, quality of materials and the standard or workmanship in the piles.

3.1.4 Piling System

The Contractor shall submit with his tender full details of the system which shall includes method of piling and the plant he proposes to use. These shall be to the approval of the Engineer.

3.1.5 Safety Standards

Safety precautions throughout the piling operations shall comply with the Health and Safety at Work Act 1974 or any subsequent reenactment thereof, and with CP 2004 and CP 2011.

3.1.6 Site Conditions

(a) Site Visit

Information on the location, size and depth of existing footings, engine foundations etc. will be made available to tenderers. The information given is merely given to assist tenderers in appraising the site conditions and which may affect the piling of the new building foundations. However, no responsibility is accepted by the Employer for the difficulties of the works involved.

3.1.7 Piling Layout

The piling layout is as shown on the contract drawings. These drawings may be revised and will be supplemented by further drawings as necessary for the purpose of proper and adequate execution of the works as provided in this Specification.

3.1.8 Setting Out and Tolerances

(a) Setting Out

Setting out shall be carried out from the main grid lines of the proposed structure. Immediately before installation of the pile, the pile position shall be marked with suitable identiliable pins or markers.
The main setting out lines shall be approved by the Engineer before any piling is commenced.

(b) Tolerances

The required accuracy of setting out will be as follows :-

(i)	Main setting out lines and centre lines of pile groups	± 6 mm per 30 metres
(ii)	Centreline piles on completion of driving	± 75 mm of their true position
(iii)	Variation from vertical line	1 in 75
(iv)	Variation from level for pile cut-off	± 10 mm of the precise level
(v)	Variation from specified rake	1 in 25

(c) Forcible corrections

Forcible corrections to piles shall not be made.

3.1.9 Piling Programme

The Contractor shall inform the Engineer each day of the programme of piling for the following day and shall give adequate notice of his intention to work outside normal hours and at weekends.

3.1.10 Records

(a) The Contractor shall provide the Engineer with two copies of the record of driving for each pile, these records shall reach the Engineer not later than noon of the next working day after the driving of the relevant pile and shall contain the details of the following :-

(i) contract pile reference number (location)

(ii) pile type, connector pile shoe and driving head used

(iii) nominal cross-sectional dimensions on diameter

(iv) length of performed pile

(v) date and time of driving, redriving

(vi) type, weight,drop and Mechanical Conditions of hammer or equivalent information if other of equipment is used and height of Rig

(vii) information on number and thickness of packings used during the driving of the pile and their condition after removal from the pile head

(viii) set of pile in mm per 10 blows or number of blows per 25 mm of penetration

(xi) number of blows per 300 mm over the last 3 metres of penetration

(x) number of blows per 50 mm over the last 300 mm of penetration

(xi) ground level atcommencement to installation of pile

(xii) working level

(xiii) toe level of pile

(xiv) depth from working level to pile toe

(xv) depth from working level to pile head level

(xvi) temporary compression of ground and pile from the time there is a marked increase in driving resistance until the pile reaches its final level

(xvii) all information regarding obstructions delay and other interruptions to the sequence of work

(xviii) other relevant information as may be required by the Engineer

(b) The Signed Records will form a record of work.

3.1.11 Nuisance and Damage

(a) Noise and Disturbance

The Contractor shall carry out the work in such a

(b) Damage to Adjacent Structures

If during the execution of the work damage is , or is likely to be caused to mains, services or adjacent structures, the Contractor shall submit to the Engineer his proposals for repair or avoidance of such damage.

(c) Damage to Piles

The Contractor shall ensure that damage does not occur to completed piles.

The Contractor shall submit to the Engineer his proposed sequence and timing for driving or boring piles having regard to the avoidance of damage to adjacent piles.

(d) Temporary Support

The Contractor shall ensure that piles are temporarily braced or stayed immediately after driving to prevent loosening of the piles in the ground and to ensure that no damage resulting from oscillation, vibration or movement of any freestanding pile length can occur.

3.2 TIMBER PILES

3.2.1 Material

(a) Grade and Length

All timber piles shall be made from fully seasoned “Belian” or other approved hardwood in lengths not less than 6 metres. The type of belian used shall be first grade.

(b) Warranty

The Contractor shall obtain a warranty from the pile supplier against any biological decay of the piles within 10 years of the date of substantial completion. In the event of failure to obtain such a warranty from the timber supplier, the Contractor himself shall give such a guaranty in writing.

(c) Joint Connection

Joint connections where required shall be as shown on the drawings or as specified or to similar approved details.

(d) Tolerance in Dimensions

The dimension of sawn piles shall be within the range of 6 mm less and 12 mm greater than their specified cross-sectional dimensions. The centroid of any cross-section of a sawn pile shall not deviate by more than 25 mm from the straight line connecting the centroids of the end faces of the pile.

(e) Condition

The timber shall be free from defects not permitted for its grade.

3.2.2 Pile Shoes

The material and dimensions of the pile shoes shall be as specified. Steel pile shoes shall be fabricated from steel to 4360. grade 43A.

The shoe shall be attached to the pile by spikes, screwed or bolted to the timber. The shoe shall be co-axial with the pile and firmly bedded to it.

3.2.3 Pile Head

The pile head shall be flat and at right angles to the axis of the pile unless otherwise specified, a metal helmet may be used, the top of the pile being trimmed to fit closely into the recess of the underside of the helmet. A hardwood dolly and, if necessary, a packing shall be used above the helmet.

If during driving the head of the pile becomes excessively broomed or otherwise damaged, the damaged part shall be cut off, the head retrimmed and the helmet, if any, refitted.

3.2.4 Pile Connector or Splicing

(a) Pile shall be provided in one piece unless otherwise approved. A connector or spilece shall be capable of resisting safely any stresses which may develop during lifting, pitching or driving, and number the designed working load. The position and details of the connector or splice shall be subject to approved.

A splice or connector shall be made in accordance with the following principles or by another approved method. The two timbers shall be of the same sectional dimensions and each cut al right. angles to its axis to make contact over the whole of the cross section when the two timbers are coaxial. An approved jointing compound shall be used at the contract surface. The two timbers shall be joined by a steel tube of rectangular section to fit the timbers closely. The tube shall be bolted, screwed or spiked to the timbers to keep the joined ends in close contact.

(b) Where it is necessary to extend a partly driven pile, the upper part must be securely supported during the making of the joint.

3.2.5 Working Load

(a) The Contractor shall be responsible for ensuring that all piles will safely carry the working loads. Generally the recommendations contained in British Standard Code of Practice for Foundations - CP 2004:1972 shall be followed in calculating the safe working loads.

(b) The typical working load of the piles 125 mm x 125 mm shall be 100 kN and it is anticipated that the piles will be driven to an average depth of 12 m below finished site level.

(c) The Contractor shall provide the Engineer with particulars of the minimum dynamic set required, expressed as the number of blows to drive the final 25 millimetres, before any piling commences. Information provided by the Contractor shall include full details of energy per blow.

3.2.6 Inspection, Handling, Transportation and Stacking

(a) Inspection

The Contractor shall notify the Engineer of the delivery of timber to the site, and provide all labour and materials to enable the Engineer to inspect each piece on all faces and to measure it at the time of unloading and immediately prior to driving.

(b) Handling

Piles will be handled using only the points whereby the piles are caused the least possible stresses, at which approved lifting facilities shall be provided. Loading and off-loading of piles shall be by methods approved by tile Engineer.

(c) Transportation

Transportation from the storage area to the driving position shall be suitable vehicles. Pulling of piles along the ground will not, be allowed.

(d) Pitching

Pitching and driving shall be carried out so as not to cause damage to the piles, or undue stresses. The Engineer may require the procedure to be notified to suit these conditions.

3.2.7 Driving

(a) Performance of Driving Equipment

Piles shall be driven by the equipment which is to the approval of the Engineer. The Contractor shall submit with his tender full details of the performance size and type of his driving plant together with information of the type of hammer and the number of rigs he proposes to employ on the works. The Contractor shall satisfy the Engineer regarding the suitability, efficiency and energy of the driving equipment.

(b) Marking

All piles shall be marked at 300 mm intervals with the number of 300 mm from the toe of the pile. The top 3 metres shall be sub-divided at 150 mm intervals by marks without numbers.

(c) Piles to be Guided

Piles shall be adequately whilst being driven and the guides shall be held rigidly in position down to the lowest level reached by the hammer.

(d) Pile Heads

The heads of piles shall be protected during driving by means of driving helmets incorporating packings in sound condition and dollies if required. The type of driving helmets and also the materials and dimension of the packings shall be to the approval of the Engineer. The type of packing shall only be changed when authorised by the Engineer and they shall be kept in a sound condition.

(e) Length of Piles

The length of pile to be driven in any position shall be approved.

(f) Driving Procedure and Redrive Checks

(i) Each pile shall be driven continuously until the specified or approved set and/or depth has been reached, except that the Engineer may permit the suspension of driving if he is satisfied that the rate penetration prior to the cessation of driving will be substantially reestablished on its resumption or if he is satisfied that the suspension of driving is beyond the control of the Contractor. A follower (long dolly) shall not be used unless approved, in which case the Engineer will required the set to be revised to take into account the reduction in the effectiveness of the hammer blow.

(ii) As soon as the required level and set is reaches, the set shall be proved by continuing to drive with further hammer blows equal to three times the number required to produce the accepted set without reduced resistance.

(iii) The first pile driven and subsequent piles, as selected by the Engineer, shall be subjected to a re-drive test at a minimum of 24 hours after the first driving is completed, to check the applicability of the driving formula. The pile shall be redriven a minimum of50 mm, in the presence of the Engineer's Representative. In the event of the redrive test showing a reduced resistance, the action to be taken shall be decided by the Engineer.

(vi) At the start of work and in a new area or section sets shall be taken at intervals during the last 3 mm of the driving to establish the behaviour of the piles.

(v) The methods used to correct lean or deviation from specified line of piles during driving shall be to the approval of the Engineer. Methods involving the use of undue force shall not be used for correcting lean or departure from alignment of partially driven piles.

(vi) The Contractor shall inform the Engineer without delay if an unexpected change in driving characteristics is noted. A detailed record of the driving resistance over the full length of the next nearest available pile shall be taken if required.

(vii) The Contractor shall inform the Engineer immediately if underground obstructions are encountered and shall suspend driving
until the Engineer's approval to proceed is obtained.

(viii) The Contractor shall give adequate notice and provide all facilities enable the Engineer to check driving resistance. A set shall be taken only in the presence of the Engineer unless otherwise approved.

Redrive checks, if required, shall be carried out on an approved procedure.

(g) Final Set

The final set of each pile shall be recorded either as the penetration in millimetres per 10 blows or as the number of blows required to produce a penetration of 25 mm.

When a final set is being measured, the following requirements shall be met.

(i) The exposed part of the pile shall be in good condition without damage or distortion.

(ii) The dolly and packing, if any, shall be in sound condition.

(iii) The hammer blow shall be in line with the pile axis and the impact surfaces shall be flat and at right angles to the pile and hammer axis.

(iv) The hammer shall be in good condition and operating correctly.

(v) The temporary compression of the pile shall be recorded if required.

(h) Spliced or Connecting Piles

Spliced or connecting piles shall be observed continuously during driving to detect any departure from true alignment of the two parts. IL' any such departure occurs, driving shall he suspended and the Engineer shall be informed.

(i) Driving Sequence and Risen Piles

Piles shall he driven in an approved sequence to minimize the detrimental effects of heave and lateral displacement of the ground.

When required, levels and measurements shall be taken to determine the movement of the ground or any pile resulting from the driving process.

When a pile has risen as a result of adjacent piles being driven the Contractor shall submit to the Engineer his proposals for correcting this and the avoidance of it in subsequent work.

3.2.8 Preparation of Pile Head

After driving the piles shall be cut off square at the designed cut-off level.

3.2.9 Rejection of Piles

If any pile is in any way considered unsatisfactory by the Engineer in accordance with the provision of this Specification, he reserves the right to order the Contractor to remove the pile and/or drive replacement piles at position selected by the Engineer, at no extra cost.

3.2.10 Bakau Piling

Bakau piles are to be at least 125 mm diameter unless otherwise stated and are to be of length specified or required. The diameter specified is to be taken as that at mid-length, but the pile shall at no point be smaller than 40.. mm under the specified diameter.

Piles are to be fresh and to the approval of the Engineer and are to be properly stacked on site and protected from the direct rays of the sun.

Except for drainage and similar work and in other special circumstances, where a lighter simple rig may be used if approved by the Engineer, piles are to be driven by a proper rig having a hammer weighing at least 250 kg and with a fall of at least 1.2 in controlled by frame guides. The head of piles are to be protected with a steel ring or cap during driving.

Piles are to be carefully and accurately pitched and driven vertically. Piles are to be driven to the set or driven length specified or required, or until refusal. On completion of driving all pile heads are to be cut off squarely to the required level.

3.3 STEEL PILES

3.3.1 Material

3.3.3.1 General

The Contractor shall seek the Engineer's instructions before ordering the piles. When preliminary piles are specified the instructions for the piles for the main work will not necessarily be given until the results of the driving and tests on the preliminary piles have been received and evaluated.

All piles shall be of the type and cross-sectional dimensions specified. For standard rolled section the dimensional tolerances and weight shall comply with the relevant standard.

For proprietary sections the dimensional tolerances shall comply with the manufacturer's standards. The rolling or manufacturing tolerances shall be such that the actual weight of sections does not differ from the theoretical weight by more than - 2.5% to +5% unless otherwise agreed.

3.3.1.2 Straightness of piles

For standard rolled sections the deviation from straightness shall not exceed 1.04 (1-4.5) where 1 is in metres and the deviation in millimetres. For proprietary sections made up from rolled sections the deviation from straightness shall not exceed 1/1000 of the length of the pile.

3.3.1.3 Fabrication of Piles

The root edges or root faces of lengths of piles that are to be butt welded shall not differ by more than 25% of the thickness of pile not exceeding 12 mm thick or by more than 3 in for piles thicker than 12 mm. When piles of unequal thickness are to be butt welded the thickness of the thinner material shall be the criterion.

Pile lengths shall be set up so that the differences in dimensions are matched as evenly as possible.

3.3.1.4 Strengthening of Piles

The strengthening to the toe of a pile in lieu of a shoe or the strengthening of the head of a pile shall be made from material of the same grade as the pile unless otherwise approved.

3.3.1.5 Pile Shoe

Cast steel pile shoes shall be of steel to BS 3100, grade A welded fabricated pile shoes shall be to & 4360, grade 43A.

3.3.2 Welding

For a pile where the 1oad will he carried by tile wall or section of the pile, and if the pile will be subjected to loads that induce reversal of stresses during or after construction, the welding shall be to BS 5135.

For a tubular pile where the load will be static and will be carried by the wall of the pile or by a concrete core, the welding shall be to BS 2937.

3.3.3. Inspection and Test Certificates

The Contractor shall provide the Engineer with test certificates, analyses and mill sheets. The Contractor shall ensure that adequate notice be given to the Engineer when the processes can be inspected or tests can be witnessed.

The Engineer has the right to inspect and test at any stages of the manufacturing processes provided that, once he has been notified of when the materials will be ready for inspection, any delay in his attendance does not cause delay to or disrupt the production processes.

3.3.4 Handling and Storage of Piles

All piles within a stack shall be in groups of the same length and on approved supports. All operations such as handling, transporting and pitching of piles shall be carried out in a manner such that damage to piles and their coatings is minimized.

3.3.5 Workmanship

3.3.5.1 Welders' Qualifications

Only welders who are qualified in the approved welding procedure in accordance with the tests laid down in the relevant British Standard shall be employed on the Permanent Works unless such work is in connection with the correction of minor surface defects. Copies of certificates relating to welders' tests shall be made available to the Engineer on request.

3.3.5.2 Welding Procedures

Tile Contractor shall submit for approval full details of the welding procedures and electrodes with drawings and schedules as may be necessary. Tests shall be undertaken as may be required by the relevant British Standard or as may be required by the Engineer.

3. 3. 5. 3 Fabrication of Piles on Site

When the pile lengths are to be made up on the site all test procedures and dimensional tolerances shall conform to the Specification for the supply of pile material. Adequate facilities shall be provided for supporting and aligning the lengths of pile.

3.3.5.4 Radiographic Tests

Radiographic tests shall be carried out as specified. While satisfactory results are being obtained, one radiograph 300 mm long shall be made for not less than 10% of the number of welded connections in the case of a pile where the load is carried by the wall or section of the pile, and for not greater than 10% of the number of welded connections in the case of a pile where the load is to be carried by a concrete core.

3.3.5.5 Marking of Piles

Each pile shall be clearly marked in white paint with its number and its overall length. In addition, each pile shall be marked at intervals of 250 mm along the top 3 m of its length before being driven.

3.3.6 Driving Piles

3.3. 6.1 Leaders and Trestles

At all stages during driving and until incorporation in the superstructure the pile shall be adequately supported and restrained by means of leaders, trestles, temporary supports or other guide arrangements to maintain position and alignment and to prevent buckling. These arrangements shall be such that damage to the-piles is minimized.

3.3.6.2 Length of Piles

The length of pile to be driven in any position shall be approved.

The Corporation may, if approved, provided each pile in more than one length, the first length or subsequent lengths being extended during an interval in the pile driving operation. The extra lengths shall be cleaned and prepared to the tolerances in clause securely held to line and level.

3.3.6.3 Driving Procedure and Redrive Checks

Each pile be driven continuously until the specified or approved set and/or depth has been reached, except that. the Engineer may permit the suspension of driving if he is satisfied that the rate of penetration prior to the cessation of driving will, be substantially re-established on its resumption or if he is satisfied that the suspension of driving is beyond the control of the Contractor. A follower (long dolly) shall not be used unless approved, in which case the Engineer will required the set to be revised to take into account the reduction in the effectiveness of the hammer blow.

The Contractor shall inform the Engineer without delay if an unexpected change in driving characteristics is noted. A detailed record of the driving resistance over the full length of the next nearest available pile shall be taken if required.

At the start of work in a new area or section sets shall be taken at intervals during the last 3 m of the driving to establish the behaviour of the piles.

The Contractor sha1l give adequate notice and provide all facilities to enable the Engineer to check driving resistance. A set shall be taken only in the presence of the Engineer unless otherwise approved.

Redrive checks, if required, shall be carried out to an approved procedure.

3.3.6.4 Final Set

The final set of each pile shall be recorded either as the penetration in millimetres per 10 blows or as the number of blows required to produce a penetration of 25 mm.

When a final set is being measured, the following requirements shall be met.

(i) The exposed part of the pile shall be in good condition without damage or distortion.

(ii) The do1ly and packing, if any, shall be in sound condition.

(iii) The hammer blow shall be in line with the pi1e axis and the impact surfaces shall be flat and at right angles to the pile and hammer axis.

(iv) The hammer shall be in good condition and operating correctly.

(v) The temporary compression of the pi1e shall he recorded if required.

3.3.6.5 Driving Sequence and Risen Piles

Piles shall be driven in an approved sequence to minimize the detrimental effects of heave arid lateral displacement of the ground.

When required, levels and measurements shall be taken to determine the movement of the ground or any pile resulting from the driving process.

When a pile has risen as a result of adjacent piles being driven the Contractor shall submit to the Engineer his proposals of correcting this and the avoidance of it in subsequent work.

3.3.7 Preparation of Pile Head

If a steel superstructure is to be welded to piles, the piles shall be cut to within 10 mm of the levels shown on the Drawings. If piles are to be encased in concrete they shall be cut to within 20 mm of the levels shown on the Drawings, and protective coatings shall be removed from the surface of the pile heads down to a level 100 mm above the soffit of the concrete.

3.4 PRECAST REINFORCED CONCRETE SEGMENTAL PILES

3.4.1 General

This section applies to piles made of elements cast a precasting works away from the site, where work cannot normally be closely supervised by the Engineer. The elements are jointed together as necessary on site during driving, using special proven steel joints, incorporated into the pile e1ements when cast.

3.4.2 Ordering of Piles

The Contractor shall order the piles to suit the construction programme and seek the Engineer’s approval before placing the order. When preliminary piles are specified the approval for the piles for the main work will not necessarily be given until the results of the driving and tests on preliminary piles have been received and evaluated.

3.4.3 Materials and Components

3.4.3.1 British Standards

In the manufacture of jointed precast concrete segmental piles, fabricated steel components shall comply with BS 4360 grades 43A or 50A, cast steel components with BS 3100 grade A, and ductile iron components with BS 2789

3.4.3.2 Pile Joints

The joints shall be close-fitting face to face and the locking method shall be such as to hold the faces in intimate contract. The design and manufacture of the jointing system shall be approved by the Engineer prior to the commencement of the Contract.

A jointed pile shall be capable of withstanding the same driving stresses as a single unjointed pile of the same cross-sectional dimensions and materials.
The welding of a joint to main reinforcement in lieu of a lapped connection with projecting bars affixed to the joint shall not be permitted.

3.4.3.3 Pile Toes

Piles toes shall be constructed so as to ensure that damage is not caused to the pile during installation. Where positional fixity is required on an inclined rock surface or in other circumstances, an approved shoe may be required.

3.4.3.4 Pile Head Reinforcement

Where the pile head is not furnished with a joint, it shall be so reinforced or banded as to prevent bursting of the pile under driving conditions.

3.4.4 Tolerances in Pile Dimensions

The cross-sectional dimensions of the pile shall be not less than those specified.

The head of a pile element or the end of the pile upon which the hammer acts shall be square to the pile axis within a tolerance of 1 in 50.

Each pile joint shall be square to the axis of the pile within a tolerance of 1 in 150. The centroid of the pile joint shall lie within 5 mm of the true axis of the pile element.

Each face of a pile element shall riot deviate by more than 6 mm from any straight line 3 m long jointing two points on that face, nor shall the centre of area of the pile at any cross-section along its length deviate by more than 1/500 of the pile length from a line joining the centre of area at the ends of the element. Where a pile element is less than 3 m long the permitted deviation from straightness shall be reduced below 6 mm on a pro rata basis in accordance with actual length.

3.4.5 Reinforcement

The main longitudinal reinforcing bars shall he in one continuous length. Splicing of bars will not, be permitted except at element ends.

Concrete cover to steel reinforcement shall be in accordance with the requirement of BS 8110.

In very aggressive ground or exposure conditions, cover greater than 25 mm may he required but alternative protection methods may be approved.

3.4.6 Formwork

If a pile is constructed with a shaped point or shoe, then the end of the pile shall be symmetrical about the longitudinal axis of the pile.

Holes for handling or pitching, where provided in the pile, shall be lined with steel tubes; alternatively, approved insets may be cast in.

Formwork shall be robust, clean and so constructed as to prevent loss of grout or aggregate from the wet concrete and ensure the production of uniform pile sections. The piles are to be removed from the formwork carefully so as to prevent damage.

3.4.7 Pile Quality

A certificate of quality from the pile manufacturer shall be provided to the Engineer when required stating that the requirements of this Specification have been fulfilled during manufacture.

3.4.8 Marking of Piles

Each pile element shall be marked in such a manner that it can be identified with the records of manufacture, which shall state the date of casting, t~be cement type,
concrete grade, element length and any other relevant data.

3.4.9 Handling, Transportation, Storage and Acceptance of Piles

The method and sequence of lighting, handling, tr~ sporting and storing piles shall be such as to avoid shock loading and to ensure that the piles are not damaged. Only designed lifting and support points shall be used. During transport and storage, piles shall be appropriately supported under the marked lifting points or fully supported along their length.

All pile elements within a stack shall be in groups of the same length. Packing of uniform thickness shall be provided between piles at the lifting points.

Concrete shall at no time be subjected to loading, including its own weight, which will induce a compressive stress in it exceeding 0.33 of its strength at the time of loading or of the specified strength, whichever is the less. For this purpose the assessment of the strength of the concrete and of the stresses produced by the loads shall be subject to the agreement of the Engineer.

A pile element. shall be rejected when the width of any transverse crack exceeds 0.3 mm. The measurement. shall be made with the pile in its working attitude.

3.4.10 Driving Piles

3.4.10.1 Strength of Piles

Piles shall not be driven until the concrete has achieved the required strength to avoid damage.

3.4.11 Leasers and Trestles

At all stages during driving and until incorporation into the super-structure, the pile shall be adequately supported arid restrained by means of leaders, trestles, temporary supports or other guide arrangements to maintain position and alignment and to prevent buckling. These arrangements shall be such that damage to the pile does not occur.

3.4.12 Performance of Driving Equipment

The Contractor shall satisfy the Engineer regarding the suitability, efficiency and energy of the driving equipment.

Where a drop hammer is used, the mass of the hammer shall be at least half that of the pile at the moment of driving unless otherwise approved by the Engineer. For other types of hammer the energy delivered to the pile per blow shall be at least equivalent to that of a drop hammer of the stated mass. Drop hammers shall not be used from floating craft in such a manner as to cause instability of the craft or damage to the pile.

3.4.13 Length of Piles

The length of pile supplied to be driven in any position and any additional lengths to be added during driving shall be approved prior to the commencement of pile-driving. During the execution of the works any changes to the supplied lengths shall be approved.

3.4.14 Driving Procedure and Redrive Checks

The driving of each pile shall be continuous until the specified depth and/or resistance or set has been reached. In the event of unavoidable interruption to driving, the pile will be accepted provided it can subsequently be driven to the specified depth and/or resistance or set without damage. A follower shall only be used when approved, in which case the Engineer will require the set. where applicable to be revised in order tc' take into account reduction in the effectiveness of the hammer blow.

The Contractor shall inform the Engineer without delay if an unexpected change in driving characteristics is noted. A detailed record of the driving resistance over the full length of the nearest available pile shall be taken if required.

At. the start of the work in a new area or section a detailed driving record shall be made over the full length of the first pile and during the lat 3 m of subsequent piles until consistency of behaviour is established. Where required, detailed driving records shall also he made for 5% of the piles driven, the positions of such piles being specified by the Engineer.

The Contractor shall give adequate notice and provide all necessary facilities to enable the Engineer to check driving resistances. A set of resistance measurement shall be taken only in the presence of the Engineer unless otherwise approved.

Redrive checks, if required, shall be carried out to an approved procedure.

3.4.15 Final Set

When driving to a set criterion, the final set of each pile shall be recorded either as the penetration in millimetres per 10 blows or as the number of blows required to produce a penetration of 25 mm (see Table1.1).

When a final set is being measured, the following requirements shall be met.

(a) The exposed part of the pile~ shall be in good condition, without damage or distortion.

(b) The helmet, dolly and any packing shall be in sound condition.

(c) The hammer blow shall be in line with the pile axis the impact surfaces shall be flat and at right angles to the pile and hammer axis.

(d) The hammer shall be in good condition, delivering adequate energy per blow, and operating correctly.

(e) The temporary compression of the pile shall be recorded if required.

3.4.16 Driving Sequence and Risen Piles

Piles shall he driven in an approved sequence to minimize the detrimental effects of heave and lateral displacement of the ground.

When required, level and measurements shall be taken to determine the movement of the ground or of any pi le resulting from the driving process.

When a pile has risen as a result of adjacent piles being driven the Engineer may call for redriving or other testing to demonstrate that the performance of the pile is unimpaired. If required, the Contractor shall make proposals for correcting piles detrimentally affected and for avoidance or control of heave effects in subsequent work.

3.4.17 Preboring

If preboring is specified, the diameter and depth of prebore shall be as shown on the Drawings or stipulated in the Particular Specification.

3.4.18 Jetting

Jetting shall be carried out only when the Contractors detailed proposals have been approved.

3.4.19 Repair and Lengthening of Piles

3.4.19.1 Repair of Damaged Pile

If it is necessary to repair the head of a pile during driving, the Contractor shall carry out such repair in an approved way which allows the pile-driving to be completed without further damaged. If the driving of a pile has been accepted but sound concrete of the pile is below the required cut-off level, the pile shall be made good to the cut-off level, using an approved method so that it will safely withstand the imposed design load.

3.4.19.2 Lengthening of Piles

Where piles are required to be driven to depths exceeding those expected, leaving insufficient projection for bonding into the following works, the piles shall be extended or replaced as required by the Engineer using approved materials and methods.

3.4.20 Cutting Off Pile Heads

Unless otherwise specified when the driving of a pile has been approved the concrete of the head of the pile shall be cut off to the level specified or shown on the Drawings. The length of splice reinforcing bars projecting above this level shall be as specified or shown on the Drawings.

Care shall be taken to avoid shattering or otherwise damaging the rest of the pile. Any cracked or defective concrete shall he cut away and the pile repaired in an approved manner to provide a full and sound section to cut-off level.

3.5 PILE TESTING

3.5.1 General

The Contractor shall install at least one pile solely for testing purposes and shall submit a detailed driving record any other data as directed by the Engineer for the purpose of proving the proposed pile design. If this preliminary pile test does not satisfy the specified settlement, a further pile shall be installed and tested.

In addition up to 2% of working piles shall be tested by means of proof testing as described below. The load test shall be carried out on a pile selected by the Engineer, not less than seven days after completion of installation of the pile.

The Contractor shall provide all the equipment required for carrying out load tests on piles together with the apparatus for measuring displacement and loading of the piles during testing and the equipment shall be to the satisfaction of the Engineer.

Measurement of pile movement during testing shall be by a means capable of reading to 0.1 mm. This shall be related to a datum point situated at a sufficient distance from the pile to ensure stability.

The loading system shall incorporate a proving ring, load cell or other apparatus capable of measuring the load to an accuracy with + 2%.

3.5.2 Preliminary Piles Tests

The test pile load shall be twice the specified working load and shall be applied in steps not exceeding 50 kN or 25% of working load , whichever is less. Displacement readings shall be taken every 5 minutes after application of the load increment until two consecutive readings show that the displacement has ceased. When the test load reaches the specified working load, the displacement readings shall continue until it is established that no further displacement has occurred over a 15 minute period.

The working load shall be then maintained for a further 24 hours, displacement readings taken every 2 hours.

When no further displacement is apparent on completion of the 24 hour period or when approved by the Engineer the load shall be removed in one stage and recovery readings taken every 15 minutes until recovery has ceased.

The pile shall then be re-loaded in one stage to the specified working load, readings being taken every 15 minutes until displacement has again ceased.
The load shall be then increased in equal increments up to twice the specified working load, the same procedure being followed as stipulated for the beginning of the test. The maximum load shall be maintained for 24 hours or as directed by the Engineer after all displacement has ceased, and readings shall be taken every 2 hours during this period.

On completion of this period or when approved by the Engineer all loads shall be removed and the displacement on recovery noted.

3.5.3 Proof Load Test

The Engineer will select working piles to be proof tested as the work proceeds, but in no case later than 24 hours after receipt of the Contractors notice of completion of the piling, and the Contractor shall arrange his driving programme to accommodate these tests. The proof test load shall be one and a half times the specified working load and shall be applied for at least 72 hours. Settlement and time records shall be taken at every increment of 5 kN of load as the load is being added and removed and at least every 12 hours whilst the load is being sustained. The records shall be taken jointly by the Engineer and the Contractor.

3.5.4 Test Results

On completion of each pile test the Contractor shall supply the Engineer with two copies of a complete report which shall include graphs of load-settlement, load-time-settlement and recovery of the pile as the load is removed.

SECTION 4 - CONCRETOR

4.1 GENERAL

All materials to be subject to the Engineers approval, but the fact that the Contractor has used “approved” materials will riot absolve him of his responsibility in producing requisite concrete strengths.

The Contractor to furnish manufacturers test certificates for cement and steel reinforcement to the Engineer for his approval, before any material is brought onto the site.

4.2 REINFORCED CONCRETE

The reinforced concrete works including prestressed concrete have been designed generally in accordance with the recommendation contained in BS 8110 (1986)

4.3 UNREINFORCED CONCRETE

Unreinforced concrete works shall comply with all the relevant requirements for reinforced concrete.

4.4 CEMENT

The cement shall be Portland cement complying with BS 12 or Portland blast furnace cement complying with BS 146.

4.5 AGGREGATES

Aggregates shall comply with the recommendation of BS 882 and testing according to BS 812. In special circumstances a deviation from BS 882 in respect of grading of aggregates may be accepted, subject to the prior approval of the Engineer.

The fine aggregate not to contain silt or other fine material exceeding 6% by volume, when tested according to the method given in BS 812 Clause 15, neither is it to contain organic material in sufficient quantity to show a darker colour than the standard depth of colour No. 3 when tested according to the method in BS 812 Clause 28 “Organic Impurities”.

Fine aggregate may be claimed from a river by arrangement with the Authorities, royalties being agreed between the Contractor and the Authorities, and the cost thereof will be held to be included in the Contract.

On no account will the use of mining sand or crushed stone sand be permitted.

The total chloride content of the concrete mix arising from the aggregate together with that from any admixtures and any; other source should not in any circumstances exceed the following limits expressed as a percentage of chloride ion by weight of cement :-

(a) Exposed, prestressed or sulphate resisting cement concrete - 0.1%.

(b) Other concrete - 0.2%.

For structural concrete grade the maximum size of fine aggregate shall be 5 mm. The preferred nominal maximum sizes of coarse aggregate are 40 mm, 20 mm, 14 mm and 10 mm as specified in TABLES 1, 2 AND 3.

Any special requirements in regard to size, type of colour of aggregate are specified in Tables 1, 2 and 3.

4.6 WATER

The water to be used in the works shall be clean and free from all harmful matter, in suspension or solution. Where tests are required they shall be in accordance with the requirements of BS 3148.

4.7 REINFORCEMENT

Mild steel reinforcement shall comply with the recommendation of BS 4449.

High yield stress steel reinforcement shall be :-

either cold-worked deformed bars complying with BS 4461,

or

hot-rolled deformed bars complying with the following requirements:-

minimum yield stress: 460 Mpa

minimum elongation : up to and including 22mm nominal size 12%,
over 22mm nominal size 14%

(a) Welded Steel Fabric

Welded steel fabric comply with the recommendation of BS 4483. All mesh shall be delivered to site as flat sheets.

4.8 STORAGE OF MATERIALS

Cement shall be sorted in weather-tight buildings, bins or silos which will provide protection from dampness and contamination. Bags of cement shall be stacked arid used in rotation to prevent deterioration due to storage.

Aggregate stockpiles shall be arranged and used in a manner which will prevent excessive segregation or any contamination with other materials, or with other sizes of aggregates.

Sand shall be allowed to drain until it has reached a uniform moisture content before it is used.

Admixtures shall be stored in such manner as to avoid contamination or damage. For those in the form of suspension or non-stable solutions, suitable agitating equipment shall be provided to ensure uniform distribution of the ingredients. Liquid admixtures shall be protected from temperature changes which would adversely affect their characteristics.

Reinforcement shall be stored in racks clear of the ground.

Where materials are to be stored on suspended floors or roofs the Contractor shall ensure that such storage will not overload or distort the structural frame.

Storage methods which in the opinion of the Engineer will result in contamination or deterioration of the material stored shall not be used.

4.9 REJECTED MATERIALS

All materials which have been damaged or are contaminated, or have deteriorated or do not comply with the requirements of this specification shall be rejected and shall be removed from the site immediately at the Contractor’s expense.

4.10 TESTS

(a) General

Before the commencement of the Contract, the Contractor shall submit to the Engineer for his approval, the name of the Testing Authority he proposes to employ.

The Contractor shall provide all equipment necessary for carry out all tests on site specified or described in this Specification, and he shall make and provide for all necessary arrangements for the delivery of all samples and test pieces to be tested by the approved Testing Authority.

The Contractor shall provide for maintaining all testing equipment on site in proper working order to the satisfaction of the Engineer.

The Contractor shall provide for sending copies of test results to the Engineer when these are required.

All costs in connection on with tests specifically required in this specification on shall he borne by the Contractor.

The Contractor will be paid, at rates to be agreed, for any other special test called for by the Engineer, unless the test results show failure by the Contractor to comply with this Specification.

The manufacturer's certificates of test will in general be accepted as proof of soundness, but the Engineer may require additional tests to be carried out on any cement which appears to him to have deteriorated through age, damage to container, improper storage or for any reason. The Engineer may, with test being made, order that bag of cement, a portion of the contents of which has hardened or which appears to be defective in any other way, be removed from site.

(b) Aggregates

All sampling and testing of aggregate shall be carried out in accordance with the relevant recommendations of BS 812.

At the commencement of the Contract, the Contractor shall deliver to the approved Testing Authority for inspection and analysis, 3 separate samples of each type of aggregate to be used in the structural concrete grades. For each type of aggregate the 3 samples shall be taken at the proposed source of supply at intervals of not less than one day. For fine aggregates the samples shall be 20 kg weight each and for coarse aggregate the samples shall be 50 kg weight each.

To ensure that no significant variation in the grading of the aggregate occurs during the Contract, sieve analysis shall be carried out on site at fortnightly intervals. The results of these analysis shall be recorded on a chart and kept on the site and to be handed to the Engineer on completion of the structural concrete works.

If the grading of any aggregates is changed, the Engineer shall be notified before any of this aggregate is used in the works.

The quantity of water contained in the aggregates shall be determined by an approved method at least once a day before concrete mixing is commenced.

(c) Mixing Plant

Weight batching plant shall be checked weekly in the presence of the Engineer, the checking shall be carried out with approved weights provided by the Contractor for this purpose.

The water gauge of the concrete mixer shall be inspected and tested weekly when concreting is in progress.

If any fault in the mixing plant is detected by these tests or otherwise, the fault shall be rectified to the satisfaction of the Engineer before any further use is made of the equipment.

(d) Concrete Tests

Concrete test cubes shall be made, cured and tested and the results recorded, in accordance with the recommendations of BS 1881, unless specifically modified in subsequent clauses of the Specification.

The test specimens shall be 150 mm cubes, made in steel moulds of approved design. The test cubes shall be taken from physical batches of concrete as directed by and in the presence of the Engineer without prior notice.

Subject to the Engineer's approval, tests of work cubes may be carried out on site with a testing machine of approved design~ in the presence of the Engineer. The test cubes shall be properly packed, suitably labelled, and sent, carriage paid, by the Contractor to the approved Testing Authority.

Slump tests or compaction factor tests of the mixed concrete shall be carried out at regular intervals and the results recorded and kept on site.

(e) Exposed Concrete Finishes

Where exposed concrete finishes are required the Contractor shall provide in a suitable area the site test samples of each type of finish to be used in the works. These test samples shall be approved by the Engineer before these finishes are used for comparison in the actual works.

The test pieces shall be vertical panels, 900 mm square and 150 mm thick. After approval they shall be retained on the site until the concrete works have been completed, when they shall be demolished and removed from the works.

(f)) Load Tests

Load tests of completed parts of the structure may be called for by the Engineer at any time.

The standards of acceptance for structural load test are stipulated in CP 110. The test procedure will be specified by the Engineer.

Where the results of such tests indicate that any member of part of the structure does not comply with this Specification that part of the structure shall be classed as defective work.

4.11 CLASSIFICATION OF CONCRETE MIXES

The following terms shall be used to describe the classes of concrete required

(a) Ordinary Structural Concrete

Ordinary structural concrete is concrete of any grade which is used in reinforced, prestressed or plain concrete construction and which does not contain admixtures or materials other than the following :-

(i) Portland cement complying with the requirements of BS 12, Portland blast furnace cement complying with the requirements of BS 146, sulphate-resisting Portland cement complying with the requirements of BS 4027.

(ii) Aggregates from natural sources complying with the requirements of BS 1047.

(iii) Water which is clean and free from harmful matter.

(b) Special Structural Concrete

The structural concrete shall be considered as “special” when it contains admixtures or materials other than those described above.

(c) Designed Mix

When a designed mix is specified the Contractor or manufacturer will be responsible for selecting the mix proportions in accordance with the requirements for designed mixes to achieve the required strength and workability, but the Engineer will be responsible for specifying the minimum cement content and any other properties required to ensure durability.

(d) Prescribed Mix

When a prescribed mix is specified the Engineer will specify the mix proportions and the Contractor or the manufacturer will undertake to provide a proper concrete containing the constituents in the specified proportions in accordance with the appropriate provisions of the prescribed mixes. The Engineer will therefore be responsible for ensuring that the mix proportions prescribed will provide the strength and durability he requires.

The class of concrete mix required will therefore be covered by one of the following descriptions :-

(a) Designed mix for ordinary structural concrete.

(b) Prescribed mix for ordinary structural concrete.

4.12 ADMIXTURES

(a) General

Suitable admixtures may be used in concrete mixes for special structural concrete with the prior approval of the Engineer. Both the amount added and method of use should be to the approval of the Engineer who should be provided with the following data :-

(i) The typical dosage and detrimental effects of under dosage and overdosage.

(ii) The chemical name(s) of the main active ingredient(s) in the admixture.

(iii) Whether or not the admixture contains chlorides and if so, the chloride ion content of the admixture expressed as a percentage by weight of the admixture.

(iv) Whether or not the admixture leads to the entrainment of air when used at the manufacturer's recommended dosage.

Unless otherwise agreed an admixture should comply with one of the following British Standards: BS 1014, BS 3892 and BS 5075.

For admixtures for which there is no British Standard the type and/or proprietary brand may be specified.

In admixtures for use in:-

(i) Concrete containing prestressing tendons, reinforcement and embedded metal and made with any type of cement, and

(ii) Complete without embedded metal made with cement to BS 1027 and BS 1248.

The chloride ion content should not exceed 2% by weight of the admixture or 0.03% by weight of the cement.

(b) Calcium Chloride

Admixtures containing calcium chloride shall not be used.

(c) Pulverized-fuel Ash

Where pulverized-fuel ash is used the total sulphate content expressed as sulphate anhydride (S03) of the concrete mix shall not exceed 4% by weight of the cement. The sulphate content shall be calculated from the sulphate contents of the cement, pulverized-fuel ash as determined by tests carried out in accordance with BS 4550, BS 1047 or BS 3681 and BS 3892 respectively.

Pulverized-fuel ash shall not he used in conjunction with a cement complying with the requirements of BS 4027 in concrete required to be resistant to sulphates.

(d) Air-entraining Agents

The admixture shall be of such a type that the air content can be maintained within the limits specified irrespective of extension of mixing time to 30 mm.

4.13 GRADES OF CONCRETE

The following grades of concrete shall be used in the works where specified :-

Grade	Characteristic Strength N/mm^2 (MPa)	Lower Grade for Compliance with Appropriate Use
7	7.0	Plain concrete
10	10.0	
15	15.0	
20	20.0	Reinforced concrete with dense aggregate
25	25.0	
30	30.0	Concrete with post-tensioned tendon
40	40.0	

The characteristic strength is that determined from test taken at 28 days.

(a) Minimum Cement Content

The quantity of water required for the various grades of concrete shall he as specified in the Tables 1 and 2.

Table 1 gives the minimum cement content required, when using a particular size of aggregate in a Portland cement concrete, under the appropriate conditions of exposure. The reduced minimum cement contents given in Table 1 shall only be used when maximum free water/cement ratio not greater than that given for the particular condition, can be consistently produced and that it is suitable for the conditions of placing and compaction. Table 2 gives the minimum cement content required, when using a particular size of aggregate and a particular type of cement under exposure to a particular degree of sulphate attack. It should be noted that the table also gives the absolute minimum requirements for the average case and that additional recommendation for rather more severe conditions are given in the notes to the table.

(b) Maximum Cement Content

No concrete mix is to have cement content in excess of 550 kg/m unless it has been specifically designed for the increased risk of cracking due to drying shrinkage in thin sections or to thermal stresses in thicker sections.

(c) Workability

All fresh concrete shall be designed to have the required workability. The required workability shall be suitable for the conditions of handling and placing so that after compaction the concrete surrounds all reinforcements, tendons and ducts and completely fills the formwork.

Workability of the concrete may be assessed by means of the slump test, compacting factor or VB consist of meter test as appropriate.

4.14 REQUIREMENTS FOR DESIGNED MIXES

(a) Target Mean Strength

The concrete mix shall be designed to have at least the required minimum cement content and to have a mean strength greater than the required characteristic strength by at least the current margin.

The current margin for each particular type of concrete mix shall be determined, it may be taken as having the smaller of the values given by (i) or (i i.) .

(i) 1.64 times the standard deviation of cube tests on at least 100 separate batches of concrete of nominally similar proportion of similar materials and produced over a period not exceeding 12 months by the same plant under similar supervision, but not less than 1/6 of the characteristic strength for concrete of grade 7, 10 or 15, or 3.75 N/m^2 for concrete of grade 20 or above.

(ii) 1.64 times the standard deviation of cube tests on at least 40 separate batches of concrete of nominally similar-proportions of similar materials and produced over a period exceeding 5 days but not exceeding 6 months by the same plant under similar supervision, but not less than 1/3 of the characteristic strength for concrete of grade 7, 10 or 15, 7.5N/ma for concrete of grade 20 or above.

Where there are insufficient data to satisfy (i) or (ii) above, the margin for the initial mix design shall be taken as two-thirds of the characteristic strength for concrete of grade 7, 10 or 15 or 15 N/mm2 for concrete of grade 20 or above. This margin shall be used as the current margin only until sufficient data are available to satisfy (i) or (ii) above. However, when the required characteristic strength approaches the maximum possible strength of concrete made with a particular aggregates, a smaller margin but not less than 7.5 N/mm2 may be permitted for the initial mix design.

4.15 EVIDENCE OF SUITABILITY OF PROPOSED MIX PROPORTIONS

The Contractor is required to submit to the Engineer evidence for each grade of concrete showing that at the intended workability, the proposed mix proportions and manufacturing method will produce concrete of the required quality.

If adequate data for "target mean strength" are not available, trial mixes shall be prepared or, for ordinary structural concrete, the mix proportions given in Table 3 adopted for initial production.

For lightweight aggregate concrete, mix proportions having the required minimum cement content and recommended by the producer of a particular lightweight aggregate as complying with the strength requirements of grades 15, 20 or 30 may be accepted in lieu of trial mixes, subject to the Engineer's approval after examining evidence that the results can be achieved. For higher grades of concrete, trial mixes shall be made.

The following information will have to be provided by the Contractor before any designed mix is supplied. Subsequently the Contractor shall declare any change in sources of materials and any change in cement content which results in a difference greater than 20 kg/m from the cement content last declared.

(a) Nature and source of each matter

(b) Either:

(i) appropriate existing data as evidence of satisfactory previous performance for target mean strength, and current margin and if required workability and w/c ratio; or

(ii) full details of tests on trial mixes; or

(iii) for ordinary structural concrete a statement that for initial production the appropriate mix proportions given by Table 3 will be used.

(c) Proposed quantities o each ingredient per cubic metre of fully compacted concrete.

4.16 TRIAL MIXES

Where trial mixes are required three separate batches of concrete shall be made using materials likely to be typical of the proposed supply and preferably under full scale production conditions. If circumstances make this inconvenient, the batches may be mixed in a laboratory unless this is specifically precluded by the Engineer. Sampling and testing shall be in accordance with BS 1881.

The workability of each of the trial batches shall be determined and three cubes made from each batch for test at 28 days. A further three cubes from each batch shall be made for test at any earlier age. The trial mix proportions shall be satisfactory if the average strength of the nine cubes tested at 28 days exceeds the specified characteristics strength by the current margin minus 3.5 N/mm2 or if nine tests at an earlier age indicate that it is likely to be exceeded by this amount.

If trial mixes are required to demonstrate that the maximum free water/cement ratio is not exceeded, two batches shall he made in a 1aboratory with cement and surface dry aggregates known from past records of the suppliers of the material to be typical. The proposed mix proportions shall not be accepted unless both batches have the correct cement content and a free water/cement ratio below the maximum specified value at the proposed degree of workability. For this purpose existing laboratory test reports may be accepted instead of trial mixes only if the Engineer is satisfied that the materials to be used in the structural concrete are likely to he similar to those used in the tests.

4.17 REQUIREMENTS FOR PRESCRIBED MIXES

(a) Prescribed Mixes for Ordinary Structural Concrete

All prescribed mixes for ordinary structural concrete shall be produced to comply with any requirements described in detail in the Specification.

Except when specified otherwise, for ordinary structural concrete of grades 7,10, 15, 20, 25 and 30 the mix proportions shall be selected from Table 3 and the constituent materials shall be selected from the following:

For grades, 7, 10 and 15.

Cement complying with the requirements of either BS 12 or BS 146.

Coarse aggregate complying with the requirements of BS 882 or BS 1047 and fine aggregate complying with the requirements of BS 882 or all-in aggregate complying with the requirements of BS 882 but preferably with the higher sand contents given in Table 3.

For grades 20 and above.

Cement complying with the requirements of BS 12, BS 146 or BS 4207.

Coarse aggregate complying with the requirements of BS 882 or BS 1047 and sand complying with grading zones 1, 2 or 3 of BS 882.

The Engineer shall be informed of the nature and source of each material to be used and subsequently whenever a change is made. No admixtures shall be used unless with the approval of the Engineer.

The cement contents for these prescribed mixed are given in Table 3 together with the total weights of dry aggregate to produce approximately one cubic metre of concrete. Depending upon the specific gravity of the aggregates slight adjustments may be required to the quantity of aggregate to produce this volume of concrete having the required workability, strength and cement content. Table 3 also gives the approximate proportions of the aggregate to be used although small adjustments may be required on the site depending on the properties of the local materials. For grades 7, 10 and 15 a range of fine aggregate proportions is given, the lower percentage being applicable to finer material such as zone 3 sand and the higher percentage being applicable to coarser materials such as zone 1 sand. Where single-sized coarse aggregates are used, the proportions shall be chosen to produce a combined grading within the limits of BS 882 or BS 1047 for graded coarse aggregate of the appropriate size.

The actual batch weights shall be calculated to suit the size of the mixer from the values given in Table 3 for the appropriate grade of concrete. Allowance has to be made for a moisture content typical of the aggregates being used.

Where necessary the aggregates for grades 7, 10 and 15 may be batched by volume in which case the bulk density of the damp aggregate may be taken as 1,500 kg/m . One whole bag of cement may be taken as weighing 50 kg.

The concrete mix shall be produced to comply with all the requirements described in detail in the specification.

4.18 PRODUCTION OF CONCRETE

(a) General

The supervision employed shall be such as to ensure the required standard of control over materials and workmanship. The Engineer shall be afforded all reasonable opportunity and facility to inspect the materials and the manufacture of concrete and to take any samples or to make any tests. All such inspection, sampling and testing shall be carried out with the minimum of interference with the process of manufacture and delivery.

(b) Cement

Provision sha11 be made to protect cement before use and to prevent accidental mixing of different types. Manufacturers' certificates shall be submitted to the Engineer on request.

(c) Aggregate

Separate fine and coarse aggregates shall be used except for grades 7, 10 and 15 where all-in aggregate may be used. Separate storage facilities with adequate provision for drainage shall be provided for each different size of aggregate used.
All aggregate deliveries shall be inspected and at least a proportion of them shall undergo regular testing. Aggregates shall be handled and stored so as to minimise segregation and contamination.

For the grades of concrete other than 17, 10 and 15, the grading of each size of aggregate from each pit, quarry or other source of supply shall be determined at least once weekly. The results of such tests shall be reported to the Engineer and shall be used to check whether the gradings are similar to those of the samples used in the establishment of the batch weights.

(d) Batching and Mixing

The quantity of cement, fine aggregate and quantities of the various sizes of coarse aggregate shall be measured by weight except that aggregates may be measured by volume in the following instances:-

(i) concrete of grades 7, 10 and 15 using dense aggregate,

(ii) concrete of grades 7 and 10 using lightweight aggregate, and

(iii) the lightweight coarse aggregate component only in concrete of grades 15 and higher.

A separate weighing device shall be provided for weighing the cement. Alternatively, the cement may be measured by using a whole number of bags in each batch.

The amount of water shall be measured, by volume or by weight. Any solid admixtures to be added shall be measured by weight by liquid or paste admixtures may be measured by volume or weight.

The batch weights of aggregate shall be adjusted to allow for a moisture content typical of the aggregates being used.

The accuracy of the measuring equipment shall be within $\pm$ 3% of the quantity of cement, water or total aggregates being measured and within $\pm$ 5% of the quantity of any admixture being used All measuring equipment shall be maintained in a clean, serviceable condition.

The mixer shall comply with the requirements of BS 1305 or BS 4251 where applicable. The mixing time shall be not less than that used by the manufacturer in assessing the mixer performance. In the case of mixes of low workability or high cement content a satisfactory mixing time shall be determined by comparing the strength of samples mixed for different times.

(e) Control of water Content

The water content of each batch of concrete shall be adjusted so as to produce a concrete of the workability required by the trial mixes or by Table 3 as appropriate.

(f) Control of Strength of Designed Mixes

During production adjustments of mix proportions shall be made in order to minimise the variability of strength and to approach more closely the target mean strength. Such adjustment are regarded as part of the proper control of production but the specified limits of minimum cement content and maximum water/cement ratio shall be maintained. Changes in cement content may have to be declared. Such adjustments to mix proportions shall not be taken to imply any change to the current margin.

A change in the current margin used for judging compliance with the specified characteristic strength becomes appropriate when the results of a sufficiently large number of tests show that the previously established margin is significantly too large or too small. Recalculation of the margin shall be carried out in accordance with the requirements as specified under 'Target Mean Strength" but, although a recalculated margin is almost certain to differ numerically from the previous value, the adoption of the recalculated value would not generally be justified if the two values differ by less than 18% when based on tests on 40 separate batches; or less than 1.1% when based on tests on 100 separate batches, or less than 5% when based on tests on 500 separate batches.

On the adoption of a recalculated margin it shall become the current margin for the judgement of compliance with the specified characteristic strength of concrete produced subsequently to the change.

4.19 COMPLIANCE WITH SPECIFIED REQUIREMENTS

(a) General

Provided that the Engineer is satisfied that the materials used are in accordance with the specification and that correct. methods of manufacture and practices of handling raw materials and manufactured concrete have been used, the compliance of :

(i) A designed mix for ordinary structural concrete shall be judged by the strength of the hardened concrete, in comparison with the specified characteristic strength; together with the cement content, in comparison with the specified minimum cement content.

(ii) A prescribed mix for ordinary structural concrete shall, unless otherwise specified, be judged on the basis of the specified mix proportions and required workability.

(iii) A design mix for special structural concrete shall be judged in a manner similar to (i) above except that in addition when it is applicable, compliance with any specified special requirements shall be taken into consideration.

(iv) A prescribed mix for special structural concrete shall be judged in a manner similar to (ii) above.

When requirements not described in detail in CP 110 are specified (e.g. density or modulus of elasticity of concrete), compliance with those requirements shall he determined only in association with a detailed description of the method of test and with tolerances which take appropriate account of variability due to manufacture, sampling and testing.

All sampling and testing of constituent materials shall be carried out in accordance with the provisions of the appropriate British Standard, and all sampling and testing of fresh and of hardened concrete shall be carried out in accordance with the provisions of BS 1881 unless such provision is at. variance with CP 110.

(b) Strength

The characteristic: strength of concrete is that 28 days cube strength below which not more than 5% of the test results may be expected to fall.

Compliance with the specified characteristic strength shall be judged by tests made on cubes at an age of 28 days unless thee is evidence, satisfactory to the Engineer, that a particular testing regime is capable of predicting the strength at 28 days of concrete tested at an earlier age when compliance may be based on the results of such tests along.

(c) Testing Plan

Each cube shall be made from a single sample taken from a randomly selected batch of concrete. The samples shall, where practicable, be taken at the point of discharge from the mixer, or, in the case of ready mixed concrete, at the point of discharge from the delivery vehicle.

Compliance with the specified characteristic strength may be assumed if :

(i) The average strength determined from any group of four consecutive test cubes exceeds the specified characteristic strength by not less than 0.5 times the current margin; and

(ii) Each individual test result is greater than 85% of the specified characteristic strength.

The current margin shall be taken to be two-thirds of the specified characteristic strength for concrete of grade 7, 20 or 15, or 15 N/mm2 for concrete if grade 20 or above, unless a smaller margin has been established to the satisfaction of the Engineer.

If only one cube result fails to meet the second requirement then that result may be considered to represent only the particular batch of concrete from which that cube was taken provided the average strength of the group satisfies the first requirement.

As a guidance, the rates of sampling and testing of concrete shall. be in accordance with Table 4.

If more than one cube in a group fails to meet the second requirement or if the average strength of any group of four consecutive test cubes fails to meet the first requirement then all the concrete in all the batches represented by all such cubes shall be deemed not to comply with the strength requirements. For the purposes of this subclause the batches of concrete represented by a group of four consecutive test cubes shall include the batches from which samples were taken to make the first and the last cubes in the group of four, together with all the intervening batches.

(d) Action to be Taken in the Event of Non-Compliance with the Testing Plan

When the average strength of four consecutive test cubes fails to meet the first requirements as stipulated under "Testing Plan", the mix proportions of subsequent batches of concrete shall be modified to increase the strength.

If the cube strengths at 28 days are less than those specified, the work from which the concrete for the test cubes was taken will be rejected by the Engineer and will be broken out and rebuilt or otherwise made good as directed by him at the Contractor's own expense.

(e) Cement Content

The cement content of any batch of concrete shall be not less than the specified minimum value minus 5% of that value, nor more than the specified maximum value plus 5% of that value.

As an alternative the cement content may be determined from samples representative of any batch of concrete provided that a suitable testing regime including errors due to sampling is used to measure the cement content of fresh concrete to an accuracy of + 5% of the actual value with a confidence of 95%.

(f) Workability

The workability of concrete shall be within the following limits :

Slump	$\pm$ 25 mm or $\pm$ 1/3 of the required value, whichever is the greater
Compacting Factor	$\pm$ 0.03, where the required value is 0.09 or more; $\pm$ 0.04, where the required value is less than 0.90 but more than 0.80, $\pm$ 0.05, where the required value is 0.80 or less.
VB	$\pm$ 3 seconds or $\pm$ 1/5 of the required value, whichever is the greater

(g) Water/Cement Ratio

The water/cement ratio of a batch of concrete shall not exceed the specified maximum value by more than 5% of that value.

(h) Air Content of Fresh Concrete

The percentage air content determined from individual samples taken at the point of placing the concrete and representative of any given batch of concrete shall be within ± 1.5 of the required value. The average percentage air content from any four consecutive determinations from separate batches shall be within + 1.0 of the required value.

4.20 READY-MIXED CONCRETE

Ready-mixed concrete may be used subject to the Engineer's prior approval. The Engineer will require to inspect the plant from which the said concrete is to be supplied.

The supply and delivery of ready mixed concrete to comply with the recommendations of BS 1926.

The ready-mixed concrete will comply with all the requirements of this Specification.

The Contractor to maintain records of all supplies of ready-mixed concrete placed on the works, including :

(a) Delivery notes giving details of quality and mix proportions.

(b) The time at which each batch of concrete was mixed and details of any additives uses.

(c) Positions in the works where concrete is placed.

The concrete to be agitated continuously by rotation of the mixer drum during transport to the site and while awaiting discharge.

In the case of truck mixed concrete, the water may be added either at the concrete supplier's plant, or under the Contractor's supervision after arrival at site, but not during transit.

The concrete to be compacted in its final position in as short. a time as possible after mixing, arid not later than one and a half hours after specific time when the cement comes in contact with the aggregate.

Works test cubes to be made on site by the Contractor in accordance with the provision of this Specification, irrespective of any sampling and/or testing which may be carried out by the Supplier.

4.21 PRECAST CONCRETE

The principles contained in the references to Reinforced Concrete apply to precast concrete.

All precast concrete to be vibrated.

Precast concrete to be cast in wrot timber or steel moulds with 6 mm chamfered arises.
All moulds to be coated with mould oil of a non-staining nature.

Concrete to be well rodded and tamped into moulds, no facing up is to be dcne where work is to be left exposed, on the faces to be true, clean and regular with good arises.

The Contractor to protect precast concrete units from damage during lifting, handling or storage and where necessary to provide adequate protection to prevent the concrete from damage due to rubbing by slings or contact with other unit or any cause.

During assembling the Contractor to provide and maintain sufficient and proper temporary supports for each precast concrete unit until such time as the Engineer permits its load to be transferred to the adjacent structure.

This section of the specification applies similarly to precast concrete piles.

4.22 FORMWORK

(a) General

In this Section, "forms" shall mean that part of the formwork in direct contact with the concrete."Formwork" shall include the forms and all their support.

Except where specified otherwise, the formwork shall conform with Standards Association of Australian (SAA) Codes AS 1082, AS 1509 and AS1510.

The responsibility for the sufficiency of the whole of the formwork shall rest entirely with the Contractor.

Each section of formwork to structural members shall be inspected and passed by the Engineer immediately before concrete is placed in that section.

Should any formwork be displaced during concreting, or within the periods specified for the retention of formwork, the concrete shall be removed between such limits as the Engineer may determine, construction joints shall be formed and the section of work shall be reconstructed after the formwork has been strengthened and adjusted.

Concrete work which does not comply with the tolerances specified, or has other defects due to inadequacy of formwork, shall be removed and replaced, or the defects shall be remedied as directed.

Formwork shall be such as to produce concrete to the shapes, lines, levels, grades and dimensions required by the contract drawings within the tolerances specified.

All discrepancies between the contract documents shall be referred to the Engineer for decision before proceeding with the work.

(b) Stability

Forms shall be constructed from well seasoned timber, plywood, steel or other suitable approved material which is to be properly supported and braced or tied to maintain position and shape during and after the placing of concrete.

Formwork shall be supported in a manner which will prevent its settlement.

(c) Tolerances

The dimensional tolerances of the formwork shall be such that the concrete produced from the forms shall conform to the dimensional tolerances specified herein.

The lines, levels and grades of the formwork shall be checked by the Contractor before and during placing of concrete.

Dimensions, levels and grades for the Beatings or supports of all precast units shall be checked and passed before any unit is hoisted and fixed in position.

Dimensional tolerances on formed surfaces and structural member thicknesses shall be in accordance with (i) to (iii) below: -

{i) The deviation of any point on the surface of a building element from its correct position in space shall not exceed 10 mm

(ii) The deviation of measured dimension between any two points on the surfaces of building elements shall not exceed 1/500 of the dimensions correct value; except that in the case of_ cross-sectional dimensions of structural members such as columns, beams, slabs and walls, the tolerance shall be minus 0 and plus 6 mm.

The last mentioned concession shall not apply to the measurement of flatness of formed surfaces. No misalignment exceeding 2 mm shall occur between the edges of adjoining pours at joints in the concrete, nor shall any misalignment exceeding 2 mm occur in the surface of the concrete as the result of adjoining sheets of form facings.

(d) Treatment of Forms

All form linings shall be treated prior to placing of concrete with a suitable release agent. None of this agent shall be allowed to touch the reinforcement.

Sufficient evidence of tests shall be provided to ensure that no reaction which will affect the concrete surface will occur between any concrete additives, release agents, form surface coatings or curing compounds.

(e) Cleaning of forms

All dust, debris and rust or other stains, shall be removed from the interiorr of the forms before the concrete is placed.
In order to facilitate the removal of major debris and to allow inspection immediately before the placing of concrete, certain of the forms shall be readily removable. Minor debris, dust, etc. shall be removed by vacuum cleaning, compressed air or the equivalent.

(f) Re-use of Forms

The number of re-uses and the condition of faces and edges of forms shall he consistent with the concrete surface type specified.

(g) Stripping, Removal of Forms

Forms shall riot be disturbed until it the concrete in contact with them has hardened sufficiently to withstand such action without damage.

In the absence of any specific direction by the Engineer, Table 5 shall be used in determining stripping times for concrete made with ordinary Portland Cement.

Subject to the approval of the Engineer the Contractor may use the following alternative to determine stripping times.

Forms shall not be stripped before the concrete supported by them has attained the strength designated in Table 6. The strength of the concrete at stripping shall be taken as the average strength of two (2) cubes taken from the pour to be stripped. It shall be the responsibility of the Contractor to obtain such prior approval otherwise stripping time shall be as Table 5 or as directed by the Engineer.

Removal of bottom forms between bearers or props prior to the removal of supports may be permitted by the Engineer, provided the formwork has been designed to allow such removal without disturbance of the support.

The Contractor shall provide sufficient tomming to ensure that the loading caused by "green" concrete floors (not up to design strength fcu, as shown in the Specification or on the drawings) , formwork, building equipment and materials is supported by such a number of concrete floors that no floor carries loads exceeding its capacity based on Table 6. The number of floors to remain tommed will depend on the design dead and live load of the floors, the pouring cycle and rate at which the concrete gains strength.

Neither walls, nor any permanent loading shall be erected on any part of the structure while any part is still supported by formwork.

(h) Finishes from Forms

Forms shall be mortar tight and shall produce concrete surfaces as specified. Formed surfaces which will be exposed to view shall be finished to Class A tolerance as described in Clause 30 (b) of this Specification.

Surfaces which will not be exposed to view, or which are to be plastered, shall be finished to the following standard.

Properly designed forms shall be used. Small blemishes caused by entrapped air or water may be expected, but the surface shall be free from voids, honey-combing, or other large blemishes. Tolerances shall be to Class B as described in Clause 39=0 (b) of this Specification.

4.23 REINFORCEMENT

(a) Bending

All reinforcement bars shall be accurately shaped in a manner that will not injure the material, to the details shown on the drawings. Bars shall not be bent hot.

(b) Cleaning

All reinforcement shall be free of all loose mill scale and thoroughly cleaned to remove all loose rust, oil, grease or other harmful matter, immediately prior to being placed in position in the works.

(c) Placing

All reinforcement shall be accurately placed, securely fixed and adequately maintained in the positions shown on the drawings within the following tolerances :

(i) Cover of concrete over reinforcement, where specified cover is 24 mm or more, - 0 : + 8 mm.

(ii) Cover of concrete over reinforcement, where specified cover is less than 24 mm, - 0 : + 5 mm.

(iii) Lateral spacing of reinforcement, $\pm$12 mm.

Reinforcement shall be free from bends not required on the contract drawings, kinks and similar defects.

The concrete cover to the reinforcement detailed on the drawings shall be maintained by use of mortar blocks, reinforcement chairs, or other approved methods. Mortar blocks used for this purpose shall be made with 1:2 mortar measuring 50 mm x 50 mm and true to the thickness equivalent to the concrete cover to reinforcement as specified.

The use of mortar blocks is not permissible on exposed concrete faces.

The Contractor shall supply and fix all necessary chairs required to maintain the reinforcement in the correct position. The spacing of chairs and the diameter of bars used in their manufacture shall be agreed with the Engineer.

All laps of fabric and all intersections of bars shall be securely connected with malleable iron wire of suitable size or by another approved method.

No metal part of any device used for connecting bars or for maintaining reinforcement in the correct position shall remain permanently within the specified minimum concrete cover to the reinforcement.

The minimum concrete cover to reinforcement shall be provided in conformity with the requirements shown on the drawings.

(d) Welding

Welding of reinforcement where required shall not be carried out without the written permission of the Engineer.

(e) Projecting Reinforcing

Projecting reinforcement or dowel bars for future connection of the structural works shall be protected by cement paint, if they are to be left exposed for a long time.

(f) Splicing

When splices not already shown on the Contract drawings are found necessary, the details of the proposed splices shall be submitted to the Engineer for approval.

4.24 CONCRETING

(a) Mixing

Concrete shall be mixed in an approved mechanical batch type concrete mixer. Mixing shall be continued until there is a uniform distribution of the materials in the mixer and the mass is uniform in colour. The mixing time for each batch shall not be less than the minimum period recommended by the mixer manufacturer.

The volume of mixed materials in each batch shall not exceed the rated capacity of the mixer. Each batch of concrete shall be discharged completely before the mixer drum is recharged.

The mixer drum shall be thoroughly washed out whenever mixing ceases.

(b) Transporting

Concrete shall be transported as quickly as possible from the mixer to its final position without segregation or loss of any of the ingredients.

All plant and equipment used for transporting concrete shall be kept clean; all containers used for transporting concrete shall be thoroughly washed out whenever mixing ceases.

Runs or gangways for concrete transport and main runs for foot traffic shall not be supported or allowed to bear on the fixed reinforcement.

(c) Placing

All concrete shall be placed under the supervision of a capable foreman experienced in reinforced concrete construction.

The concrete shall not be placed if slump is not within the required limits.

There shall be no additional of water or any other material to the concrete at the site without the approval of the Engineer.

The concrete shall not be placed at a time, or under such conditions, which will not permit the standard of concrete required by this Specification to be attained.

The concrete shall be placed in such a manner as to avoid segregation or loss of materials. To achieve this in the placing of concrete in thin walls and columns in excess of 1.5 metres in height, it may be necessary to pour the concrete through enclosed chutes or access hatches, and the Engineer may so direct this chutes should be kept as close to vertical as possible during the placing operation.

The concrete placing shall be carried out continuously between the construction joints and in such a manner that a plastic edge is maintained.

Where construction joints are shown on the drawings, they shall neither be eliminated nor located without the approval of the Engineer.

The Contractor shall plan and arrange all the construction joints to ensure that the effect of shrinkage of the concrete is minimised. The Contractor shall submit to the Engineer for his approval drawing showing his proposed positions of construction joints and the lifts. Construction joints shall generally be located as follows

Columns	Joints in columns shall be at the underside of floor members and at floor level.
Floors	Joints shall be located at or near the middle of the span in slab and beam unless otherwise instructed.
Walls	Vertical joints shall be away from corner. Spacing between vertical joints shall not generally exceed 12 m.

Before fresh concrete is placed against hardened concrete at construction joints, the joint surfaces of the hardened concrete shall be thoroughly roughened to remove laitance and to expose aggregate. The surface shall be cleaned so that all loose or soft material, all foreign matter, and all laitance are removed. Immediately ahead of concrete placement, the joint surfaces shall be dampened with water, and shall not be allowed to dry out before placing fresh concrete.

(d) Compaction

The concrete shall be thoroughly compacted by means of suitable mechanical vibrators, and carefully worked around the reinforcement and embedded fixtures, under waterstops and into the sides and corners of the formwork.

The coarse aggregate shall be worked back from the forms so as to bring a full surface of mortar against the form, without formation of excessive surface voids.

The compaction shall be such that all air or stone pockets which may cause honey-combing, pitting or places of weakness are eliminated.

The Contractor shall keep on hand on the site for emergency use, one spare mechanical vibrator over and above those in use.

(e) Hot Weather Requirements

Concrete which is placed when the surrounding air temperature is greater than 32 degree C shall have a temperature not more than 32 degree C when placed in the forms.

In addition, the formwork and reinforcement shall be maintained at a temperature not greater than 32 degree C by protection, cold water spraying or other effective means.

(f) Notice of Concreting

Before concreting Contractor shall give at least 24 hours notice to the Engineer and obtain his approval. If due notice is not given the Engineer may require the Contractor to remove at his own expense any concreting so placed. Public holidays and weekends are not to be regarded as time for giving of notices.

4.24 CONCRETE CURING AND PROTECTION

(a) General

Freshly cast concrete shall be protected from premature drying and excessively hot temperatures. In windy conditions, wind breaks shall be erected to shield the concrete surface during and after placing. The concrete shall be maintained at a reasonably constant temperature with minimum moisture loss for the curing period.

The responsibility for the curing and protection of the concrete shall rest entirely with the Contractor.

Curing methods which do not conform to this specification shall be rejected.

(b) Curing

All exposed surfaces of concrete (surfaces which are not in contact with forms) shall be cured by one of the following methods :

(i) Ponding or continuous sprinkling with water.

(ii) Covering with an impermeable membrane concrete that has taken its initial set and that has been moistened with a fine spray of water. The covering material shall be held firmly against the concrete for the full length of all edges and laps and at frequent intervals between so that there shall be no air circulation at the concrete surface.

(iii) The use of an absorptive cover, kept continuously wet.

(iv) The use of curing compounds, approved by the Engineer. Such compounds shall be used in accordance with the manufacturer's recommendations and shall not be used on any surface against which additional concrete or other finishes are to be placed.

Note : In general, wax or oil-based compounds are not compatible with adhesives; whilst varnish, PVA or chlorinated rubber-based compounds may be.

(c) Period of Curing

Curing shall commence immediately after initial set of the concrete and shall continue for a minimum period of 7 days for ordinary Portland Cement concrete. For concrete made with high early strength cement, the minimum curing period shall be 3 days.

Rapid drying out at the end of the curing period shall be prevented.

Surfaces from which formwork has been removed before the curing period has elapsed shall be cured for the remaining period by one of the methods listed in Clause 25 (b).

(d) Hot Weather Requirements

Precautions shall be taken to avoid excessive evaporation losses from the surface of a freshly placed concrete. Curing compounds shall not be regarded as effective for this purpose.

If the temperature of the surrounding air is higher than 32 degree C, suitable barriers shall be erected to protect the freshly .placed plastic concrete from wind and sun until the concrete has hardened sufficiently to allow covering, in accordance with Clause 25 (b) (i) and Clause 25 (b) (iii), unless otherwise permitted by the Engineer.

(e) Protection

The concrete shall be protected from damage due to load over-stresses, heavy shocks and excessive vibration, particularly during the curing period.
All finished concrete surfaces shall be protected from damage due to any cause, such as construction activities, rain and running water.

Self-supporting structure shall not be loaded in any way which will over stress the concrete.

4.25 CONCRETE IN WATERTIGHT CONSTRUCTION AND WATER RETAINING STRUCTURES

(a) General

The septic tank shall be watertight.

(b) Waterstop

Flexible rubber waterstops shall be incorporated in construction and expansion joints as indicated on the drawings. Waterstops shall be "Spanseal" brand of the type indicated on the drawings, or equivalent to the approval of the Engineer. Waterstops shall be jointed in accordance with the manufacturer's recommendations. Waterstops shall be supported and maintained in their correct locations in a manner which will not damage the waterstop or cause them to be pierced. Any damaged waterstop shall be removed and replaced at the expense of the Contractor.

(c) Slabs

Slabs with inclination not exceeding 30 degree shall be formed with formwork or a concrete base at the bottom face. The base shall be reasonably watertight to prevent loss of grout. The top face shall be floated to a fall as specified on the drawings.

Drains, pipe inlets and outlets, and gullies shall be formed integrally with the slabs. Pipe fittings built into slabs shall have a weep flange, located centrally in the slab.

Where an additional finish is specified, the top of the slab shall be left with a scratched finish to facilitate bonding of the additional finish.

(d) Walls

Walls shall be formed with formwork held in position by strutting and bracing or by specially designed metal bolts. Holes created in the wall by the use of special tie-bolts shall be grouted back using an approved non-shrink grout.

Wall shall be cast in lifts, with each lift not exceeding 2,400 mm unless otherwise agreed by the Engineer. Concrete shall be placed with care so that it can be compacted around the waterstop and so that free fall of the concrete will not cause the waterstop to fold. On reaching the horizontal construction joint, the top of the concrete shall be rammed by a specially designed hammer.

The joint shall be properly prepared before the next lift of concrete is placed. The joint surfaces of the hardened concrete shall be thoroughly roughened and cleaned so that all loose or soft material, all foreign matter and all laitance are removed.

Immediately before placement of concrete, the joint shall be dampened with water and kept moist until the next lift is placed.

(e) Testing

The Contractor shall provide all necessary testing for watertightness whenever the Engineer directs.

The water retaining structure shall be tested in accordance with the following procedure :

When concrete work on the water retaining structure has been completed and concrete has attained its design strength, but before the application of any surface finishes such as plastering, tiling or tanking the water retaining structure shall be filled with water at a rate not exceeding 300 mm height per day.

When the water retaining structure has been filled, it shall be left full for a period for at least seven days, during which records will be kept of any drop in the water level, and any leaks through walls and joints noted and clearly marked. After the seven days period has elapsed, the structure shall be emptied and all leaks made good. Retesting shall then be carried out to the above procedure, until all leaks have been located and eliminated.

(f) Defective Work

When in the opinion of the Engineer damp patches or leakage of water in the finished works are due to failure of the Contractor to comply with this Specification, the Contractor shall bear the cost of making good all affected work together with any retesting.

4.27 CONCRETE BELOW GROUND LEVEL

Any ground water around construction to excavate areas shall. be kept clown to an approved level by dewatewring, until thee is no danger of flotation due to hydrostatic pressure.

Concrete in foundation and work below ground level shall be protection from admixture with subsoil, or other deleterious materials, during and Subsequent to placing.

4.28 FLOOR HARDENER

Floor hardener shall he applied to floor surfaces where specified on the drawing.

4.29 IN-SITU FINISHES TO UNFORMED SURFACES

(a) Scratched Finish

Where a scratched finish is specified, the following procedure is to be adopted :-

After the concrete has been placed, struck off, consolidated and levelled to Class C tolerance, the surface shall be roughened with stiff brushes or rakes before final set.

(b) Tolerances

The surface of the concrete shall be finished as specified to the tolerances listed below :

Class A	True planes within 3 mm in 3 m, as determined by a 3 m straight edge placed anywhere on the slab in any direction.
Class B	True planes within 6 mm in 3 m, as determined by a 3 m straight edge placed anywhere on the slab in any direction.
Class C	True planes within 6 mm in 600 m, as determined by a 600 m straight edge placed anywhere on the slab in any direction.

4.30 REMEDIAL WORK

The Contractor to be responsible for carrying out all necessary remedial work to shrinkage cracks or other defective work, and to seal any leaks or penetration of moisture. Any defects in watertightness appearing during the Defects Liability Period to be rectified by the Contractor at his own expense and to remain dry for a further period equal to the Defects Liability period, in the even of any moisture penetration during this further period the Contractor to rectify the said leakage as aforesaid.

No cutting or drilling of watertight concrete for pockets or fixings will be permitted, unless authorised by the Engineer.

Shutter bolts or fastenings for formwork, necessitating the use of fixings embedded in the concrete, to be such as not to impair the watertightness of the structure, and to he subject to the approval of the Engineer. The use of shutter bolts necessitating through holes shall be subjected to Engineer's approval.

4.31 DFFECTIVE WORK

If at any time the Engineer considers concrete to be defective, such work to be immediately removed, and replaced at the Contractor's expense.

4.32 TELEPHONE TRUNKING

Electrical conduits, telephone trunking and other pipes may only be bedded in floor and other structural members after inspection and approval by the Engineer. Electrical conduits and telephone trunking will generally be placed on top of RC slabs and bedded in screeds before applied floor finishes. Where approved by the Engineer, trunking may be fixed in the floor slab under the top reinforcing steel. Ensure that no concrete enters the trunking during concreting. Set-down at trunking junction shall be approved by the Engineer.

4.33 DAMP PROOF MEMBRANE

0.125 mm thick polyurethane sheet Grade 500 or other equal and approved vapour barier shall be laid under the ground floor slab.

Joints are to be thrice 50 mm folded and stapled together.

4.34 WATER PROOFING

The floor slab of the toilets and plant room floor slab shall be applied with “Hitchins Vandex” or approved equivalent concrete cementitions waterproofing system consist of “Vandex Super” @ 0.75kg/m^2 and vandex premix @ 1kg/m^2 all in strict accordance to manufacturer’s instruction.

The reinforced concrete gutters shall be laid with “Hitchins Traffigard” waterproofing system.

The contractor and the manufacturer shall jointly provide a warranty of ten (10) years to the owner commencing from the date of practical completion.

SECTION 5 - ETERNAL WORKS

5.1 GENERAL

The relevant reference to materials, goods and workmanship under the headings of the foregoing specification apply equally to "External Works."

5.2 SITE EXCAVATION AND FILLING

Excavate and/or fill the area of the site to the formation levels shown on the drawing. Stated difference in levels to be attained on excavation and/or filling.

Areas to be filled, are to be filled in 150 mm layers and consolidated to the satisfaction of the Engineer. On no account is filling to be laid on top of turfing.

From embankments and gradients to the directions of the Engineer, trim and prepare surfaces of excavation and/or fill to receive hardstanding, etc.

5.3 CONCRETE ROADS AND HARDSTANDINGS

(a) Formation

Carry out work on formation only after completion of subgrade drainage, culverts, service pipes or any other work which may affect the road construction; unless otherwise agreed by the Engineer. Trim, level and grade formation of the area of the roads and hardstanding to form required cambers and gradients and consolidate with 10 ton power roller. The formation shall be so graded to drain surface water to side ditches or other drainage system. Any subsidence or movement to be made up with laterite gravel, quarry waste or other approved materials, rolled again, until a uniform surface is attained.

(b) Sub-base

Provide crusher run materials, placed and spread evenly on formation to a compacted thickness as shown on the drawings or as directed by the Engineer. The materials shall be crushed rock of hard durable particles or fragments of crushed rock from a source approved by the Engineer. Lay crusher run in layer of 200 mm (maximum) thickness, blind with quarry waste to fill in voids and rolled with a 10 ton power roller. Add additional quarry waste where necessary and rolled again until no appreciable subsidence or movement occurs under wheels.

(c) Surfacing

The surfacing shall be reinforced with 2 layers of BMC A8 and laid with Grade 20 concrete at a thickness of 150mm. The concrete is to be well compacted and graded at 1:30 across the section. Expansion joint shall be provided at every 3.0m along the concrete carriageway.

5.4 WALKWAYS/FOOTPATH

Trim, level and grade formation of area of walkways to falls and consolidated with 10 ton power roller. The formation shall be so graded to drain surface water to storm water drains and other drainage system. Any subsidence or movement to be made up with laterite gravel, quarry waste or other approved materials, rolled again until a uniform surface is attained. Lay sand blinding on formation to receive concrete pavings. Lay concrete grade 20 to a thickness of 100mm reinforced with 1 layer of BMC A7. Cast concrete walkways in bays not exceeding 6 m in any direction. Finish surface of walkways to be a texture approved by the Engineer.

5.5 KERBS

Provide precast concrete kerbs to details and where indicated on the drawings. The kerbs shall be half battered by hydraulically pressed or table vibrated in strong well made steel moulds with rounded front edges. The kerbs shall be constructed of concrete, Grade 20, laid and haunched with mass concrete, Grade 15. Straight kerbs with outlet channel shall be constructed and reinforced as shown on the drawings. Bed kerbs on concrete base with cement mortar (1:3). Kerbs shall be jointed with cement mortar (1:3), flush pointed.

5.6 CAR PARKING LINES

Prepare, clean surface of metal road and paint two coats of reflective car parking lines, 100 mm wide as shown on the drawings.

5.7 PROTECTION OF SITE, ETC. AND DRAINS

Provide for the protection of the area of the site, from and by the effect of soil erosion, keep surface water drains, etc. free from obstruction by silt, from whatever cause arising including excessive rainfall, from Date for Possession of the site, to Date of Practical Completion of the Works.

Any remedial work and making good under this heading will be at the Contractor's own expense and will be executed to the entire satisfaction of the Engineer.

SECTION 6 - BRICKLAYER

6.1 SCOPE OF WORKS

The work included in this section covers the supply and erection of all brickwork and blockwork.

The whole of the work shall be carried out in accordance with the drawings and details.

6.2 BRICKS

Bricks shall be first quality standard grade clay bricks of local manufacture well and evenly burnt, free from cracks and other defects, hard and sound and shall ring when struck. The average compressive strength, when tested in accordance with B.S. 1257 shall not be less than 70 kg per square centimetre. All bricks shall be of nominal dimensions stated in B.S. 657 for Type 2 (66 mm) bricks, unless otherwise approved and shall be square and clean, of uniform size and shape with a frog on one or both bed faces. Bricks shall be up to the standard of a sample of each type to be approved by and deposited with the Engineer.

The Contractor shall allow the Engineer to take additional samples of bricks of each type from each consignment, free of charge, for testing as required.

6.3 CEMENT

Cement is to be Portland Cement from approved manufacturers and shall comply with B.S. 12 - 1958 for Portland Cement.

Cement shall be delivered to the site in moisture proof containers bearing a test seal indicating that it has been tested and passed by an approved testing authority. At no time prior to being placed in the concrete mixer shall cement be removed from the manufacturer's container and stored in any other receptacle. Cement shall be supplied in bulk only with the written approval of, and under conditions required by the Engineer.

Cement in storage shall be kept dry. It shall be stored in a shed or room with a floor raised off the ground and with walls and roof that will ensure effective protection against weather and damp air. Cement shall be used as nearly as practicable in the order in which it is received from the suppliers. Cement which has become lumpy or partially set will be condemned and must be removed from the work immediately.

6.4 SAND

Sand shall be clean, sharp, hard, strong uncoated grains of natural sand, well graded and to approval. Requirements of sand shall also be as described under "Concrete".

6.5 LIME

Quick lime is to be properly slaked and run to putty and matured for at least two weeks before use.
Hydrated lime shall be of best quality of an approved brand run to putty and mixed with sand and water and allowed to stand for at least sixteen hours before use.

6.6 PRECAST CONCRETE BLOCKS OR VENTILATION BLOCK

Precast concrete blocks or ventilation block shall comply with B.S. No. 2028.

Before placing an order for blocks, a sample of ten blocks shall be submitted to and approved by the Engineer. All blocks subsequently produced for use in the works shall be equal or superior to the approved sample. Further samples shall be selected from time to time by the Engineer for testing.

All blocks shall be at least 28 days old before use.

6.7 GLASS BLOCK

Glass Block shall be as specified with 2 No. of 6 mm diameter mild steel wall ties at interval of every 2 horizontal courses and every 8 vertical blocks and bedded and pointed in cement mortar and pointed on both sides with white cement, all installed in strict accordance with the manufacturer’s instructions and recommendation.

All glass block shall be installed truly vertical and straight.

6.8 WATER

Water for mortar shall be clean and free from oil, acid, alkali, organic matter or other deleterious substances in suspension or in solution.

6.9 MORTAR

All brickwork shall be built in cement mortar, unless otherwise approved or as otherwise stated and shall consist one part of cement to three parts of sand by volume.

Mixing of all mortar shall be done by means of a mechanical batch mixer or by hand on a clean watertight platform of adequate size.

All materials shall be accurately gauged. Mortar shall not be used after one hour has elapsed from the time the cement was added or after it has commenced to set. Retempering of hardened or partly hardened mortar will not be permitted.

6.10 REINFORCEMENT

All half brick walling is to be reinforced with 63 mm "Exmet" or other equal and approved expanded metal reinforcement at every forth course, the bottom-most reinforcement being two courses above floor level. All brick-on-edge walling shall be similarly reinforced at every third course.

6.11 CAVITY WALL TIES

Cavity walls are to be bonded together with zinc coated mild steel wall ties comply with B.S. 1243 vertical twist type or butterfly type.

6.12 TIES TO COLUMNS

Where brickwalls abut or carry across the face of columns and walls, the Contractor shall provide at every fourth brick joint a 6 mm diameter by 450 mm mild steel rods one end cast into concrete.

6.13 DAMP-PROOF COURSE

Damp-proof course shall be fibre based membrane, unless otherwise stated, in accordance with B.S. 743 Type 58 and located generally 150 mm above ground floor level, laid full widths of walls and lapped 150 mm (minimum) at intersections, junctions, etc., and free from tears and laid on a bed of cement mortar (1:3) and neatly pointed on exposed edge.

6.14 NOTICE TO OTHER TRADES

Before commencing any brickwork, the Bricklayer shall confer with other trades to ensure that all pipes, conduits, drain sleeves, bolts, hanger, door and window fixing lugs or timber pellets or any other materials necessary to be installed in the brickwork at the time it is built, have been fixed or provided for.

6.15 CUTTING, CHASES AND RECESSES ETC.

Cutting of openings for other trades shall be avoided as much as possible.

All chases, fair and raking cutting, beam filling, corbelling and cutting grooves for flashings shall be formed or cut as required.

All ducts, recesses for service lines and the like shall be formed to the correct dimension.

Neatly cut brickwork to rake at underside of stairs or roof trusses, gables, etc.

6.16 LIMIT OF BRICK LAYING

No brickwork is to be built off or supported on reinforced concrete beams, slabs or concrete encased structural beams until minimum 7 days after formwork and props supporting the concrete items have been removed. Care shall be taken to avoid the stacking of bricks which may induce excessive concentrated load on the structure.

6.17 WORKMANSHIP

All brickwork shall be of the highest standard and executed by fully competent tradesmen. Lay all work perfectly plumb, true and level and in even plans.

All brickwork shall be set out and built to the dimensions, heights and thicknesses as shown on the drawings.

All bricks shall be well soaked in water before being used, the beams wall etc. on which they are to be laid is also to be wetted if dry.

All bricks are to be well buttered with mortar before being laid and all joints are to be completely filled with mortar as the work proceeds. Single frogged bricks are to be laid frog uppermost.

Brickwall shall be laid to rise four courses to the foot. All half brickwork shall be in stretcher bond. All brickwork shall be carried up uniformly, no portion under construction being raised more than 900 mm above another at any time. All perpends, quoins etc. are to be kept strictly perpendicular, true and square and every course is to be kept truly level. Brickwork of 225 mm thickness or more shall be laid in English bond unless faced, in which case lay such 225 mm wall in stretcher bond and tie each skin to other with wire ties as specified.

6.18 BUILDING IN

Build in all anchors, water stops, lintols, sills and the like and perform all sundry labours as required and as shown on the drawings as the work proceeds.

Cutting out of brickwork by other trades will not be permitted. The Bricklayer shall leave in the structure the necessary holes for pipes and other works required by any Nominated Sub-Contractor. He will do all cutting necessary and all patching and making good required after all other trades have completed their work. Neatly cut brickwork to rake at underside of stairs or roof trusses, gables, etc.

6.19 BUILDING IN WOOD FRAMES

Opening for doors, windows, vents, etc. are to be properly marked out and left unbuilt until the wooden frames have been fixed in position.

All timber frames are to build in as the work proceeds and the back of frames to have one coat of aluminium wood primer before fixing.

All door frames, window frames, vent frames, plates etc. are to be bedded in cement mortar (1:3).

6.20 KEY FOR PLASTER

All joints of brickwork to be plastered, rendered or screeded are to be raked out to form a key.

6.21 PUTLOG HOLES

All putlog holes shall be carefully, properly and completely filled up on completion of walling works and before any plastering is commenced.

6.22 TESTING

All brickwork and blockwork shall be tested in accordance with the relevant British Standards.

6.23 COMPLETION AND CLEANING DOWN

On completion, make good all damaged joints on exposed faces of brickwork and make good after all other trades.

Clean down all exposed faces of brickwork throughout with a solution of diluted hydrochloric acid and clean water and afterwards with clean water only to remove surplus mortar, stains and dirt.

6.24 FLASHINGS

Rake out joints of brickwork for flashings, rake out and enlarge joints for turn-in of asphalt where required, and point in mortar as specified for the brickwork.

6.25 SUNDRY LABOURS

Leave or form all holes, mortices, chases, etc., cut and fit brickwork around steelwork and concrete works, build in ends of cills, joists, etc., and carry out all other labours shown on the drawings or as necessary for the execution of the work.

All bolts, brackets, lugs, etc., are to be grouted or pinned in solidly with cement mortar, and holes and chases for pipes, conduits, etc., are to be packed solidly with cement mortar or fine concrete.

6.26 FAIR FACE

All exposed brickwork which is not to be plastered etc. is to be built with a fair face and pointed with a neat flush joint (internally) or struck joint (externally) as the work proceeds. The face of the brickwork is to be kept perfectly clean as the work proceeds; no subsequent rubbing down will be permitted.

6.27 FACINGS

Faced brickwork is to be carried out in special facing bricks obtained from a source approved by Engineer. Samples should be submitted toEngineer for approval before ordering.

Face work shall generally be laid out from the centre of unbroken wall surfaces and shall be symmetrical. No portion of the work shall be carried up more than one scaffold height above any adjoining part. All work shall be of the highest standard and executed only by fully competent tradesmen. Lay all work perfectly plumb, true and level and in even plans.

All face work shall be in stretcher bond. External face work shall have 9 mm square raked horizontal joints and flush vertical joints. Internal face work shall have cut and struck horizontal joints and flush vertical joints. The mortar for all joints shall be coloured to match the face work or as directed. Should the colour admixture exceed 2% (by weight) the amount specified the cement volume shall be increased by the equivalent volume of the added colouring.

SECTION 7 - PLASTERER, PAVIOR AND TILER

7.1 SCOPE OF WORK

The work described within this trade shall include all labour, tools and equipment, securement, devices, scaffolding and materials of every character and nature, and the performance of all operations in connection with all finishes. The words plastering and rendering are synonymous in meaning.

7.2 SPECIFICATION AND CODES

All applicable standard specifications and codes shall establish a minimum standard of quality and shall not be construed to be a limit of perfection or quality for any of the materials to be furnished or utilised in this work. Engineer reserves the right to select and/or accept only the best grades of standard products which in his opinion will provide finished work of recognized performance, characteristics suitable for the various and respective surfaces. Materials of questionable or unknown quality shall not be the subject of approval request.

The following specifications and codes of practice will serve as a basis for approval of minimum standards of materials applicable thereto.

Portland Cement	BS 12
Sand	BS 882, 1198, 1199, 1200
Hydrated Lime	BS 890
Plastering	Code of Practice CP 211
Metal Lathing	BS 1369, 405

7.3 GENERALLY

The Contractor should refer to the Schedule of Finishes for the location of the various types of finishes required on floor, wall and ceiling.

The following clauses describe the materials and workmanship requirements and the application of the various finishes.

All areas to receive applied finishes shall be kept free from oil, grease, paint, smoke stains, oxide stains and other deleterious substances.

All temporary holes and faults in alignments etc., shall be rectified by the various trades as the work progresses.

All fixing, conduits, pipes, sleeves, junction boxes, etc., of all trades shall be correctly located and securely fixed and anchored in position before the plasterer commences work.

Touching up or making good to render after other trades shall only be executed by skilled plasterers.

The work shall be carried out in an approved sequence to allow all following trades to comply with the time schedule, e.g. a time allowance shall be made for a sufficient drying out period of plastered or rendered surfaces to allow for the application of paint or other applied finishes.

If cracks, blisters or any other faults in rendered or plastered work appear at any time before the expiration of the maintenance period, they shall be cut out, stopped, pointed and made good and the whole walls or areas affected must be re-painted, all to the satisfaction of and as instructed by the Engineer.

All surfaces to be plastered or screeded, including previous coats, are to be brushed down to remove all dust and loose material and are to be well wetted.

All undercoats and screeds to receive tiling, paving, etc., are to be well scratched with a wire comb or trowel to form a key.

Each coat of plaster or screed is to be prevented from drying out too rapidly where necessary by spraying with water or other means, as directed by Engineer.

Undercoats and screeds are to be allowed to set for at least seven days before application of the following coat or of the tiling, paving, etc.

Finishing coats are to be perfectly even and true, and of consistent finish.

The Contractor shall be responsible for finishing floors flush with all margins against which they abut. Special care must be taken to protect the underbed surface until handed over to those responsible for the laying of the floor covering.

The various sub-contractors concerned in laying floor finishes shall upon laying the first place of their products automatically accept without reservation the base upon which it is laid and the edges up to which it finishes and no subsequent claim as to the suitability or otherwise of the base and finishes will be considered.

Any portions of the works which become drummy or loose shall be cut out and relaid without extra cost to the Employer.

Floor finishes shall not be laid until wall and ceiling finishes are complete.

7.4 MATERIALS

The materials used for finishes shall be of the same quality as the materials described for concrete.

Cement shall be as specified under "Concretor".

Sand shall be clean sharp pit or river sand free from loam or vegetable matter and well screened. If there is any sign of vegetable or loamy matter in the sand it must be sieved and washed before using to the satisfaction of the

Architect/Engineer, coarse for first coat and fine sieved for the finishing coat, 100% to pass a No. 7 BS sieve.

Hydrated lime shall be as described in "Bricklayer".

Plasticiser shall be of the approved type and shall be mixed strictly in accordance with the manufacturer's instruction and to BS 4887.

The Contractor shall assure himself that water-proofing agent selected are chemically compatible with other additives of finishes.

Water shall be fresh, clean and free from deleterious matter, used in measured quantities sufficient to maintain correct regular plasticity.

Water-proofing compound shall be as specified or equal and approved compound used in conjunction with the manufacturer's instruction.

7.5 MIXING

All materials for rendering and screeding shall be accurately gauged by volume mixed thoroughly in a dry state and again mixed with water to an even consistency on proper watertight boarded platform.

Materials which have taken their initial set must not be re-tampered or re-used.

Mixing Boxes shall be kept free of all set or hardened materials. The mixes shall consist of materials described above in the proportion as herein stated.

7.6 PREPARATION OF SURFACES

(a) Preparation of Brick and Masonry Surfaces

All joints to brickwork, blockwork, masonry, etc. to receive other finishes are to be thoroughly raked out not less than 9mm deep to form a key. All such surfaces are to be well wetted immediately before the application of applied finishes.

(b) Preparation of Concrete Surfaces

All concrete walls, columns, beams and soffits to be plastered or rendered are to be treated with a slurry of cement and coarse sand (1:2) mixed to the consistency of a thick slurry either thrown on as a spatterdash coat or brushed or stippled. The slurry is to be applied immediately after removal of the formwork and is to be wetted with water one hour after application and left to harden. Any concrete surfaces which have been allowed to mature before slurrying are to be lightly hacked all over to form a key, wire brushed down, well wetted and slurried. Before any plaster and screed is applied the spatterdash shall be lightly brushed to remove loose particles, dust, etc. and well wetted with water.

7.7 CEMENT AND SAND SCREED

Cement and sand screeds are to be laid as required for floor or roof finishes or wall tiles, shall be finished even and true to the exact line, level or falls required.

Screeds to receive tiles bedded in cement mortar are to be scratched to form keys; those to receive thermoplastic and similar pavings bedded in mastic or adhesive are to be finished smooth, all to the satisfaction of the Engineer and the Sub-contractor applying the floor finish. All screeds to be fully bonded to concrete base.

No screed is to be less than 12mm thick unless otherwise specified. Screeds for pavings are to be adjusted in thickness to allow differing adjacent pavings to finish at the same level.

All screeds are to be (1:3) cement and sand mix.

Finish described as water-proof shall be as above but shall have approved water-proofing additive used strictly in accordance with the manufacturer's instructions.

All wall backing screeds to receive ceramic and mosaic tiles are to be mixed with approved adhesive cement as described in the Bills of Quantities and installed strictly in accordance with manufacturer's instructions.

7.8 CEMENT PAVING

Cement paving shall be of cement and sand (1:3) of the thickness required. It shall be laid in alternate bays not exceeding 3.60 metre in either direction, unless otherwise approved and is to be finished with a hard steel trowelled surface. Excessive trowelling, resulting in formation of "laitance", is to be avoided. The concrete surface to receive paving shall be prepared as described before.

Joints shall be filled with approved sealing compound.

Paving is to be damp-cured for at least seven days after laying by covering with sand or sacking kept wet or by other approved means.

7.9 COLOURED CEMENT PAVING

Coloured cement paving is to be as specified for cement paving, but with approved coloured cement or an approved colouring compound. Mixing is to be thorough to ensure even colouring, and care is to be taken to ensure matching of successive mixes by exact proportioning and by use of matching aggregates. Paving of irregular colouring will not be accepted.

7.10 CEMENT SKIRTINGS

Cement skirtings where required are to be formed in cement and sand (1:3) of the height and profile specified, and are to be trowelled smooth. On flush skirtings a 12mm wide V-joint is to be formed at the junction with the plaster over; projecting skirtings are to be finished with a rounded top edge. Skirtings over cement pavings are to have a 12mm diameter cove at the junction with the paving.

All mitred angles, stop ends, etc. are to be neatly formed.

Coloured cement skirtings are to be coloured as described above for paving.

7.11 CEMENT AND SAND PLASTER

(a) Workmanship to Plastering

All plastering work shall be carried out by competent tradesmen and approved equipment.

The Plastering Sub-contractor shall comply with all relevant "Codes of Practice" and shall generally satisfy himself that all surfaces to be rendered are in a satisfactory condition and have imperfect and unsatisfactory backgrounds rectified before commencing work.

Clean all surfaces with heavy wire brush to remove all dust, dirt or loose rust from metal work. All pipe conduits, etc., shall be correctly chased in and well anchored and of sufficient depth to permit satisfactory concealment without surface blemish to rendering. All temporary grounds and screeds shall be fixed and sufficient thickness shall be allowed to finish on correct plane.

All permanent grounds and fixing plugs shall be correctly located and fixed, all expanded metal wrappings, etc., shall be securely fixed over lintels, joints between different materials, banks of conduits, pipes, expansion joints where applicable and other similar conditions before rendering.

Render coats shall be applied with sufficient pressure to thoroughly fill all voids, chipping, chasings, rakings, etc., and of thickness 12mm nominal, 6 mm minimum, 19mm maximum in one operation screeded off.

Heavily cross scratch render coats before initial set to provide mechanical key.

All coats shall be wetted before commencing succeeding coats.

All surfaces shall be finished flat, even, straight, level and plumb, hard and true and free from cracks, stains, blisters, water marks, and other imperfections. All angles shall be straight and true and all curved surfaces even and true to radius, with small "V" joints formed straight and regular at junctions with other materials.

Where practical each coat in any one plane shall be finished in one operation.

When undercoats are thoroughly set and dry then apply the next coat. Unless otherwise stated, all rendered surfaces shall be carried out at least 50mm above the level of false ceilings.

Finishes shall be carried behind all fittings, whether built in or not, down to floors where paved skirtings do not occur and hard up to all jambs and frames, turned into window reveals, beads and across sills where tile finish is not specified and into jambs and heads of all other external windows.

Carry out work during suitable weather conditions and obviate effects of uneven suction.

Protect all openings to prevent draughts. All finished work shall be protected against damage. In the event of accidental damage the work shall be repaired immediately by competent tradesmen and as directed by the Engineer.

Cement render surfaces shall be kept moist by regular spraying for seven (7) days after application.

(b) Angles

External angles on internal or external plaster are to be slightly rounded, and internal angles are to be slightly coved.

(c) External Plastering to Wall and Column

Unless specified otherwise on the drawings or described otherwise in the Bills of Quantities, plastering to external concrete walls, column, brickwall, etc. shall be carried out in two (2) coats as follows:-

(i) 10mm Undercoat of cement and sand (1:3 by volume)

(ii) 10mm Finishing coat of cement, lime and sand (1:1:6 by volume), finished with a steel trowel or wood float as directed.

Unless specified otherwise on the drawings wall and column above false ceiling shall be plastered accordingly.

Under no circumstances shall the total thickness of the plaster be exceeding 50mm. If the total thickness of the plaster has to be exceeding 50mm in order to achieve the required verticality of the finished wall or column, the Contractor shall, at his own cost, propose to the Architect/Engineer for approval a method statement for carrying out the

Work satisfactorily and all cost involved in this additional work to the plastering work shall be borne by the Contractor.

(d) Internal Plastering to Wall and Column

Unless specified otherwise on the drawing as described otherwise in the Bills of Quantities, plastering to internal brickwork and blockwork, concrete wall and column shall be carried out in two (2) coats as follows:-

(i) 8mm Undercoat of cement and sand (1:3 by volume)

(ii) 8mm Finishing coat of cement, lime and sand (1:1:6 by volume), finished with a steel trowel or wood float as directed.

Unless specified otherwise on the drawing, wall and column above false ceiling shall be plastered accordingly.

(e) Plastering to Soffit of Concrete Slab and Sides and Soffit of Beams

Unless specified otherwise on the drawing or described otherwise in the Bills of Quantities, plastering to concrete soffit and beams is to be carried out in two (2) coats as follows:

(i) 8mm Undercoat of cement and sand (1:3 by volume)

(ii) 8mm Finishing coat of cement, lime and sand (1:1:6 by volume), finished with a steel trowel or wood float as directed.

Unless specified otherwise on the drawings, no plaster to concrete slab and sides and soffit of beam behind false ceiling.

7.12 WORKMANSHIP TO PAVING/TILING

(a) Generally

All work shall be executed by experienced tradesmen in accordance with the specification and to the satisfaction of the Engineer.

The Contractor must ascertain and finish the work to the exact requirements of Sub-contractors for respective applied finishes.

Materials shall be mixed in sufficient quantities for immediate use and not to be used after one hour has elapsed from the addition of water. Gauges are not to be mixed with each other or old stuff retempered.

Screeds and pavings shall be laid and finished to a true and even surface and to the exact thickness as described.

All render or tile work on walls shall be completed and rooms and spaces kept clear of all plant and other equipment before commencing the floor screeding and laying of finishes.

No paving shall be applied in unsuitable weather unless adequate protection is arranged before hand to the approval of the Engineer.

The Contractor or his Sub-contractors must satisfy themselves as to the suitability of all surfaces by testing with a meter or standard chemical processes that the correct requirements are obtained prior to laying any covering.

They shall report in writing to the Engineer any condition which in their opinion will affect the satisfactory execution of their work or endanger its permanency as it will be considered.

Paving or finishes shall not be applied on any work which may be unfinished, imperfect, wrong or in an improper condition to receive pavings and such work shall not be covered up or finished against until same has been rectified and authority to proceed given by the Engineer.

The Contractor or the Sub-contractor are required to do all making good of work described in this trade after all other trades.

The Contractor shall make certain that any curing compound used shall be guaranteed to bond all types of vinyl tiles or sheet flooring.

The Contractor shall provide for proper curing of all hard surfaces, floors and screeding by keeping surfaces well wetted to prevent premature or quick drying. All finished floor surfaces shall be adequately protected from damage.

(b) Surface Finishes

The surface finish of floor base screeds and applied finishes shall be in all cases finished to the heights above the structural concrete slab as indicated on the drawing. The nominal thickness of screed shall vary to take up the different thicknesses of floor coverings as specified or indicated on the drawings.

All floor finishes where required shall be graded evenly to out-lets so that no floor holds "Standing Water". Unless otherwise specified, the finished floor shall have a minimum average thickness of 25mm.

7.13 GLAZED WALL TILING

Glazed wall tiles are to be sound and free from cracks and crazes, and are to be of regular size and shape and even colour.

Tiles are to be bedded on to the prepared backing screed as described using cement grout or approved waterproof adhesive and the joints are to be grouted in white cement. Tiles are to be soaked in water for at least three hours before laying.

Tiles are to be laid to regular line and pattern as required, with even joints not exceeding 1.5mm wide. Tiling to ends of walls, faces or piers, or other narrow surfaces between two external angles is to be set out symmetrically in the width. Tiling is to be set out where possible so that cut tiles occur only at internal angles. Where cushion edged tiles are used, no cut edge of a tile is to abut an uncut edge except at an internal angle; otherwise, both tiles are to be cut. Tiles are to be sorted and set out so as to minimise the effect of any unavoidable minor variation in colour.

All cutting is to be neatly and accurately carried out. Holes for screws or bolts are to be drilled with a special drill, and not cut.

Unless otherwise specified, tiling at external angles and exposed edges such as tops of dadoes and edges of splashback is to be finished with rounded-edge tiles, with the correct special fittings for all angles thereon.

Wall tiling is to be laid to project, slightly more than the thickness of the tile in front of the adjacent wall plaster; the thickness of the screed under is to be such as to ensure this.

7.14 MOSAIC TILING

Mosaic floor tiles shall be as specified or other equal and approved of selected colours, fixed face downwards with an adhesive paper backing to patterns or designs as selected by the Engineer. The mosaic tiles shall be transferred to the cement screed surface and when dry, the paper shall be washed off. The joints of the tiles shall be filled with cement grout composed of one part of cement to one part of sand (1:1). When the grout has set, all surplus grout shall be cleaned off and the whole surface covered with a layer of sand as directed.

Mosaic tile floors shall be laid on cement and sand (1:3) screed to make up the total thickness as required and be made to fall evenly towards water outlets.

Mosaic tiles skirtings shall be formed on cement and sand (1:3) screed to the height and total thickness as required. Provide bottom courses on splay at junction with floor paving.

7.15 CERAMIC, HOMOGENEOUS AND QUARRY TILE

(a) Generally

All tiles shall be as specified and laid by tile layers approved by the Engineer to pattern provided during the Construction period

All tiles shall be properly set out, prior to laying, to ensure that the joints are regular and continuous, and to minimise unsightly cutting. Tiling shall be carried out such that joints locations and flooring patterns meet with approval.

All tiling work shall be laid to pattern as directed or approved by Engineer. The Contractor shall agree patterns, joints patterns and locations with the Engineer before commencing on the work. No claim made on grounds of failing to include this requirement in the contract sum will be entertained.

Provide a layer of sawdust or other approved protective covering over newly completed tiled floors and maintain and renew as necessary, and clear away on completion and clean, polish and leave floors in perfect condition.

The work shall be guaranteed by the Contractor for a period as required against defects in materials and workmanship. Areas becoming drummy, sweating, discolouring or showing other defects shall be removed and replaced at the Contractor's expense.

(b) Materials

All tiles used shall be as specified and of approved brand, colour, pattern and manufacture. The Contractor shall submit samples and/or coloured catalogues to the Engineer for selection and approval before placing any order.

All joints in floor and wall tiles are to be pointed in white cement tinted to match the colour of tiles.

All tiles shall be of first grade quality.

(c) Laying

Screed shall be laid after concrete slab has been thoroughly roughened, cleaned, wetted and spread with a layer of neat cement slurry. Screed shall be 1:3 cement and sand. The setting bed for floor tiles shall be of neat cement grout of the right consistency.

The wall tile shall be set to the backing screed with neat mastic adhesive cement which shall be a chlorinated and isomerized rubber based waterproof adhesive of approved manufacture. Unless described otherwise backing screeds for wall tiles are to mix with ‘Laticrete’ or equal and approved synthetic glue to manufacturer's instruction. Wall tiles could be bedded on to the backing screed in neat cement grout only if the Engineer approve it. All tiles after pointing are to be thoroughly cleaned and polished to the satisfaction of Engineer.

(d) Certificate of Quality

A certificate of Guarantee of Quality from the manufacturer shall be produced to ascertain that tiles supplied (wall and floors) are of first grade quality.

7.16 EXPOSED GRANOLITHIC PAVING

Exposed granolithic paving shall be laid to the thickness specified or shown on the drawings.

Exposed granolithic paving shall compose of 2 parts cement, one part of clean washed sand and 5 parts of granite chippings. The granite chippings should be able to pass a 13mm sieve and retained by a 5mm sieve; the chipping shall be thoroughly washed and free from dust. The composition of the granolithic paving may be varied only with the express approval of the Engineer.

Paving shall be finished to a perfectly smooth, trowelled and even surface, or finished to falls as required. Just prior to finish setting of the paving, brush surface with a sponge or wire brush to expose chipping surfaces and wash out cement with clean water. The whole of the finish surface shall be free from discolouration and in perfect finish to the satisfaction of the Engineer.

Cure granolithic paving finish for 7 days by keeping damp.

7.17 JOINTS IN TILING

Grout all joints in tiling work with neat white Portland Cement and point all joint to form a smooth flush surface.

All vertical and horizontal joints shall be accurately formed so as to be uniformly even and true plumb and level in both directions.

Where required grout shall be coloured to match the tiles. All joints between plumbing or other built in features shall be made with light coloured mastic non oil migrating caulking compound.

7.18 JUNCTIONS

Where floor finish materials differ on either side of doorways, materials shall be joined under doors.

7.19 COVERED WORK AND FIXING THROUGH TILES

The Contractor and his tiling contractor shall note that they shall not proceed with the installation and setting of any tile work that covers and conceals the work of the mechanical and other trades until it has been inspected, tested and approved for concealment.

All like work set around pipes fittings and fixtures shall be neatly and accurately cut after scribing profiles required so as to fit tightly around same.

Fixing through tiles for wall fittings shall be done by the tile layer who shall do all necessary drilling and take delivery of and fix expansion bolts or screw fixings from other trades as required.

7.20 CARPET

Carpet shall be as specified or other equal and approved type.

Sample shall be submitted for approval prior to placement of orders. Sample shall also include underlay and other accessories.

The Contractor shall submit drawings showing positions of all seams and obtain the Engineer’s approval before commencing work.

Before laying carpet, all work by other trades in the area and vicinity shall be kept out of the area.

The temperature of the area shall be maintained within the manufacturer's recommended limits during installation. When using adhesives, provide adequate ventilation and take all necessary fire precautions.

Prior to the laying of carpet, the sub-floor shall be prepared in accordance with the manufacturer’s recommendations. Remove foreign substances such as oils, greases, loose material, etc. and leave surface dust-free and clean. Surface finish shall be made good where necessary. Remove protruding nails and other projections. Level uneven concrete surfaces to the approval and satisfaction of the Engineer. The sub-floor shall also be satisfactorily dry before commencing laying. The carpet shall be cut and butt up to those permanent partitions.

Generally, carpet shall be laid flat, accurately fitted, free from defects including warping, wrinkles, twists and the like, with seams keep straight and paralleled to the walls, and taut enough to withstand movement by furniture without rucking and all to the satisfaction of the Engineer.

The underlay shall be of the approved type and have an estimated life not shorter than that of the carpet. The underlay shall also be compatible with the carpet and non-shrinking to the extent that no evidence of cracks shall be visible when the carpet is laid. The underlay should also be non-staining and able to withstand normal traffic without indenting, deforming or losing its attachment to the sub-floor.

During laying, the work shall be progressively clean, removing waste, excess materials, adhesive, etc.

When the laying is complete, remove waste, temporary fastenings, etc. Examine for and correct defects including lumps, looseness, air-pockets if bonded, and the like. When the installation is complete and after any adhesive bonding has set, clean the whole carpet by industrial vacuum machine or such method as may be recommended by the carpet manufacturer or as instructed by Engineer or as necessary to remove all extraneous matter, marks, soiling and the like and to lift the pile where appropriate.

After the final cleaning, lay a suitable cover over the carpet to protect it from damage. Do not allow condensation to form under the cover. Remove the cover as required by the Architect/Engineer during inspection, make good any defects and leave the whole fit for immediate occupation and use.

6.21 VINYL SHEET FLOORING

(a) Material

The vinyl sheet flooring shall be as specified or other equal and approved vinyl sheet which shall be fully flexible conform to BS 3261 and shall have qualities of quietness, resilience, resistant to heel and castor damage, durability, grease resistance and acid/alkali resistance.

(b) Laying

The vinyl sheet shall be laid on a prepared surface with an approved dispersion adhesive and thermal welded at seams. The Contractor shall submit shop drawing to show laying pattern and positions of seams for the approval of the Engineer prior to laying.

Prior to handing over, the Contractor shall clean and polish the entire floor. The floor must first be cleaned to remove all dust, scrubbed with the application of an approved treatment to remove all stains, sealed with approved wax.

All laying procedures and methods shall be in strict compliance with the manufacturer's instructions and recommendations.

(c) Application/Surface Preparation

The floor receiving the vinyl sheet shall be inspected to ensure that it is dry, clean, level and free from moisture, grease or chemical and cracks.

Apply a levelling compound to the screeded floor to receive the vinyl sheet.

The whole works shall be completed by the Contractor, cleaning, sealing and waxing the whole floor before handing over.

All works shall be carried out in accordance with the recommendations of the manufacturer.

7.22 VINYL TILES FLOORING

(a) Material

The vinyl tiles flooring shall be as specified in the “Schedule of Finishes” or other equal and approved vinyl tiles which shall be fully flexible conform to BS 3261 and shall have qualities of quietness, resilience, resistant to heel and castor damage, durability, grease resistance and acid/alkali resistance.

All vinyl tiles of the same kind shall be consistent in colour, pattern and tone. The Contractor shall, at his own cost, replace any vinyl tiles which after laying fail to achieve a consistent colour, tone or pattern throughout.

(b) Laying

The vinyl tiles shall be laid on a prepared surface with an approved dispersion adhesive. The Contractor shall submit shop drawing to show laying pattern and positions of joints for the approval of the Engineer prior to laying.

Prior to handing over, the Contractor shall clean and polish the entire floor. The floor must first be cleaned to remove all dust, scrubbed with the application of an approved treatment to remove all stains, sealed with approved wax.

All laying procedures and methods shall be in strict compliance with the manufacturer's instructions and recommendations.

(b) Application/Surface Preparation

The floor receiving the vinyl tiles shall be inspected to ensure that it is dry, clean, level and free from moisture, grease or chemical and cracks.

Apply a levelling compound to the screeded floor to receive the vinyl tiles.

The whole works shall be completed by the Contractor, cleaning, sealing and waxing the whole floor before handing over.

All works shall be carried out in accordance with the recommendations of the manufacturer.

7.23 NON-SLIP NOSING TILES

Unless otherwise shown on drawings, approved type and colour non-slip ceramic nosing tiles are to be provided and laid to treads of steps and edges of drops and to other areas as shown on drawings or as directed by the Engineer. The non-slip ceramic nosing tiles shall be properly laid and bedded on cement and sand (1:3) screed to the approval and satisfaction of the Engineer.

7.24 DIVIDING STRIPS

Provide aluminium or brass dividing strips of 3.2 x 25mm continuous section at junction of and flush with different pavings, including those laid by Sub-contractors. This applies to all in-situ and tile pavings, and to divisions between such pavings and wood flooring, but not to divisions between different types of wood flooring. Strips are to be indented or perforated for key, and are to be laid to accurate line and level.

Similar strips are to be laid in squared or patterned pavings where specified; for curved work or where so specified, black ebonite strips of approved pattern are to be used.

7.25 SLEEVES

Where pipes are brought through the floors the finish must be cut neatly around sleeves inserted by the Contractor or Sub-contractor and must not finish against the pipes themselves. Where external downpipes or service pipes pass through slabs balconies or flat roofs form kerb against sleeves and cove to floor.

7.26 COVERS AND BASES

Cast iron or concrete covers or bases to fittings and recesses shall be finished to match adjacent floor finishes margins and skirtings except where bases are fully covered they shall be finished as a monolithic finish.

7.27 FLOOR CHASES

Floor grates and floor chases shall have sides and bottoms finished to match adjoining floor finishes and the bottom graded to outlets. Where not discharging directly to sumps they shall have 38mm G.W.I. waste outlet built in and fitted with screwed brass grating flush with floor of chase and discharge into nearest downpipe or stormwater drain.

7.28 BASES FOR FITTINGS

Floor finishes shall be carried under all fittings such as W.C. pans, etc., and shall be laid before fitting is connected. Where squat pan tops are set in floor finish a 6mm gap shall be left between pan top and tiling and full depth finished with waterproof caulking and finished with 6mm x 6mm bead of an acid alkali and detergent proof anti-bacteria composition of approved kind.

7.29 SAMPLES

The Contractor shall submit free samples of all finishes for approval and shall complete the work in accordance with the approved samples.

7.30 SUNDRY LABOURS

Plaster, screeds, paving and tiling are to be neatly made good around pipes, brackets, stays, etc. Where plaster, etc. has to be cut away for these the hole is to be formed to a regular outline, with the edges of the plaster undercut to form a key; the plaster in making good is to be finished flush with the surrounding plaster and later rubbed down.
Screeds and paving are to be formed to channels as required and dished to outlets.

7.31 CURING

All finishes containing cement laid in a plastic state shall be protected from damage and premature drying by a covering until the finish is thoroughly cured. Absorbent coverings shall be kept well watered at all times.

7.32 PROTECTION

Protect all other work from damage by standing or mortar droppings.

Finished pavings shall be protected with building paper, hessian or sand as required, maintained in position and in the cases of cement pavings or screeds, kept damp to prevent drying and kept clear of traffic for not less than fourteen days.

No traffic is to be allowed on any paving until it has set or hardened sufficiently to allow this without damage. All pavings, including those laid by Nominated Sub-contractors, are to be covered up and protected as necessary.

7.33 SHANGHAI PLASTER

Shanghai plaster shall consist of 16mm thick layer of cement and sand (1:3) render coat and 10mm thick finishing coat. The finishing coat shall be composed of 2 parts of cement and 5 parts of granite chippings (to pass 10mm mesh and graded to 5mm). The finishing coat shall be applied to the rendering before the latter commences to set; when the finishing coat is about to set the surface shall be gently brushed with a soft, wet brush to expose the stone chippings. The concrete surfaces to receive shanghai plaster shall be thoroughly cleaned and wetted before the render coat is applied.

All shanghai plaster surfaces shall be properly cured and apply with 2 coats of ‘SKK’ or equal and approved polyurethane clear finish, all in strict accordance with the manufacturer’s recommendation.

7.34 WATERPROOFING SYSTEM

Waterproofing system to all wet areas and areas as shown in the drawings shall be as specified or other equal and approved system.

All waterproofing shall be laid or applied by approved Specialist Contractor or Applicator laid in strict accordance with the manufacturer's instructions. A certificate from the manufacturer attesting the specialist contractor or applicator status shall be submitted to the Architect/Engineer before commencement of waterproofing work.

All surfaces shall be handed over to waterproofing applicator clean, free from dust and dirt, loose particles, laitance, oils, curing agents, etc., smooth, level and free from structural defects.

The various waterproofing specialist contractor or applicator concerned shall upon laying the first place of their product automatically accept without reservation the base upon which it is laid and no subsequent claim as to the suitability or otherwise of the base and finishes will be considered.

Upon completion of the waterproofing system, the Contractor shall at his own expense and in the present of Engineer's representative carry out flood test (ponding test) to the waterproofed area for 48 hours prior to the installation of protective course. The Contractor shall plug drains and outlets and place barriers to contain the water. Value for waterproofing work executed will be included in the interim payment only when the said work has been tested to the Engineer's satisfaction.

The Contractor shall, jointly and severally with the manufacturer and specialist contractor/ applicator, provide a waterproofing guarantee to the Employer for a period of ten (10) years against defective material and workmanship. The guarantee shall commence upon Practical Completion of the whole project.

The Contractor shall make good any such defects appearing within the said guarantee period at his own expense and to the satisfaction of the Engineer. If the Contractor shall fail to do so for seven days after notice in writing of a defect from the Engineer or Employer, the Employer shall be entitled to engage others to make good the same and charge the cost thereof to the Contractor.

All guarantee shall be lodged with the Engineer before the date of Practical Completion.

SECTION 8 - ROOFER

8.1 GENERAL

All roofing shall be thoroughly watertight on completion and if any defective material or workmanship be found on finishing, it shall be stripped out and relaid by the Contractor at his own expense. All roofing work shall be carried out by the skilled tradesmen.

8.2 METAL ROOFING DECKING

Metal roof decking shall be the proprietary product as specified or shown on the drawings and shall be free from twist, buckle or other surface imperfections. All metal roofing decking shall be in continuous lengths. The Contractor shall provide a complete details of the type, sections, fixing method, etc of the roof decking for the Engineer's approval prior to installation.

Metal roofing decking shall be installed with approved fixing clips, fasteners and accessories in strict accordance with the manufacturer's instructions and recommendations and to the satisfaction of the Engineer.

Roofing sheet fixed to curved roof shall be sprung curved. All sheeting to be rolled on site in order that the sheet length can be achieved without end lapping.

(a) 'UGI' Unilok Clean Colorbond Roof Decking

Where specified, the 'UGI' Unilok Clean Colorbond metal roofing sheet shall be as manufactured by Messrs. United G.I. Product Sdn. Bhd. or other equal and approved type complying with AS 1397 with a total coated thickness of 0.48mm and weight 4.91 kg/m2.

Colour of roofing shall be selected by the Engineer.

(b) Coated Steel Roof Cappings And Accessories For Metal Roofing

Ridge, hip and fascia cappings, flashings, external and internal corner pieces etc shall be of the same gauge, material and finish as that of the main roof fixed in strict accordance with the manufacturer's instructions and to the satisfaction of the Engineer.

Fixing accessories and fasteners shall comprise cadmium plated or hot-dip galvanised steel fasteners and neoprene washer, use approved screws with seal for main roof and for capping, flashing and side-laps. Screws may be power driven or nailed as appropriate.

(c) Handling and Storage of Coated Steel Roof Cladding And Accessories

All metal roofing materials shall be stored, handled and shipped in a manner that will ensure unscratched and undamaged units delivered to site. Storage, handling and shipping procedures shall be as stringent as necessary to avoid scratches, abrasions, corrosion and damage.

Packs of sheets shall be kept dry in transit and on site to prevent water and/or condensation being trapped between adjacent surfaces. Packs of sheets standing on site shall be stored clear of ground. On no account must the materials be left in the open and exposed to the weather.

(d) Workmanship, Installation And Protection

Installation of coated steel roof, fascia wall cladding and gutters shall be carried out strictly in accordance with the manufacturer's instructions.

End lapping will not be permitted unless with the specific permission from the Engineer. In the event that end lapping is required and permitted by the Engineer any additional cost will be at the Contractor's expense.

Under no circumstances must lead or copper bared materials be in contact with the coated steel sheets and this extends to ensuring that water running off lead or copper bared materials do not fall onto coated steel materials.

Bare copper wire should not be installed over the coated steel sheets nor should copper conductors be so placed that moisture condensing on them can affect the coated steel surfaces.

On completion of the works, all debris and sheets cut-offs must be removed from the roof surface and all scratched surfaces on roof, fascia and wall surfaces shall be cleaned, primed and touch up in strict accordance with the manufacturer's instructions. Panels which are badly scratched shall be replaced as instructed by the Engineer.

8.3 FIBREGLASS INSULATION

Provide one layer of fibreglass insulation quilt with a nominal weight as specified to the underside of metal roofing as indicated on the drawing, properly laid over galvanised chicken wire mesh or galvanised square grided mesh as specified.

The roofing sheets shall be fixed in position immediately after the laying of insulation and no insulation will be allowed to be exposed to the weather. Temporary protective coverings shall be provided by the Contractor to protect the insulation from weather if the roofing sheets cannot be laid immediately.

8.4 ALUMINIUM FOIL

Provide aluminium foil as specified to the underside of metal roof as shown on the drawings. All joints shall be tapped with approved tape to the Engineer’s satisfaction.

Aluminium foil shall be laid in accordance with the manufacturer's instruction and approved by the Engineer.

8.5 CHICKEN WIRE MESH

Unless specified otherwise on the drawings, chicken wire mesh used shall be in 38mm x 38mm x 26 gauge or equal and approved size.

8.6 UPVC RAINWATER DOWNPIPES

Unless specified otherwise on the drawings or described otherwise in the Bills of Quantities, all unplasticised polyvinyl chloride (UPVC) pipes specified for use in rainwater installation shall be 'BESSTEM' or equal and approved complying with BS 4576:1970 and approved by SIRIM. UPVC pipes to be casted in concrete column and structure shall be of heavy duty type recommended by the manufacturer.

The tubing is to be jointed in accordance with the manufacturer's instructions by the "Sleeve" method, using the solvent cement recommended by the manufacturer. All tees, reducing sockets, elbows and other fittings are to be those specially made for use with the tubing.

Bends in pipes may be formed by filling the tube with sand and gently heating over the entire surface to approximately 130 degrees C, then cooling with water.

UPVC tubing is to be secured to walls at approximately 1350mm centres with pipe brackets of approved pattern. The brackets must be fixed to allow expansion and contraction of the tubing without damage.

8.7 RAINWATER OUTLET AND GRATING

Unless specified otherwise on the drawing, 'BESSTEM' or equal and approved UPVC dome outlet grating shall be provided to the top of each rainwater outlet.

Approved 'BESSTEM' pipe sleeve should be casted in the concrete slab while the work proceeds for the installation of concrete roof and balcony outlet and grating and waterproof the outlet with approved waterproofing compound to ensure no water leakage, all as recommended by the manufacturer.

8.8 GUARANTEE FOR ROOFING WORKS

The Contractor shall jointly and severally with the manufacturer provide a roofing guarantee to the Employer for a period of ten (10) years against water leakage, colour fading and defective material and workmanship. The guarantee shall commence upon Practical Completion of the whole project.

The Contractor shall make good any such defects appearing within the said guarantee period at his own expense and to the satisfaction of the Engineer. The Contractor shall also make good all consequential damages such as finishes and other work of similar nature caused directly or indirectly out of the said defects. If the Contractor shall fail to do so for seven days after notice in writing of a defect from the Architect/Engineer or Employer, the Employer shall be entitled to engage others to make good the same and charge the cost thereof to the Contractor.

All guarantees shall be lodged with the Architect/Engineer before the date of Practical Completion.

8.9 WATERPROOFING SYSTEM

Unless specified otherwise on the drawing, all concrete flat roof, concrete gutter and all other areas as specified to be waterproofed shall be waterproofed with the proprietary waterproofing system as specified.

Waterproofing shall be brought up 300mm onto the wall of concrete roof slab and concrete gutter, and dressing around and into outlet all in strict accordance with the manufacturer's instruction and recommendation.

The whole roof waterproofing system shall be executed by approved specialist contractor or applicator in strict accordance with manufacturer's instructions and specification. A certificate from the manufacturer attesting the specialist Contractor or applicator status shall be submitted to the Engineer before commencement of waterproofing work.

All surfaces shall be handed over to waterproofing applicator clean, free from dust and dirt, loose particles, laitance, oils, curing agents, etc., smooth, level and free from structural defects.

The various waterproofing specialist contractor or applicator concerned shall upon laying the first place of their products automatically accept without reservation the base upon which it is laid and no subsequent claim as to the suitability or otherwise of the base and finishes will be considered.

Provide collars, sleeves, etc at areas where pipes, conduits, outlets, etc are found, and properly seal and ensure watertightness, all in strict accordance with manufacturer's details.

Protect membranes until covered by subsequent construction or handing over.

Upon completion of the waterproofing system, the Contractor shall at his own expense and in the present of Engineer's representative carry out flood test (ponding test) to the waterproofed area for 48 hours prior to the installation of protective course. The Contractor shall plug drains and outlets and place barriers to contain the water. Value for waterproofing work executed will be included in the interim payment only when the said work has been tested to the Engineer's satisfaction.

The Contractor shall jointly and severally with the manufacturer and applicator, provide a waterproofing guarantee to the Employer for a period of ten (10) years against defective material and workmanship. The guarantee shall commence upon Practical Completion of the whole project.

The Contractor shall make good any such defects appearing within the said guarantee period at his own expense and to the satisfaction of the Architect/Engineer. The Contractor shall also make good all consequential damages such as finishes and other work of similar nature caused directly or indirectly out of the said defects. If the Contractor shall fail to do so for seven days after notice in writing of a defect from the Engineer or Employer, the Employer shall be entitled to engage others to make good the same and charge the cost thereof to the Contractor.

All guarantee shall be lodged with the Engineer before the date of Practical Completion.

SECTION 9 - CARPENTER, JOINER & IRONMONGER

9.1 SCOPE OF WORK

Scope of work shall consist of furnishing all labour, tools and materials of every nature and perform all operations in connection with installation of all rough temporary and permanent work.

The Contractor shall provide all labours necessary for the proper execution of the work to the true intent of this specification and the accompanying drawings.

The Contractor shall include for the manufacture, delivery to the site and fixing in the building of all joinery work.

Except where special finish is stated the Contractor shall have all floors, stairs, landings and other joinery works cleaned down and scrubbed and shall leave the whole of his work in good order, and to the complete satisfaction of the Engineer.

9.2 TIMBERS

All timbers shall be first quality the best of their respective kinds and shall hold to the full sizes specified. They shall be thoroughly seasoned, free from shakes, vein, bores, borer holes and other defects. All timbers shall be sawn square to the specified sizes, allowance being made only for saw cut and dressing. Timbers showing signs of borer or other defects shall be condemned and must be removed from the site.

All timbers shall be graded in accordance with the Malaysia Grading Rules by timber graders and approved by Sarawak Timber Industry Development Corporation (STIDC).

Timbers for “Carpenter” shall be one of the following types unless otherwise specified on the drawings or described in the Bills of Quantities, or approved in writing by the Architect/Engineer.

(a) For structural purposes (posts, beams, struts, rafters, joists, etc.)

Heavy hardwoods classified under ‘Manual of Sarawak Timber Species - Properties And Uses’ Second Edition, 1987 published by Sarawak Timber Industry Development Corporation.

(b) For other carpentry (plates, studs, noggings, battens, wall boarding, flooring, etc.)

Medium hardwoods classified under ‘Manual of Sarawak Timber Species - Properties And Uses’ Second Edition, 1987 published by Sarawak Timber Industry Development Corporation.

(c) For joinery (doors, windows, wall boarding, fitting, skirting, etc.)

Medium hardwoods classified under 'Manual of Sarawak Timber Species - Properties And Uses' Second Edition, 1987 published by Sarawak Timber Industry Development Corporation.

9.3 MOISTURE CONTENT

The Engineer shall reject any joinery timbers having a moisture content less than 10% or greater than 14% with the bulk of the timber having a content of 12.3% for joinery, floors or finished work also timbers having a moisture content greater than 40% for scantlings. The Engineer reserves the right to submit any timber for test and report. Should any test fail to achieve the specified requirements, the cost of the test, transportation and rejection of the consignment from which the sample is drawn shall be borne by the Contractor. Should the test prove satisfactory the cost of the above shall be borne by Employer.

The Contractor shall replace at his own expense any timbers which shrink or are damaged in finished work caused through the use of imperfectly seasoned timber.

9.4 SEASONING

Timber for structural purposes and other carpentry shall be adequately seasoned before use so as to prevent undue shrinkage, distortion or splitting, and any timber which subsequently develops before the end of the Defects Liability Period such defects so as, in the opinion of the Engineer, to affect unduly the strength, durability or appearance of the Works is to be replaced at the Contractor's own expense.

Timber for joinery is to be well seasoned before use for a period of at least 3 months, either before or after delivery to site, and the Contractor is to allow for programming his work accordingly. Any seasoning defect occurring before the end of the Defects Liability Period and which, in the opinion of the Engineer, affects the Works adversely is to be replaced at the Contractor's own expense.

All timber required for the Works shall be purchased as soon as possible after the Contract is signed and shall be delivered to the site or to the Contractor's woodworking shops and properly stored under cover and stacked to the satisfaction of the Engineer.

9.5 MARKING/CERTIFICATE OF TIMBER QUALITY AND TYPE

The type, species of all timber used shall be certified by a registered Forester approved by the Forest Department and a certificate to that effect shall be produced together with the approved markings by the registered Forester.

9.6 TIMBER PRESERVATIVE

Timber preservative shall be organic solvent or non-staining water solvent types all in accordance with the classification of BS 1282 and shall be applied in accordance with the manufacturer's recommendations.

9.7. CLASS OF TIMBER TO BE TREATED

All timber for carpenter' work is to be treated with timber preservative before fixing unless required to be painted.

Creosote is not to be used for preservative treatment with masonry or contact with plaster and other decorative finishes.

9.8 PRESSURE TREATMENT

Where specified, pressure treated timber shall be impregnated under vacuum and pressure with an approved proprietary wood preservative. The Contractor shall produce a certificate from the Supplier that the timber has been pressure treated in accordance with the manufacturer's instructions and showing the quantities and sizes of timber treated and the nett retention of dry salt obtained. Ends of pressure-treated timber which are cut shall be sealed with an approved wood preservative.

9.9 STRENGTH

No carpentry timber used shall be below Strength Group A or B as defined by the Malayan Forest Record No. 13 an abstract of which adopted for Sarawak is given in a Booklet "Column Sarawak Timber" compiled by the Sarawak Forest Department.

All structural sizes quoted are based on these strength groups. Contractor shall satisfy himself and be responsible that all timber and all sizes are suitable and adequate for their particular location and conditions.

9.10 SIZES

Timber where dressed and more than 25mm thick may finish 5mm smaller than specified size. Dressed timber where specified 25mm or less must finish to within 1.5mm of specified size.

9.11 FINISHES

All exposed surfaces of timber shall be dressed and rubbed down with sand paper perfectly smooth, all other surfaces except where particularly mentioned shall be left off the saw. Timber for joinery with natural finish or clear vanished or polished finish is to be selected to match grain and colour and to avoid knots and other defects and is to be left clean.

9.12 FRAMING

All work shall be strongly framed together in accordance with the best practice and shall include all checking, housing, halving, mitreing, spiking, bolting, screwing, etc., as required for first class work. All timber shall be accurately placed in position levelled and/or plumbed in an even plane. Where required timber shall be bedded in mortar.

No structural timber shall be cut more than 1/6th of its depth.

Joints in carpentry timber are to be accurately formed and of appropriate type to transmit the loading and resist the stresses to which they are subject. Abutting surfaces in timber exposed to the weather are to be thickly coated with priming paint immediately before assembly, unless required to be glued.

Joints in plates, heads and cills of partitions and similar members are to be halved 150mm long or, at angles, for the width of the member. Joints in purlins, ridges and similar members are to be scarfed for a length equal to twice the depth of the member, and tightly wedged. Rafters or joists trimmed around openings are to be correctly framed with tusk-tenon joints and dovetailed housings. Studs in partitions are to be stub-tenoned at head and cill.

9.13 TIMBER TO BE CONTINUOUS

Every post, beam, joist, rafter, purlin, stud, strut tie and similar member is to extend in one piece between its supports or fixings, unless otherwise specified or approved in writing, in which case it is to be adequately jointed in an approved manner.

Plates, head and cills of partitions, and similar members are to be in one piece between points of change of direction provided that halved joints may be used to avoid the use of timber exceeding 6.00 metre long.

9.14 NOTCHING HOLES, ETC.

Where joists, rafters, etc. are notched over supports the depth of the pitch is not to exceed two-fifths of the depth of the member.

Holes in joist, etc., for pipes are to be as near to the neutral axis as possible and are not to exceed one-quarter of the depth of the member.

9.15 SETTING OUT

Properly and accurately set out all work required and do all cutting, trimming, notching, etc. required by other trades.

9.16 TRIMMING

Where floor joists or rafters are trimmed around openings or projections, the trimmer and trimming joists or rafters are to be of the same depth as the common joists or rafters but are to be 25mm more in breadth.

9.17 GROUNDS

Grounds and backing shall be of selected approved Meranti timber spaced at not more than 600 mm centres and secured to plugs or bedded in cement screed.

9.18 FIXING

Contractor shall provide all necessary nails, bolts, etc. as required for the work.

9.19 PLUGS

Unless otherwise specified plugging for fixing carpentry to brickwork or concrete shall be with wood plugs cut with a slightly twisted taper to fit tightly into the joint or mortice into which they are driven or dovetailed where cast in-situ or built in. Plugs shall be spaced at not more than 450mm centres.

9.20 NAILS, BOLTS, ETC.

All nails, screws, bolts and other fastenings are to be of a suitable type and size and in sufficient number.

Where necessary to avoid splitting, holes for nails are to be pre-bored of diameter not exceeding four-fifths that of the nail. Holes for bolts are to be bored from both surfaces of the timber, and are to be of a diameter equal to 11/16 times that of the bolt. Washers are to be used under all nuts and bolt heads. Nuts are to be brought up tight but not so as to crush the timber.

Timber connectors are to be toothed-plate type to comply with B.S. 1579. The teeth are to be fully embedded in the timber, by the use of a high tensile threaded rod with large plate washers instead of the permanent bolt where necessary. Where three or more timber are joined by a bolt and connectors, one connector is required between every two timber unless otherwise specified.

Where fixing with cups and screws is specified the cups are to be brass turned or heavy pressed pattern surface pattern cups are not to be used.

9.21 GLUE

Glue is to be an approved resin-based or synthetic resin-based adhesive of appropriate type, and is to be used in accordance with the manufacturer's instruction.

9.22 BUILDING PAPER

Building paper where specified as an underlay to tiled or other pitched roofs is ‘Sisalkraft” or equal approved reinforced building paper. Nails where required are to be clout nails, or are to have folded paper washers. The paper is to be lapped 150mm at joints.

Where specified as an underlay to pitched roofs, building paper is to be laid and lapped as specified above for roofing felt.

9.23 CEILING

(a) General

The Contractor should refer to the Schedule of Finishes for the location of the various types of ceiling.

The ceiling workers shall co-operate with other trades in the preparation of ceiling layouts and during installation. Air-conditioning outlets, fire detectors, lights and similar ceiling outlets shall be located at the centre of solid panels and not at the intersection of ceiling panels or grid suspension.

No additional point loads shall be carried by the ceiling or suspension system without prior discussion with and approval of the Engineer.

The Contractor shall particularly note that where modular ceilings are specified and scheduled, allowance must be made for all make-up tiles of non-standard size in order to conform with the ceiling layouts.

The tiles shall rest on anodised aluminium grid suspension systems in strict accordance with the specification to a grid pattern to suit the ceiling layout.

The tile sizes shall not dictate the ceiling layouts.

(b) Exposed Grid Ceiling Suspension System

All exposed grid ceiling suspension system, unless otherwise stated or in the “Schedule of Finishes”, shall be approved hot-dipped galvanised steel suspension tee system with prepainted galvanised steel flanged cappings of approved colour arranged in 600 x 600mm grids or 600 x 1200mm grids hung by means of adjustable hangers with rod and clip power-fixed to concrete soffit or other supporting framework above. The principal parts shall include main runner and cross tee and complete with all accessories. All ceiling and suspension shall be installed in strict accordance with manufacturer's requirement and instruction.

The suspension system shall be able to achieve a permanent and perfectly uniform level and rigid, system of securement and to hold each and every ceiling board in the same plane with no projecting dropped or sagged board edges at any time. The individual board shall be quickly and easily removed and replaced without injury to the surfaces.

(c) Timber Suspension System

Where ceiling boards are to be fixed on to timber joist suspension or framing, the Contractor shall construct the timber suspension system or framing, which shall generally consist of treated hardwood joists, noggings, trimmings, hangers, etc., in accordance with the drawings.

Additional trimmings and noggings shall be provided at recessed lighting points, access panel, etc.

The suspension system shall be able to achieve a permanent and perfectly uniform level and rigid, system of securement and to hold each and every board in the same plane with no projecting dropped or sagged board edges at any time. The individual board shall be quickly and easily removed and replaced without injury to the surfaces.

(d) Metal Concealed Grid Ceiling System

Where ceiling boards are to be fixed onto metal concealed grid ceiling system, the Contractor shall construct approved hot-dipped galvanised concealed grid ceiling system, which shall generally consist of hot-dipped galvanised top cross rails, secondary sections, joiners, connectors, fixing clips, suspension rod, brackets, nut, angles, furring channel, steel studs, etc., in strict accordance with manufacturer's detail and instruction.

Additional channel and trimmings shall be provided at recessed lighting points, access panel etc.

The suspension system shall be able to achieve a permanent and perfectly uniform level and rigid, system of securement and to hold each and every board in the same plane with no projecting dropped or sagged board edges at any time. The individual board shall be quickly and easily removed and replaced without injury to the surfaces.

(e) Fibrous Plaster Board Ceiling

Fibrous plaster board ceiling shall be of the thickness shown on the drawings or in the "Schedule of Finishes" and fixed on timber joist suspension and framing.

All boards to be temporarily screwed to metal concealed grid ceiling system, joints to be continuously grouted at back and boards to be grouted with fibreglass/gypsum plaster over metal framing at not more than 375mm centres.

After grouting has set, remove temporary screws, flush up joints and screw holes with superfine gypsum plaster and leave homogeneous surface to dry before painting. All ceiling to be installed to manufacturer's requirement and instruction.

(f) Aluminium Ceiling

Where indicated in the drawings or Schedules of Finishes, the Contractor shall supply and install the type of aluminium ceiling as specified or equal and approved aluminium ceiling system.

The entire ceiling system shall complete with all fixing and edging accessories and install according to manufacturer's detail and specification.

(g) UAC Superflex Ceiling

The Contractor shall construct UAC Superflex ceiling to areas specified in the drawings and Schedules of Finishes.

All UAC ceiling shall be constructed of UAC Superflex board described in the "Schedule of Finishes" fixed with pointed galvanised nails and space nails no further than 300mm and no less than 10mm from edge of sheets to timber framing as specified in the drawings. The joints and ceiling perimeter shall be lined with hardwood beadings all as described and detailed.

(h) Plasterboard Ceiling

Plasterboard ceiling shall be 'BORAL' or equal and approved standard core plastereboard ceiling fixed onto treated hardwood framing and flush up joints and screw heads with jointing compound and slotted perforated paper tape, all in strict according with the manufacturer's instructions.

9.24 JOINERY TIMBER GENERALLY

All timber except where specifically otherwise described shall be approved in writing by the Engineer.

All timber shall be of best quality, sawn die square, free from sap, shakes, waney edges, large, loose or dead knots and all other defects and shall be to the approval of the Engineer.

All joinery shall be wrot and all sizes stated are the finished sizes.

9.25 PLYWOOD

Plywood shall comply with the requirements of B.S. 1455 (except that it need not be British-made).

Plywood for use externally, including doors or panels in open verandahs, is to be type WBP (bonded with weather and boil-proof adhesive). That for use internally is to be type MR (bonded with moisture-resistant adhesive).

9.26 HARDBOARD

Hardboard shall be of approved manufacture to comply with B.S. 1142. Standard quality is required unless tempered or super quality is specified.

Boards are to be well wetted with a brush on the rough side before fixing, and are to be fixed with 19mm brass or coppered panel pins of square section ("Masonite" ref. M.N. 2, 18 gauge or equal approved). Boards are to be nailed at not exceeding 100mm centres along all edges and intermediate bearers, and are to be nailed from the centre outwards.

But joints are to be made lightly and not forced together. All exposed edges of sheets, unless otherwise specified, are to be planed to form a regular and even V-joint.

9.27 SOFTBOARD

Softboard or insulating board shall be of approved manufacture to comply with B.S. 1142. Except where both faces of the board are concealed, boards are to have a smooth or "ivory" finished on one side

Boards shall be carefully handled and store to avoid damage: damaged boards may not be used.

Boards shall be fixed with galvanised clout nails at not exceeding 100mm centres along all edges and intermediate bearers.

9.28 LAMINATED PLASTIC SHEETS

Laminated plastic sheets shall be abrasion resisting, cigarette proof, synthetic resin bonded decorative laminated plastic veneer, similar to "Formica" or other equal and approved and shall be of "Standard" grade. The sheeting shall be fixed to surface with patent adhesive strictly in accordance with the manufacturer's instructions.

9.29 JOINERY WORKMANSHIP

All wood for interior finished joinery work shall be thoroughly seasoned and kiln dried stock satisfactory to the Architect's/Engineer's requirements. Care shall be exercised by carefully screening to avoid any strong contrasts in colour and graining of finishing woods for all wood surfaces to trim, panelling, wall and column facing so that any one room or wall surface will present a reasonably uniform appearance.

All cutting, framing and fitting shall be done as required to accommodate work of other trades. Use of wooden plugs, shims or other shrinkable materials for fixing, levelling or plumbing will not be acceptable in any form.

Mortice and tenon joints shall be set in an approved type of water and moisture proof glue with wedges and/or pins.

In so far as practicable all joinery work, panelling, etc., shall be assembled in shop, back painted and finished throughout before delivery to buildings. No woodwork shall be admitted to the building until time as wet trades are entirely dry and/or in inclement weather, where proper provision has been made to provide ventilation.

All exposed timber or other material shall have all nail heads well punched in, thoroughly sanded and hand scraped to remove all machine and hammer marks and other blemishes. All free edges of timber are to be pencil rounded. Particle board and similar materials are generally to have a paint finish unless otherwise specified.

9.30 JOINERY FIXING AND FRAMING UP

No joinery shall be fixed until walls and concrete work have thoroughly dried out. Bolts shall be fitted with nuts and washers shall be placed between all bearings of heads and nuts against timber.

All framed work shall be put together immediately upon the general work being commenced but not wedged or pinned and glued until the framing is prepared in readiness for immediate fixing. All framing to be put together with well fitting mortice and tenon joints wedged up solid and pinned with 9mm Grade ‘A’ hardwood pins and glued.

All brass screw shall be two and one half times the thickness of the first timber through which they are driven.

Screws exposed to view (except for hardware) shall be raised head pattern brass, finished chromium plated in paintwork and Florentine bronze in polished work.

Patent plugs shall be set in drilled holes in brick or concrete of the correct length and diameter, and fixed in accordance with the manufacturer's instruction.

9.31 SITE MEASUREMENTS

The Contractor is to take overall measurements for joinery from the site and not from the drawings except where the work is specified to be built in.

Dimensions of joinery supplied by nominated suppliers (if any) are to be similarly confirmed to the supplier by the Contractor.

9.32 DOORS

Doors and windows are to be constructed as shown on the Drawings and of the sizes specified.

Doors and windows shall be framed up using selected seasoned or Kiln dried reconditioned timber.
Flush doors shall be as indicated on the drawing, sheeted on both faces with stress free selected plywood not less than 6mm thick unless otherwise specified.

Where glazing panels are shown, unless otherwise specified the glass shall be 6mm clear float glass bedded in felt or approved material on both sides.

All frame work of doors and windows shall be morticed and tenoned by dowels. Dowels shall be straight grained and keyed for gluing.

9.33 FIRE RESISTANT DOORS

Fire resistant doors and frames where specified in the drawings must be obtained from a manufacturer approved by the relevant authority, like BOMBA Malaysia and installed strictly in accordance with the manufacturer's instructions. The fire resistance rating of the doors delivered to site shall be clearly marked on their surfaces. The Contractor shall produce test certificates from the manufacturers to substantiate the fire resistance rating of doors delivered.

The Contractor shall include in his price for everything necessary, whether specified herein or otherwise, for complying with all the requirements and to the satisfaction of the Engineer.

9.34 FIXING FRAMES

Door and window frames shall fit neatly into the openings. All crevices between frames and walls, beams or other structures shall be filled up with cement mortar (1:3).

Unless otherwise specified, timber door and window frames, etc. against brick reveals are to be fixed with 40 x 3 x 225mm girth galvanised mild steel holdfasts, one end bent up and twice screwed to frame, and other end fishtailed and built into the joints of walling.

Holdfasts are to be fixed to the jambs not more than 900mm apart, the outer holdfasts being not more than 300mm from the end of jamb.

Where the foot of the frame is secured by a dowel or is framed to a cill or threshold secured by a water bar, the lowest holdfast may be fixed up to 900mm from the foot.

Where against concrete columns or walls, frames are to be screwed at 900mm centres to plugs cast or driven into the concrete, with screw heads sunk and pelleted if exposed.

9.35 INSPECTION

All joinery work shall be inspected by the Engineer while it is in the unpainted or unprimed state. Give the Engineer three (3) days' clear notice of inspection when joinery is completed and ready for inspection.

9.36 MATCHING

Where polished or non-painted surfaces are required, finishes shall be carefully matched for uniformity of colour and pattern the grain and texture are to maintain a uniform and balanced finish.

9.37 REPLACING TIMBERS

Any timber which splits during fixing, shrinks or is damaged in any way likely to affect efficiency of finish, shall be removed and replaced at the Contractor’s expense.

The Contractor must apply in writing for and obtain written approval for the substitution of one specified material for another.

9.38 PROTECTION

Adequately protect all joinery and finishing work against damage, discolouration by mortar or otherwise; and work so damaged shall be replaced at the Contractor's expense.

9.39 IRONMONGERY

The scope of this work consists of furnishing all finish ironmongery including delivery to the building site and to complete installation in all respects including all related items in strict accordance with applicable drawings and schedules.

The Contractor shall order the approved ironmongery at an early date to make sure that no delay is caused to the completion of the project.

All ironmongery shall be neatly packaged in substantial and secure boxes properly labelled and readily identifiable for individual locations and use.

The furnishing of the above ironmongery shall include all items of securement and fastening such as screws, bolts, nuts, brackets and the like.

Contractor shall provide one specific room free from dampness and adequately ventilated with adequate shelving for the storing and layout of all hardware as received. Samples shall be supplied to the Engineer for approval in strict accordance with the requirements of the General Conditions of the Contract relating to samples.

All ironmongery shall be installed by the Contractor who shall be responsible for the correct application thereof. Prior to general inspection the Contractor shall inspect and adjust all door closers and locks and/or all items requiring close adjustment, regulation and check all keying.

When proprietary lines or catalogue numbers are referred to they indicate characteristics and functions and a general description of type approximate size and quality required and the Contractor shall be responsible for the suitability of all items.

Ironmongery is to be fixed before painting is carried out; handles, plates, escutcheons, etc. are then to be removed, and refixed after painting has been carried out.

Where a lock “mastering” system is required, the Contractor is to obtain all necessary fixing schedules from the suppliers, and is to ensure that all locks are fixed in their correct locations. The Contractor is to arrange for all master keys and sub-master to be sent under sealed cover direct from the suppliers to the Engineer.

All keys are to be properly labelled and delivered to the Engineer in sealed containers.

All key locks are to be provided with keys in triplicate.

As-built Schedule of Ironmongery shall be submitted to the Architect/Engineer for approval upon completion of the installation of all the ironmongery.

9.40 Built-In Furniture And Fittings

Construct and fix built-in furniture and fittings all as detailed, completed with necessary ironmongery properly framed and if not to be painted or laminated, stain, apply boiled linseed oil and wax polish.

Unless detailed otherwise on the drawing, all drawers shall be completed with powdercoated steel roller runners.

Where joinery works are specified to be ‘built-in’, it shall be the responsibility of the Contractor to ensure that they are set plumb and true, and where it may be damaged or displayed by subsequent operations, the joinery works shall be temporary encased and braced.

Where joinery works are specified to be ‘fixed’ it shall be the responsibility of the Contractor to ensure that the necessary fixings are incorporated in the carcass, alternatively, the Contractor shall construct such ground works as are required to provide a suitable base and fixing for the works. They shall not be fixed in position until after all floor, wall and ceiling surfaces have been framed or constructed, unless otherwise directed by the Engineer.

SECTION 10 - METALWORK

10.1 MATERIALS

This Section covers the execution of work in connection with the supply, fabrication and erection of metal work. This Section does not apply to Structural Steelwork.

a) Metal

All ferrous metals shall be free from rust, scale, and other defects and the various shapes and sections shall be clearly rolled otherwise formed to uniform sections. All non-ferrous metal shall have uniform finished surfaces machined and buffed, free from defects and all sections shall conform accurately to the sizes and shapes required.

b) Steel

Shall comply with the requirements of BS 15 No. 1 quality and the Contractor shall produce the manufacturer's test certificates when so required by the Engineer.

c) Wrought Iron

Shall be malleable quality, straight and of constant section.

d) Aluminium Sheet

Shall be to BS 1470:1972. Angles, channels, tees and I sections shall be to BS 1161:1951.

Where stated, aluminium shall be anodised either natural or to colours selected by the Engineer.

e) Stainless Steel

Stainless steel shall be 400 stainless steel Grade 304. Where M.O. stainless steel is required it shall be Molybdenum stablished stainless steel.

All joints for stainless steel shall be welded and polished joints.

f) Ferrous Metal Preparation

Unless galvanised or concrete encased, treat all ferrous metalwork with primer paint with one coat zinc phosphate primer. Wherever practicable the priming shall be carried out after the metal has been drilled, cut, welded, etc., but before delivery to the site. All parts which will become inaccessible after building in shall receive a further coat of primer on the site.

g) Galvanising

All galvanising to metalwork shall be hot-dipped and carried out after welding, drilling and tapping, etc., has been completed and of not less than 600g of zinc per square metre of surface.

All exposed accessories shall be hot-dipped galvanised.

h) Chrome Plating

Where bronze, copper or brass is specified to be chromium plated this work shall be carried out by an approved firm and shall follow the best trade practice and the work shall be first nickel plated and then heavily chrome plated to a finish specified.

i) Protective Coating

Where extruded or sheet aluminium butt against cement render, concrete, brick or timber treated with preservative, prime the aluminium with one (1) coat of zinc chromate before fixing. Maintain the protective coating throughout the currency of the job.

On completion clean all exposed non-ferrous metal finishes which do not form part of nominated subcontracts with steel wool and petrol and wipe dry.

j) Fastening and Fixing

All screws, nuts, bolts, rivets, washers and other fastening shall be of stainless steel or aluminium.

10.2 WORKMANSHIP

a) General

The whole of the fabrication, welding, bolting, priming and erection shall be carried out by skilled tradesmen in accordance with the best trade practice.

All non-ferrous work required by the drawings indicated herein or specified shall be as detailed on drawings, of suitable thicknesses and of approved gauge to ensure the necessary rigidity when erected, free from bends or waves or other surface imperfections, true and straight vertically and horizontally. All arrises, profiles and moulded surfaces true and sharp.

All joints and mitres shall be carefully and accurately assembled and machined so as to provide close smooth connections that will not be noticeable and weather and watertight.

Screws and bolt heads shall be concealed wherever possible and countersunk finishing flush on exposed surfaces. Provision shall be made for appropriate expansion and contraction joints in all long runs of horizontal vertical exposed members and be subject to Engineer's inspection prior to forming and/or installation.

Architectural non-ferrous metalwork shall be the products of outstanding recognised manufacturers and fabricators of highest grade architectural alloy metal products and shop assembled in a shop where the grade of metalwork is of the highest grade and quality and acceptable to the Engineer.

Faces of metal in contact shall have hair line joints. Work shall be assembled with concealed fittings insofar as practicable.
Exposed joints shall be watertight. Mouldings shall be in true alignment at joints, straight, tightly and neatly fitted.

b) Welding

Welded joints shall be dressed smooth, shall be free from porosity cracks and blow holes and finished to match adjacent surfaces. When welding and dressing operations are completed all welding flux shall be removed without delay.

All welded parts shall be guaranteed not to bloom and blooms that appear within the defect and liability period shall be considered as defacement and subject to replacement.

Welding shall be carried out by expert tradesmen and in strict accordance with the current code of practice.

c) Fixings

The various members of metalwork shall be properly and neatly assembled and connected together with approved fixings. Fastenings which are exposed shall be of the same material, colour and finish as the metal to which applied unless otherwise specified.

d) Connectors

Bolts - generally shall have hexagonal heads and nuts unless otherwise stated. Threads shall be Whitworth and all bolts shall be fitted with washers.

Anchors - shall be "Ramset", "Rawl", "Sebco", "Loxin" or other equal and approved expansion tapered nut type anchors for fixing all bolts in brickwork or concrete.

Mortices for anchors shall be drilled to the required diameters in accordance with the manufacturer's instructions so that no damage is done to the receiving surface.

Powdered power fixing shall be of approved type.

e) Dissimilar Contact Surfaces

Where non-ferrous metalwork is connected and/or secured or fastened to dissimilar metal parts such non-ferrous metal shall be thoroughly insulated from direct contact with any steel ferrous metal or masonry and timber by a heavy shop coat of zinc chromate primer made with a synthetic resin vehicle. At the time of connection and/or installation of all securement devices when said securement and fastening devices are in place they shall again be coated with a thorough application of zinc chromate paint.

f) Cuttings, Drilling and Fitting

Furnish all materials and services and perform all labour in connection with all tapping, drilling, cutting and fitting of the work specified herein and/or to accommodate the work of other trades in connection herewith providing all tap holes, bolts, and screws, anchors, lugs, reinforcement and any other connecting devices, sub-frames, supports, stiffeners or items required or necessary to install the work permanently and securely in place.

10.3 MEASUREMENT

Weights have been calculated on the net theoretical weights of sections, excluding rolling margin and weights of welding material.

10.4 ROLLING MARGIN

Allowance has not been nor will be made in these quantities for rolling margins and the Contractor must include for such in his rates.

10.5 MILD STEEL

a) Steel Casement Windows and Casement Doors

Metal casement windows and casement doors shall comply with the current British Standard.

Windows and doors shall be supplied ready for fixing wood frames or with lugs for building into brickwork, concrete, etc.

Windows and doors fixed in brickwork or concrete reveals shall have cement mortar grouted into the channel of the frame as the work proceeds, and neatly pointed in approved flexible sealant externally and in cement internally where walls are not plastered.

Windows, doors and subframes, unless specifically required to be hot-dip galvanised, shall be rustproofed at the works with paint-dipped one coat anti-rust primer and supplied with coupling mullions and tubular mullions as required and all necessary hinges, fasteners, locks, catches, stays, etc.

All windows, doors and accessories shall be provided of the types and sizes as shown on drawings and all movable parts oiled and left in working order.

b) Adjustable Metal Louvre Windows

Adjustable metal louvre windows shall be of approved manufacture of the sizes shown on drawings.

Unless described otherwise in the Bills of Quantities, the channel frames, channel coupling mullions and spacer brackets shall be 18 SWG or otherwise specified thick cold rolled steel strip galvanised with hot-dip process. The clips to receive louvres shall be 22 SWG rolled steel strip sheradized after processing. The bearings shall be of hot pressed special alloy.

The operating rods shall be of 14 SWG steel. The handle and lock shall be 2.642 mm thick steel.

The finish shall be of aluminium lacquer unless otherwise specified.

The bolts, nuts and screws shall be of cadmium plated steel.

Generally, the frame shall be screwed to timber surrounds, but where required or shown on drawings for frames to be fixed to brick or concrete jambs, the frame shall be screwed, to patent wall plugs in accordance with the manufacturer's instructions.

c) Balustrades, Bars, Grilles, etc.

Unless otherwise specified, balustrades, bars, grilles, etc. shall be galvanised mild steel. Such items of fabricated metalwork shall be in accordance with the detail drawings. Form all necessary fish tails for building in. All ungalvanised mild steel work is to be primed before delivery to site.

10.6 MOSQUITO NETTING

Mosquito netting shall be of fine aluminium gauge in aluminium frame and track complete with all necessary fixing accessories.

10.7 METAL DOOR FRAME

Metal door frame shall be as specified in the Schedule of Finishes and complete with hinges, buffer, mortar guard, wire tie, adjustable striker, adaptor for concrete columns attachment and all other necessary hardware as recommended by the manufacturer. Metal door frame shall be installed in strict accordance with the manufacturer’s instructions and recommendation.

10.8 ALUMINIUM WORKS

I. General

a) Work to Conform to Drawings

All items of work shall conform to the overall sizes, designs and details shown on the Drawings, and to conform to all requirements and standards required by 'LB Aluminium Berhad' or equal and approved type.

Only dimensions shown on the drawings are to be worked from and the Contractor shall varify these dimensions with actual site measurement and/or confirm them with the Engineer before fabrication.

b) Samples and Shop Drawings

Samples of all anodised aluminium sections, sheets, glass, etc. shall be submitted to the Engineers for approval before work is commenced. On approval, the samples shall indicate the standards to be maintained for all subsequent work. A certificate of origin for any material shall be produced on demand by the Engineer.

The Contractor shall submit for approval of the Architect/Engineer complete full size detail shop drawings, showing in detail all parts of the fabrication and installation work.

c) Protection

i) The Contractor shall be responsible for protecting the Works against damage, abrasion, staining, scratching or other defacement and make good/replace any such damage.

ii) All exposed aluminium work shall be protected by protective plastic tape ('Peelcoat" or similar).

iii) All components to be delivered to the site in individual plastic wrapping or as directed by the Engineer.

iv) Any aluminium unit which is damaged in any way during transportation, before or after installation shall be replaced by the Contractor at his expense.

d) Cleaning On Completion

On completion of the Works, all protective material shall be removed and all works thoroughly cleaned with water and detergent. No abrasive agent shall be used.

II. Materials and Workmanship

a) Materials

i) Generally

All aluminium material shall be free from defects impairing strength, durability or appearance and shall be adequate in every way for their purpose. Surfaces shall be clean, straight and true with sharp defined profiles and smooth finish. All sections, sheets, etc. shall be free from bends or waves or other surfaces imperfections, true and straight vertically and horizontally with all arrises, profiles, etc. true and sharp.

All fabrication and assembly shall be carried out in the shop unless otherwise specified or permitted. Mitred joints shall be accurately fitted to a flush hairline.

Dimensions of spaces into which fabricated items are to be fitted, shall be checked in the job site before fabrication begins.

Make all necessary allowances for thermal movement in joints and fastenings, particularly in sheet and this sections and in the installation of assemblies such as frames, so as to avoid tearing, buckling, opening of joints, undue stress or fatigue or other detrimental effects.

Wherever proprietary goods or materials are specified for use in the Works, goods or materials of alternative manufacture may be accepted provided that, in the sole opinion of the Architect/Engineer they comply in all respects with those specified as regards appearance and quality.

All work shall be carried out by experienced specialist tradesmen only.

ii) Aluminium Extrusions

All extrusion to be obtained from 'LB Aluminium Bhd.' or other approved manufacturer and to be AA6063 of temper T5 (equivalent to BS H9).

iii) Aluminium Sheets

To conform to the requirements of B.S. 1470.

b) Sections

The tenderer is to note that, subject to the overall size, shape and opening/fixed panels and hanging requirements indicated on the Drawings, he shall himself design the sizes and profiles of the various sections which he intends to offer. Basically all sections shall be 'LB Aluminium' or other equal and approved and shall comply with the manufacturer's requirement.

The tenderer shall bear in mind that whatever sections he chooses to offer, they must be suitable and adequate in every way for its purpose. The sections used for frames are to be full section. All vertical aluminium frames and mullions must be reinforced with galvanized mild steel fasteners of the appropriate gauge and size strong enough for their purpose.

The tenderer shall submit prior to fabrication the following:-

i) large scale drawings showing the elevation of the items of aluminium works and full size detail drawings showing the dimensions to profile of the various sections offered and detail fixing at heads, sides, transome and cill,

ii) a detail specification describing the sections, method of hanging, etc. and

iii) all available samples of sections, etc.

c) Construction

All composite windows, screens and doors to be designed using approved sections.

Unless otherwise indicated, all composite windows, screens and doors shall meet the structural design requirements and shall comply with the manufacturer's recommendation.

Frame shall be square and flat and shall be constructed of sections cut to length, corners mitred and electrically welded and then cleaned to obtain a smooth surface. All joints and mitres shall be carefully and accurately assembled and machined so as to provide close smooth connections that will not be noticeable. Screws and bolt heads shall be concealed wherever possible and countersunk finished flush with exposed surfaces.

All openable windows are to be provided with approved quality p.v.c. weather strip all round. Notwithstanding whether shown or not in the Drawing, the tenderer shall be deemed to have allowed for the necessary flashing around the openings in his rates to ensure proper fixing and shall be to the entire satisfaction of the Engineer.

Drainage holes shall be provided to all framing section wherever necessary to discharge any water that may have been accumulated or seeped into the frames.

All drainage holes shall be provided at location approved by the Engineer.

Make provision for expansion and contraction in horizontal and vertical members exposed to weather. Any distortion in the aluminium members or any glass cracked or broken due to such inadequate provisions must be replaced at Contractor's cost.

d) Finishes

Unless otherwise stated, all aluminium surfaces shall be powder coated finish, in accordance with the manufacturer's instruction and recommendation. The finish shall conform to the current accepted standard specification for anodic finishes for Architectural work with minimum film thickness of 10 microns. The Contractor shall supply all ironmongery to match the colour of the Anodised finish.

e) Fixing

All units shall be properly fixed and installed in the positions shown with all necessary lugs, straps, brackets, timber packing pieces etc. bedding with and including ‘neoprene’ gaskets where required and everything else necessary for the proper fixing of the units all in accordance with the details as shown on the Drawings and in accordance with the manufacturer's instructions.

Where couplings are made, either direct or with mullions or transomes, joints must be bedded with silicone sealant to render them watertight. Couplings shall also be sealed with good quality silicone sealant.

Fixing frames, straps, built-in lugs, brackets, etc. shall be of galvanised mild steel of the appropriate gauge and size strong enough for their purpose.

All clearance between metal and masonry or concrete finishes to the external face of the external wall are to be fully caulked with non-setting sealing compound.

f) Fittings

The operating devices, mechanism and hardware used in connections with the works shall be built and install so that they will operate smoothly and freely, without excessive friction, noiselessly and shall be adequate for the purpose for which they are intended.

i) For Swing Doors

Double action floor spring with stainless steel cover plate shall be fitted.

Concealed bolts shall be provided at head and cill of first closing leaf.

Double cylinder deadlock shall be mortised into door style. Each leaf of door to be fitted with 2 Nos. aluminium push/pull handles (of design to be approved by the Architect/Engineer) of the same finish as the aluminium sections.

ii) For Hinged Doors

Single action floor springs with stainless steel cover plate.

Concealed bolts, head and cill of first closing leaf.

Double cylinder deadlock mortised into door style.

Each leaf of door to be fitted with 2 Nos. aluminium push/pull handles (of a design to be approved by the Architect/Engineer) of the same finish as the aluminium sections.

iii) For Sliding Doors and Windows

Horizontal sliding leaves to run on adjustable nylon or steel rollers fitted with stainless steel ball base in the cill section.

Nylon head guides to ensure easy and smooth mobility of the sliding leaves.

Woven pile, density-silicone treated weather strip around perimeter of the leaves for weatherproofing and to ensure smooth operation.

Doors to be fitted with approved flush lock to be operated by key from outside and lift knob on the inside.

Windows to be fitted with spring loaded locking device and approved handle.

The head section of the sliding window frame is to be fitted with anti-rattle skids and anti-lift blocks to be fitted to each sliding leaf.

The cill is to be supplied with weepholes. In the case of sliding windows, 28 mm internal upstand is required for the cill. The interlock rails or the sliding window to be double weather stripped with wool pile.

iv) For Projected Top Hung and Side Hung Window/Light (Casement Window)

Each window/light is to be completed with a set of concealed 'Geco' or equivalent stainless steel friction stay (size to manufacturer's recommendation) and shall be strong enough to withstand any wind action and sufficient space for the outside of the glass to be cleaned from within and a set of 'DKI' Series 22, or equivalent casement handle.

v) Ironmongery

All ironmongery and fittings shall be of specified brand or approved equivalent and a sample of each ironmongery or fittings used in the work shall be submitted for the approval of the Engineer.

g) Structural Design

All units shall be designed to withstand loads resulting from wind speed = 30 m per second. The contractor is required to submit PE structural calculations for all units for approval. Contractor shall add additional concealed reinforcements if necessary.

Wind forces to be calculated in accordance with BS Code of Practice CP3 Chapter V Part 2.

h) Erection

i) Generally

All units shall be properly fixed and installed in the correct positions as shown and shall be levelled, plumbed and squared at their proper elevations and in correct alignment.

ii) Proper Erection

The Contractor shall be solely responsible for the proper fixing of the units and shall provide everything necessary.

The Contractor is required to install the aluminium sub-frames and frames towards the end of the construction period when all finishes such as tiling and plastering has been completed to avoid damages to the aluminium members.

At an early stage, before plastering works commences, the Contractor is required to install ground pieces or sub-frames which will act as plaster guide for the plasterer to complete his plastering works. This also applies to aluminium sliding doors where guide must be provided for aluminium tracks which shall be installed towards the end of the construction period.

i) Glazing

a) Generally

i) The supply and fixing of glass to the aluminium external screens, windows, fixed lights, doors and sliding doors shall form part of this Contract.

ii) The work described under this section shall also consist of furnishing all labour, setting equipment, scaffolding, transportation costs and materials and performing all operations in connection with installation and setting of all glass and glazing complete in every respect including washing and cleaning thereof after glazing.

iii) All panels shall be glazed unless otherwise indicated.

b) Glass and Glazing Schedule

i) All glass shall conform to B.S. 952 and shall be free from bubbles, specks, distortion and other defects. All glass to be delivered in proper containers with maker's name, guarantee, type of glass and thickness or weight attached to the outside of the containers.

ii) Unless otherwise stated, all glazing to external screens, windows, fixed lights, doors and sliding doors and shall be 6 mm thick approved clear float glass, ‘Malaysia Sheet Glass Bhd’ brand or other equal and approved brand.

c) Preparation Of Frames And Glass

Ensure that:-

i) All glass rebates are square, plumb and true in plane, clean, dry and dust free.

ii) All frame adjustments are made prior to glazing.

iii) All glass edges are clean out to exact size, allowing expansion tolerances as recommended by the glass manufacturer.

iv) Glass having chipped or damaged edges of any sort shall be rejected.

v) All materials are used in strict accordance with the manufacturer's instructions.

d) Fixing of Glass Panels

i) All glass shall be bedded with an approved non-hardening glazing compound and "Neoprene" glazing gaskets.

ii) Glazing beads shall be of extruded clip-on aluminium of the same finish as the frames.

iii) All labour and other incidental materials such as glazing compound, shim, glazing clips, securing devices, felt, etc. not specified but required to complete a satisfactory and approved installation shall be provided.