

JHCO Warehouses



Tender Documents

Enabling works package

August 2024

**TENDER DOCUMENTS
SPECIFICATIONS & BOQ**

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SECTION 01350

HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES

PART 1 GENERAL

1.1 GENERAL

- A. The formulation and enforcement of an adequate safety programme shall be an obligation of the Contractor with respect to all work under this contract, whether performed by the Contractor or his Subcontractors. The general conduct of the works shall be based on the safety practices on construction work recommended in the latest edition of the "Safety Code", issued by the the National Building Code, or the equivalent of such code, practices and local regulations.

The Contractor has assurance from the Owner of his cooperation, where the implementation of the safety programme requires such cooperation.

Prior to commencing the works on site the Contractor shall submit to the Owner a safety programme for review.

The programme shall include but not be limited to the following:

1. Method of Handling Emergencies.
2. Name of Doctor.
3. Name of Hospital.
4. Name of Contractor safety Representative on the Site.
5. Location of First Aid Stations.
6. Manning of First Aid Stations.
7. List of Equipment to be maintained at the First Aid Stations.
8. Safety helmet/shoe programme including areas to be designated "Safety Helmet/Shoe Area."

1.2 DEFINITIONS

- A. Competent Person – Capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
- B. Risk - Means the probability that injury or damage will occur.
- C. Construction Worksite – Area within the limits necessary to perform the work described in this contract.
- D. Imminent Danger – A hazard which, if allowed to persist, is quite likely to cause an accident that will result in death, serious injury, significant property damage, or environmental impairment.

- E. Qualified Person – One who, by possession of a recognized degree, certified by OSHA, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve or resolve problems relating to the subject matter, the work, or the project.
- F. Site-Specific Safety Plan (SSSP) is a highly effective Document and communication tool. A SSSP is developed by Contractor to manage how a general contractor will manage the risk on a specific project site and the health and safety requirements for that project. ... The Site Specific Safety Plan should: Create a system that connects activities to hazards and hazard control.
- G. Stop-Work Order – A definitive statement made openly to another individual that an imminent danger situation exists and thus all related work must stop immediately.

1.3 EARTHWORKS

- A. Barricade open excavations made as a part of earthwork operations and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

1.4 PERSONAL PROTECTIVE EQUIPMENT

- A. Employees working in areas of potential danger of head injury from impact or from falling or flying objects shall at all time are protected by protective helmets.
- B. Employees shall be provided with suitable guards and other protection when working in areas of potential danger of burns or electric shock.
- C. Safety nets must be provided when work places are more than 3 meters above the ground, water, or other surfaces where the use of ladders, scaffolds, catches platforms, temporary floors, safety lines or safety belts are impractical.

1.5 FIRE PROTECTION & PREVENTION

- A. Only approved containers and tanks shall be used for storage and handling of flammable and combustible liquids.
- B. The Contractor shall be responsible for the development of a fire protection programme to be followed throughout all phases of the construction or demolition work, and shall provide adequate fire fighting equipment.
- C. Fire extinguishers, water buckets and sand buckets as appropriate shall be provided not less than 30 metres from any work location on each floor as work progresses. Coordinate with activation of new fire fighting equipment in each building.
- D. A fire extinguisher, rated not less than 10B, shall be provided within 15 metres of wherever more than 5 gallons of flammable or combustible liquid or 5 pounds of flammable gas are on the job site,

- E. Smoking shall be prohibited at or in the vicinity of operations which constitute a fire hazard and the area shall be conspicuously posted: "NO SMOKING OR OPEN FLAME"

1.6 STAIRWAYS & LADDERS

- A. Stairways having four or more risers or rising more than 75 cm, whichever is less, shall be equipped with a guardrail system along each unprotected side or edge.
- B. When ladders are used for access, they shall be secured. Ladder side rails shall either extend at least 1 metre above the upper landing surface, or a grasping device such as a grabrail must be provided. In no case shall the extension be such that the ladder could slip off its support.
- C. A stairway or ladder shall be provided at all personnel points of access where there is a change in level of 56 cm or more, and where no ramp runway or sloped embankment, or personnel hoist is provided.
- D. Ladders with structural or other defects shall be withdrawn from service until repaired.

1.7 MATERIALS HANDLING, STORAGE, USE & DISPOSAL

- A. Rigging equipment is to be inspected before each shift and as necessary during use to ensure that it is safe. Defective rigging equipment shall be removed from service.
- B. Aisles and passageways shall be kept clear for free and safe movement of material handling equipment or employees. Such areas shall be kept in good repair.
- C. Material stored inside buildings under construction shall not be placed within 2 metres of any hoistway, or inside floor openings, or within 3 metres of an exterior wall which does not extend above the top of the stored material.
- D. Materials shall be stored in a stable manner. Where materials are stored inside buildings, the Contractor shall ensure that storage loads are less than safe imposed working loads for the floor on which they are stored.

1.8 SAFETY OF PEDESTRIANS

- A. Access to the construction site must be cordoned off as much as possible in all work areas.
- B. All excavations are to be fenced / barricaded to prevent access by public / pedestrians.
- C. Work must be planned in such a manner as to ensure that the minimum amount of trenches are left open after hours or during weekends.

- D. No trenches in which water has accumulated may be left open

1.9 SAFETY SUPERVISOR.

- A. The Contractor shall appoint, and identify on site, supervisor responsible for health and safety for the work site. The supervisor shall be given sufficient time by Contractor to carry out safety supervisory duties on site. Reference in Contract: Contractor's Superintendent

1.10 SAFETY TRAINING AND EDUCATION

- A. The Contractor must provide safety awareness training to all its workers upon joining the site. The Safety Supervisor must hold records of training. As a minimum, the awareness training shall include:

- a. General outline of the project
- b. Access and egress to the site
- c. Wearing Personal Protection Equipment (PPE)
- d. Health, Safety and Site regulation
- e. Emergency procedures
- f. General and particular hazard of the project
- g. Security arrangement
- h. Reporting of accidents and incidents

1.11 SAFETY MEETINGS

- A. The Contractor must hold monthly Safety meeting for all its workers at which safety instructions will be issued and comments/ feedback received. Comments will be recorded by the Safety supervisor for evaluation and implementation as appropriate.

1.12 WORKPLACE SAFETY INSPECTION

- A. The Contractor and the Engineer must make weekly safety inspections of the Site or as needed to observe and correct any unsafe situation such as build up debris and litter, on floor nails, wood and metal pieces and missing or damaged safety rail..etc.

1.13 WORKERS HYGIENE

- A. The Contractor should provide onsite One sanitary facility (1 toilet with shower, 1 washing basin, 1 urinal) per 25 workers. Sanitary facilities to be covered, easily accessible, ventilated, well lit, maintained, and sanitized.
- B. The Contractor should provide safe drinking water distributed by pipes that are at least 2 meters away from any contaminated water source

1.14 PERSONAL PROTECTIVE EQUIPMENT

- A. Contractor shall provide personal protective equipment, including hard hats, safety glasses, respirators, gloves, safety shoes, and other such equipment, to the Contractor's Staff and workers.

Personal Protective	When it shall be worn (as minimum)
Non-metallic hard hats	At all times by all personnel on site
High Visibility Jackets	At all times by all personnel on site
Safety glasses meeting international standards	For the following types of work a minimum: hammer chipping, welding, grinding, use of electricity power, installation handling, and spray paint working with solvent and any other jobs where the poten of an eye injury exists.
Face shield and/or masks	Where possible exposure to hazardous chemicals, cryog fluids, acids, caustics or dust exists and glasses ma provide adequate protection such as in welding.
Gloves	When handling acids, caustics and chemicals with corro or toxic properties.
Safety shoe or substantial work shoe	At all times by all personnel working on site

1.15 USE OF MOBILE/ HEAVY EQUIPMENT

- A. The Contractor shall have mobile equipment fitted with suitable alarm and motion sensing devices, including backup alarm, when required.
- B. The Contractor shall inspect all plant and equipment to make sure all are in safe working order. Special attention shall be given to such items as cables, hoses, guards...etc.
- C. The Contractor shall take out any plant found to have defective equipment affecting its safe operation until defects are rectified.
- D. The Contractor shall make sure all plant must be operated by trained competent persons each with a valid certificate of competence. If no such certification scheme exists, the Contractor shall certify their competency, in writing.
- E. The Contractor shall not use natural and synthetic fiber rope made of material such as manila, nylon, polyester or polypropylene as slings on mobile equipment.
- F. The Contractor is responsible for the safe operation of its lifting and

handling equipment. The Contractor shall ensure that its installations and equipment respect safety recommendations and rules.

- G. The Contractor shall arrange crane location points, base footings, pick up points and swing radius with the Engineer.
- H. The Contractor shall give the Engineer a minimum 48-hour notice prior of bringing a mobile crane on Site and the Contractor shall comply with any scheduling requirements.

1.16 SAFETY HELMETS

- A. The Contractor shall provide approved safety helmets for the use of all construction personnel on site.
- B. The Contractor shall provide approved safety helmets for the sole use of the Owner, his staff and authorized visitors to the site.

1.17 GENERAL REQUIREMENTS AND BEST PRACTICE MEASURES FOR PANDEMIC AND INFECTIOUS DISEASES:

- A. **Apply Hygiene procedures** and establish hygiene stations/disinfection passages. Running water, soap and alcohol-based disinfectants should be placed in several spots.
- B. Issue notices and distribute information material to workers and, as applicable, to contractors/sub-contractors, workers in worker accommodation sites, visitors, customers, suppliers and the surrounding communities. These should be in line with the latest advice and requirements from regional and international authorities and organizations.
- C. Raise awareness and provide trainings with regard to infection symptoms: Fever, tiredness, difficulty breathing, dry cough, chills, repeated shaking with chills, muscle pain, headache, sore throat, and new loss of taste or smell. Some patients may have nasal congestion, runny nose, or diarrhea. Symptoms may appear two to 14 days after exposure to the virus.
- D. In case of workers that in the last two weeks:
 - were **in close contact** with a person who has infection
 - were **in a country/region** with a high number of cases of infection
 - experienced **fever, cough or any other symptoms**
 - **used medications** such as paracetamol or aspirin

Apply **immediate measures and inform potential contacts** to self-isolate to restrict the possibility of spreading the virus.

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- E. In case such symptoms are encountered, encourage employees to stay at home, seek medical consultation, self-isolate and avoid social interaction. Ensure, where possible, that staff has adequate access to medical consultation, including over the telephone.
- F. Provide self-isolation areas/rooms in case of worker's accommodation.
- G. Encourage employees to communicate symptoms and infection cases in their families or communities. Report and monitor the measures implemented, as well as infection incidents in the work-force and/or communities.
- H. Identify the closest medical facilities to test, confirm and opine on potential infections. Ensure routine health services remain available to all site residents and host communities in-side the health facility's catchment area. It is important to separate people accessing routine services from suspect and confirmed infection cases.
- I. Provide trainings with regard to infection diseases response measures.
- J. Inform and encourage employees about hygiene, means of infection and hazards of contacts (cough hygiene, hand sanitation, cleaning and disinfection, food preparation, PPE, healthcare etc.):
 - Cover the mouth and nose with a tissue when coughing or sneezing, and dispose of the used tissue in a wastebasket.
 - When no tissue is available, cough or sneeze into the upper sleeve or elbow, not into the hands.
 - Wash hands with soap for at least 20 seconds, rinse and dry using paper towel. If soap and water are not available, use a hand sanitizing alcohol-based gel.
- K. **Provide minimum PPE for all workers** as per national and international guidance:
 - Masks
 - Disposable gloves
 - Gowns, aprons
 - Eye protection (goggles or face screens)
- L. Ensure that there are **appropriate rooms and places to disinfect** and store potentially contaminated material.
- M. **Adjust workspaces** to facilitate **social distancing** and implementation of the hygiene measures.
- N. **Ensure** that **enhanced cleaning arrangements** are in place, to include regular and deep cleaning using disinfectant of catering facilities/canteens/food/drink facilities, latrines/toilets/showers, communal areas, including door handles, floors and all surfaces that are touched regularly (ensure cleaning staff have adequate PPE when cleaning consultation rooms and facilities used to treat infected patients). Undertake daily clean-up of area of activity.

- O. **Assign responsible staff** and define the requirements and responsibilities.
- P. **Engage** with medical authorities, hospitals, communities and stay up-to-date on the national and international guidance regarding the impacts on workspaces, continuity of business and community health and safety. Monitor the media and updated legal requirements and preventive actions taken by local authorities.
- Q. **Report** the updated legal requirements and preventive actions taken by local authorities.
- R. **Collect and treat wastes separately.** Domestic waste from infected communities, medical facilities, etc. need to be treated separately and disposed in an appropriate way to prevent further infection. Identify proper disposal facilities e.g. medical/hazardous waste landfill.
- S. **Avoid unnecessary interaction** of non-community workers or workers' accommodation residents with communities.
- T. **Identify critical staff to continue working (security guards, maintenance technicians, critical activity operators, safety expert etc.).**

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 HEALTH AND SAFETY REPORTING HEALTH AND SAFETY REPORTING

- A. Contractor shall develop a Health and Safety Plan (HS Plan) for managing health and safety, pursuant to its Health and Safety Management system (HSMS).
- B. The HS plan identifies and specifies:
 - a) That Contractor understands and manages all health and safety risks relating to the execution of the works, including gender-specific risks;
 - b) Prevention and protection measures to control risks related to the execution of the works, by differentiating, where necessary, measures concerning the protection of women and men;
 - c) Human and material resources involved;
 - d) Works requiring a permit (e.g. blasting, butting of trees);
 - e) Emergency plans to be implemented in the case of an accident.
- C. The Contractor implements prevention, protection and monitoring measures, as described in the health and safety plan.

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- D. The Contractor shall have in place a Behavioural Safety Based Programme and actively train and encourage Personnel to intervene on unsafe behaviours and situations and report on deviations.
- E. The Contractor shall document in a structured system (e.g. a Site Accident record sheet) all accidents, dangerous occurrences and investigations which shall be available at all times for inspection by the Engineer.
- F. The Contractor shall investigate any incident and record and report systematic follow-up of relevant findings and recommendations. Problem areas related to HS shall be recorded with information about status, responsible person(s) and alternative solutions.
- G. Contractor shall include in the Progress Report to the Engineer a monthly HS Performance Report. The format and content of the HS Performance Report shall be agreed with the Engineer prior to the commencement of the works and report them to the Engineer.
- H. Report shall contain the following data, as related to the works:
 - a) Progress against implementation of the Contractor's HS Plan
 - b) A list, including a brief description, of all incidents and dangerous occurrences.
 - c) Number of facilities
 - d) Number of serious incident frequency
 - e) Total Recordable injury frequency
 - f) Number and type of accidents with and without lost-time
 - g) Serious illness
 - h) Total number of 'near miss events;
 - i) Number of theft incidents;
 - j) Number of security and number and type of other incidents;
 - k) In the event that the Contractor receives communication from the Engineer on HS under-performance, the Contractor shall prepare and implement an HS Improvement Plan to rectify such

3.2 ACCIDENT REPORTING PROCEDURE

- A. The Engineer is informed within one hour day/night of any accident involving serious bodily injury to a member of personnel, a visitor or any other third party, caused by the execution of the works or the behaviour of the personnel of the Contractor.
- B. The Engineer is informed as soon as possible of any near-accident (near misses) relating to the execution of the works which, in slightly different conditions, could have led to bodily injury to people, or damage to private property or the environment.

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- C. The Contractor shall prepare a report on each accident or dangerous occurrence and a copy of the report, together with witness statements and any other relevant information, shall be submitted to the Engineer as soon as possible.
- D. A reportable accident shall include any accident to any person on Site requiring medical attention or resulting in the loss of working hours or any incident that resulted, or could have resulted in injury, damage or a danger to the Works, persons, property or the environment. Contractors will also notify and report of incidents of Subcontractors and Suppliers (in particular those for major supply items) and their Contractors Sites.
- E. The Contractor shall report any HS accident, related to Contractor activities or personnel, to national or local authorities as required by relevant legislation. A copy of all such reports shall be provided to the Engineer.
- F. The Contractor shall not notify or give any information to the media or other units or people without the employer's consent.
- G. The Contractor shall immediately rectify any situation or condition that could result in injury or a danger to the Works, person, property or the environment. If the situation or condition cannot be corrected immediately, the Contractor shall provide temporary barriers and appropriate warning signs and devices and/or take other appropriate action necessary for the protection of persons, property and the environment.

3.3 PLANNING FOR EMERGENCY SITUATIONS

- A. The Contractor shall establish an emergency plan as a section of the PA-ESMP. It covers the following emergency situations as a minimum:
 - a) e.g. Fire or explosion;
 - b) e.g. Collapse of structures, or scaffolding;
 - c) e.g. Loss of the containment of dangerous substances;
 - d) e.g. Safety incident or malicious act.
- B. The Contractor shall maintain fit-for-purpose Emergency Response Capability, which shall be clearly documented.
- C. At a minimum, the Contractor shall make contingency arrangements for calling a Doctor and transporting injured persons to hospital. The telephone numbers of the emergency services and the name, address and telephone number of the Doctor and the nearest hospital shall be prominently displayed in the Contractor's office
- D. The Contractor ensures that all personnel are informed and aware of how to react in an emergency situation, and responsibilities are defined. Information and awareness training is documented, and available on all Project Areas
- E. The Contractor organises and documents emergency simulation exercises within 3 months of the physical start of the works, and subsequently once every 12 months up to the issue of the Taking-Over Certificate. The Engineer is invited to participate in each of these exercises.

F. Fire protection

- a) Based on a fire safety risk assessment, the Contractor will ensure that adequate and appropriate fire safety measures are in place to minimise the risk of injury or loss of life in the event of a fire. Appropriate actions include: Keeping sources of ignition and flammable substances apart; Avoiding accidental fires; Ensuring good housekeeping at all times, e.g. avoiding build-up of rubbish that could burn; Installing smoke alarms and fire alarms or bells; Installing fire warning systems; Having correct fire-fighting equipment; Keeping fire exits and escape routes clearly marked and unobstructed at all times; Ensuring workers receive appropriate training on procedures they need to follow, including fire drills.
 - b) Fire will not be used as a method of forest or vegetation clearance.
 - c) Fire extinguishers are made available in each building at clearly identified locations, and fires are strictly forbidden outside of the cooking area.
- G. If applicable, the Contractor makes arrangements with local fire-brigades for emergencies

3.4 MEDICAL CHECK-UPS

- A. The Contractor organises medical check-ups carried out by a doctor or an appropriately qualified nurse for all Contractor's Personnel prior to the initial mobilisation to the Project Area to check aptitude for the work. Medical check-ups are adapted to the anticipated occupied positions and carried out pursuant to the recommendations of the International Labour Organization. Subsequent to the check-up, a written medical certificate is issued declaring the aptitude of the worker for the allocated tasks.
- B. Hearing tests are conducted for the Contractor's personnel exposed to noise levels above 80 dB(A) in order to establish initial audiograms. Annual tests are carried out to monitor any changes and detect any deterioration.
- C. The Engineer can request additional medical examinations for the Contractor's Personnel if considered necessary, all costs to be borne by the Contractor.
- D. A medical examination is carried out on any Contractor's Personnel returning to work after leave caused by a work related accident. A written medical certificate is issued confirming the Contractor's Personnel's aptitude to return to work at the designated workstation.
- E. The Contractor can produce a copy of its Contractor's Personnel's work aptitude certificates at the request of the Engineer or any competent authority.
- F. Specific arrangements for tasks' assignments or workstations shall be made for pregnant Personnel

3.5 FIRST-AID

- A. The Contractor ensures a minimum of first-aid provisions on any work site, including: suitably stocked first-aid kits; a person, respectively an adequate number of staff appointed and trained to take charge of first-aid arrangements and ensure that staff and workers are informed about first-aid arrangements.
- B. The Contractor equips the Project Area with a communication system exclusively for the purposes of communication with the first aid services. Information on how to communicate with the first aid services is clearly indicated near the communications equipment.

3.6 EMERGENCY MEDICAL EVACUATIONS

- A. The Contractor allocates rapid emergency transportation for first aid purposes to the first aid station pursuant to standard NF EN 1789:2007.
- B. In cases where there is no first aid emergency vehicle available to evacuate severely ill or injured personnel, the Contractor establishes an agreement with a specialised company for the handling of personnel in the event of a serious accident requiring an emergency medical evacuation and ensures that transport is guaranteed any time and as fast as possible. The Contractor will provide a copy of the agreement to the Engineer within one month of the physical start of works.
- C. The agreement includes a convention with a referring hospital where the member of personnel evacuated in emergency conditions will be treated.
- D. In highly remote areas or in demonstrably life threatening cases, the agreement may cover the use of air transportation (if available) in order to evacuate the injured patient(s) to the referring hospital.
- E. The telephone numbers of the emergency services and the name of the service providers and the doctors shall be prominently displayed in the Contractor's site office

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1: GENERAL

1.01 GENERAL

- A. The Contractor shall be responsible for quality control to include, but not restricted to :
 - 1. Contractor's provision and maintenance of a quality control program in conjunction with his subcontractors as approved by the Owner. The program shall provide inspection and testing of products during fabrication and installation as the Contractor may deem necessary to ensure that work is performed in compliance with the Contract. Such inspection and testing shall be performed at no additional expense to the Owner.
 - 2. Inspections and testing required by the orders, laws, ordinances, rules and regulations of local authorities.
 - 3. Employment of separate professional inspection and laboratory testing firms to provide inspection services and to supervise laboratory testing services as specified in the applicable sections of the Specifications and under the review of the Owner. Perform inspection and testing by or under the supervision of approved testing and inspection firms only.
 - 4. Provision of inspection and testing instruments, and devices required to ensure proper performance of quality control.
 - 5. Verification by affidavits and certification that specified products meet requirements of reference standards as specified in applicable sections of the specifications.
 - 6. Testing, balancing, and adjusting of equipment as specified in applicable elevator, mechanical and electrical sections of the specifications.
- B. The Contractor shall indicate in his Tender for the Owner's approval the names of the proposed independent laboratories to conduct the tests specified in the Contract Documents, laboratories associated with material suppliers will not be acceptable.

1.02 QUALITY CONTROL GENERALLY

- A. Maintain continuity of quality control surveillance throughout fabrication of products and execution of work.
- B. Submit details of quality control tests and methods proposed for each section of Divisions 2 to 16, inclusive, of the specification.
- C. Perform inspection and testing in accordance with specified reference standards, or as otherwise approved by the Owner.

- D. Calibrate measuring and testing devices periodically against certified standard equipment. Calibration shall be verified by an approved firm.

1.03 CONTRACTOR'S QUALITY CONTROL OF THE WORKS ON SITE

- A. Provide a control system to ensure quality control by phased inspections as follows:

- 1. Preparatory Phase Inspection:

Perform inspections prior to commencement of each part of the works which shall include a review of requirements with the supervisors directly responsible for that part of the works. Such reviews shall be in the form of written statements of the processes to be followed, and critical characteristics, tests and similar evaluations which will be a part of inspection procedures. Verify that products incorporated with that part of the works have been tested and applicable submissions have made for control testing. Verify that preceding work has been completed, and that work conforms to submission data and contract requirements and that necessary materials and equipment are readily available.

- 2. Continuing Inspections:

Perform inspections on a continuing basis as each part of the works commences and on a regular basis following to ensure constant compliance with contract requirements.

- B. Provide samples of materials to be tested in required quantities at locations where testing is performed.
- C. Provide labor, instruments, testing devices, facilities, and required shelter at the site:
 - 1. To determine ambient and material temperature by thermometers with Celsius scale.
 - 2. To determine relative humidity of air and moisture content of materials.
 - 3. To facilitate inspections and tests.
 - 4. For obtaining and handling of samples at site and plant.
- D. Upon receipt of items at the job site, the Contractor's quality control representative at the site shall be responsible for noting any damage suffered by them during shipment, and for directing that they be replaced.
- E. Be responsible for protecting and maintaining items on the site free from damage during storage, erection, installation and maintenance.
- F. When it is discovered on inspection that work is proceeding with incorrect materials or methods, ensure that corrections are immediately made and that improper completed work is replaced.

1.04 CONTRACTOR'S QUALITY CONTROL OF OFF-SITE WORK

- A. Impose quality control methods at the location of manufacture, fabrication and assembly of items to be incorporated in the works to ensure that they conform to requirements of the Contract Documents. This quality control shall not apply to proprietary products except as may be deemed necessary by the Contractor or as directed by the Owner.
- B. The Contractor's quality control representative off-site shall be responsible for the release of items for shipment to the job site.
- C. Notify Owner in writing at least 3 weeks in advance of packing of every batch of product components or assemblies so that the Owner may have the opportunity, if he so desires, to inspect any such product components or assemblies prior to shipment.
- D. Acceptance of product components or assemblies prior to shipment shall not imply final acceptance under the Contract.

1.05 SCHEDULING OF QUALITY CONTROL OPERATIONS

- A. Provide to the Owner for approval three copies of a schedule of quality control operations, both on-site and off-site, to outline the procedures, instructions and reports which will be used, as follows:
 - 1. Quality Control Organisation.
 - 2. Qualifications of quality control personnel.
 - 3. Authority and responsibilities of each quality control person.
 - 4. Schedule of inspections and tests with personnel assigned to each task and duration of each task.
 - 5. Schedule of required services to be provided by inspection and testing firms.
 - 6. Coordination required between sections of the specifications in order that quality control is integrated.
 - 7. Test methods which will be utilized.
 - 8. Methods of performing and documenting quality control operations.

1.06 CONTRACTOR QUALITY CONTROL PROGRAM

- A. Further to the requirements of the General Conditions entitled "Inspection and Testing", the Contractor shall provide a comprehensive Contractor Quality Control Program to ensure that all engineering, construction, materials, equipment and workmanship provided under this Contract are in compliance with contract provisions, applicable laws, codes and standards, and sound engineering and construction practices, unless specifically instructed otherwise by the Owner.

The Contractor Quality Control Program shall include, but not be limited to, the following:

- 1. Provisions for the review and certification by a responsible contractor representative of all engineering, **design and other technical** submittals to the Owner under the terms of the Contract.
- 2. Provision of a contractor Quality Control organization headed by a full time contractor Quality Control manager to monitor and supervise the

- implementation of the Contractor Quality control Programme, and monitor compliance of establishment and functioning of a testing laboratory for continued material testing.
3. Coordination of the Independent Testing Laboratory activities.
 4. The preparations and submittal for Owner approval of a Contractor Quality Control plan incorporating the requirements of the above.
- B. The provisions of review and certification of technical submittals shall ensure compliance with the requirements of:
1. General Conditions of Contract Clauses
 2. Technical Provisions:
 - a. Design Requirements.
 - b. Reference Codes and Standards.
 - c. Approved Shop Drawings, Product Data and Samples.
 - d. Any other requirement related to the preparation by the Contractor of technical documents.
- C. Prior to commencing work at the work site, the Contractor shall appoint a Contractor Quality Control (CQC) Manager supplemented as necessary by additional quality control personnel, who shall be on the work site at all times during progress of the works with complete authority to take any action necessary to ensure compliance with the contract. The CQC Manager shall be appointed by a letter addressed to him and signed by an officer of the firm. This letter shall detail the CQC Manager's authority and responsibility to direct removal and replacement of any defective work. The CQC Manager shall report directly to an officer of the firm, and not the job superintendent or project manager. The CQC Manager shall have no job-related responsibilities of appointment and the qualifications of the appointed CQC Manager shall be submitted to the Owner for approval.
- D. The Contractor shall employ an Independent Testing Laboratory acceptable to the Owner for the performance of quality control testing at the work site or location as designated. As a minimum, the laboratory shall meet the "Recommended Requirements for Independent Laboratory Qualifications," published by the American Council of Independent Laboratories, the basic requirements of ASTM E329 "Standards of Recommended Practice and Testing Agencies for Concrete and Steel as used in Construction." and shall be authorised to operate in Jordan for on- site testing. The Contractor shall submit to the Owner for approval the name, address and qualifications of the proposed Independent Testing Laboratory along with evidence of authority to operate in Jordan and qualifications of key laboratory personnel who will be responsible for testing services. All costs relating to testing shall be the responsibility of the contractor.
- E. Contractor shall submit including, but not limited to, the following structural submittals to the Owner for approval.
1. Quality Control Programme for backfill.
 2. Concrete design mix.
 3. Quality Control Programme for concrete work with test records.
 4. Concrete pouring/placement schedule.
 5. Proposal for location of construction joints and control joints.
 6. Quality assurance for structural steel fabrication, welding, bolting and fasteners.

7. Structural steel welders qualification record.
 8. Welding manuals and test reports for non-destructive testing, materials storage and warehousing details.
 9. Establishment of Sample and Mock-up room.
- F. The Soil Report available is general in nature. The Contractor shall utilise the services of a soil investigation agency approved by the Engineer, to perform any necessary soil investigation activities in accordance with an approved programme showing the number, depth and location of bore holes/test pits. On completion of the field tests and laboratory tests by the soil investigation agency, the Contractor shall verify the shape and the character of the foundations and verify correctness of design parameters used for designing of the footings and related structures based on the building loads. In the case of discrepancy the Contractor shall provide the Owner with the relevant data and redesign the foundations and related structures in accordance with the instructions of the Owner.
- G. The Contractor shall provide a material testing laboratory on site with all equipment and facilities for performing tests on site as agreed by the Owner. The laboratory shall be provided with qualified technical personnel to perform the tests. Except for such site tests which the Owner agrees can be carried out by the Contractor in the Contractor's site laboratory the Contractor must utilize the services of an independent laboratory.

1.07 CONTRACTOR QUALITY CONTROL PLAN

- A. The Contractor shall furnish 5 copies of the Contractor Quality Control Plan to the Owner for approval. The Contractor Quality Control Plan shall detail the procedures, instructions, and reports to be used to ensure compliance with the quality provision of contract. This plan will include, as a minimum:
1. The quality control organization in chart form, showing the relationship of the quality control organization to other elements of the firm.
 2. Names and qualifications of personnel in the quality control organization.
 3. Area of responsibility and authority of each individual in the quality control organization.
 4. Procedure(s) describing responsibilities and authorities for reviewing and certifying design and other technical submittals.
 5. Procedure for review of procurement documents for materials, items and services to ensure applicable contract, technical and quality requirements are specified.
 6. Procedure for describing selection, Owner approval if applicable, and surveillance of vendors and subcontractors supplying materials, items and services.
 7. Procedure for identification, maintenance, distribution and control of all contractual documents to ensure that current, approved documents are available during construction of permanent work.
 8. Procedure describing methods of identifying and instructing actions to correct non-conforming materials, items, and conditions.
 9. Procedure requiring calibration of all inspection and test equipment which required periodic calibration.
 10. Definition of the role and responsibilities of Independent Test Laboratory.

11. Procedure for implementing the Owner approved inspection and test plan.

- B. Prior to submittal of Contractor Quality Control plan, the Contractor shall meet with the Owner and discuss the quality control requirements. The purpose of the meeting is to discuss details of the system, including forms to be used for recording the quality control operations, inspections, tests, approvals, certifications, administration of the system, and Owner surveillance.
- C. Unless specifically authorised by the Owner, on-site construction or off-site fabrication shall not start until the Contractor's Contractor Quality Control Plan is accepted. Work will commence only after acceptance of the plan, or at least acceptance of that portion of the plan applicable to the specific nature of work.

1.08 CONTRACTOR'S QUALITY CONTROL REPORT

- A. Document each test and inspection in a report and submit the report in
- B. Reports shall be in a format **approved** by the Owner and shall certify off-site items produced correctly for on-site \ **work shipment**, or installed correctly, as applicable.
Similarly, the reports shall certify items that are defective with a statement included on corrective measures taken
- C. Purpose of the inspection or test, a description of methods, personnel involved.
- D. Maintain in a format approved by the Owner a log of all tests performed which shall include the date of test, type on test and the results of the test.
- E. If inspection and testing procedures are subcontracted by the approved inspection and testing firm, only copies of test reports signed by the approved inspection and testing firm will be acceptable.

1.09 WEEKLY PROGRESS REPORTS

- A. The CQC Manager shall submit weekly QQC reports to the Owner identifying prime and subcontractor activities such as work accomplished, inspections and tests conducted, results of inspection and tests, nature of defects found, causes of defects, and corrective actions taken, together with the following certification: "On behalf of the Contractor, I certify that this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the drawings and specifications to the best of my knowledge, except as noted above." This certification shall be signed for the Contractor, and by the authorized CQC Manager.

1.10 WORK DEFICIENCIES AND CORRECTIONS

- A. The Contractor shall not build upon or conceal any work containing uncorrected defects. If deficiencies indicate that the CQC Programme does not ensure the quality of the work undertaken by the Contractor, the Owner may direct that changes be made in the Contractor Quality Control Programme or

organization[^], including but not limited to, the removal of unsatisfactory quality control representatives at any level^{7 ^}

1.11 CERTIFIED TEST REPORTS AND MANUFACTURER'S CERTIFICATES

- A. Before delivery of materials and equipment certified copies of the reports of all tests required by the technical sections, applicable codes and standards or good engineering practice shall be submitted and approved. All manufacturer's certificates shall be signed by the manufacturer's official authorized to sign certificates of conformance compliance.

1.12 TEST REQUIRED BY JURISDICTIONAL AUTHORITIES

- A. The Contractor shall be responsible for inspection and testing required by jurisdictional authorities and for conformance to requirements of the authorities for testing methods and documentation
- B. Provide timely notification to the Owner of times of inspection and testing by jurisdictional authorities, so that he may, if he has so desires, observe the inspection testing or approval.

1.13 TOLERANCE FOR INSTALLATION OF WORK

- A. Unless specifically indicated otherwise, work shall be installed plumb, level, square and straight.
- B. Unless other acceptable tolerances are specified in a section of the specifications or are otherwise required for proper functioning of equipment as determined by the manufacturer, or for functioning of site services, and mechanical and electrical systems:
 - 1. "Plumb and level" shall mean ± 1 within 1 mm in 1 m
 - 2. "Square" shall mean not in excess of 10 second lesser or greater than 90 degrees.
 - 3. "Straight" shall mean within 1mm under a 1 m long straight edge.

1.14 DEFLECTION ALLOWANCES

- A. Ensure that an allowance for deflection of the structure is provided so that dead and live loads are not imposed on tops of walls and partitions.
- B. Unless otherwise determined from structural calculations approved by the Owner, provide a space for deflection of 1/500 of the span of the structural system due to live load only.
- C. At fire rated separation walls and partitions, employ methods to provide deflection space which will ensure that integrity of the fire rating is maintained.

1.15 LANTER DEFFECTS

- A. defective work discovered after substantial will be rejected, whether or not it has been previously inspected.

1.15 AUDITS

- A. The Contractor Quality Control Plan implementation is subject to audit by the Owner.

PART 2: PRODUCTS

Not Used.

PART 3: EXECUTION

Not Used.

END OF SECTION

SECTION 01500

TEMPORARY UTILITIES AND FACILITIES

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Temporary Utilities:
 - 1. Temporary electricity and lighting for construction purposes.
 - 2. Temporary ventilation.
 - 3. Telephone service.
 - 4. Temporary water service.
 - 5. Temporary sanitary facilities.
- B. Construction Facilities:
 - 1. Field offices and sheds.
 - 2. Vehicular access.
 - 3. Parking.
 - 4. Progress cleaning and waste removal.
 - 5. Project identification.
 - 6. Traffic regulation.
 - 7. Fire prevention facilities.
- C. Temporary Controls:
 - 1. Barriers.
 - 2. Enclosures and fencing.
 - 3. Security.
 - 4. Water control.
 - 5. Dust control.
 - 6. Erosion and sediment control.
 - 7. Pollution control.
 - 8. Rodent control.
 - 9. Pest control.
 - 10. Tree protection.
- D. Removal of utilities, facilities, and controls.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with Government and Municipal codes and regulations and with utility company requirements.
 - 2. Comply with National Electric Code.

1.3 EMPLOYER'S AND ENGINEER'S OFFICE

- A. Separate space for sole use of Employer and Engineer with separate entrance door with new lock and two keys.

- B. Employer's offices area shall be (Min 30 sm net) for the exclusive use of Supervision staff.
- C. The offices shall be fully ventilated, furnished with chairs, tables, drawing boards and equipment, plan chest, filing cabinets, shelving, photocopier, telephones, electronic calculators and kitchen equipment all as scheduled herein.
- E. The facilities shall be fully maintained and cleaned and attendance provided at all times. The Contractor shall provide suitably qualified labour to clean and maintain the offices, maintain all equipment, provide, prepare and serve refreshments and provide general attendance to the Engineer.
- F. All utilities shall be provided continuously and maintained at the contractor's expense. The telephone shall be installed and maintained by the Contractor including service charges and local call charges only.
- G. The maintenance of all the facilities listed above shall include the cost of all consumables required.
- H. The Contractor shall submit his layout plan of the office facilities to the Engineer for approval. The completion of the office facilities shall not be later than 14 days from the commencement of the mobilization period.

1.4 SERVICING REQUIREMENTS

A. Power, Telephone and Data Outlets:

- 1. The Contractor shall ensure that the rooms and areas within the field offices are supplied with adequate power, telephone and data outlet locations to satisfy the equipment schedule, to be installed in full in compliance with current industry standards and the authorities having jurisdiction. The Contractor shall make arrangements and pay all local charges (Local and international call charges) in connection with the installation, maintenance and operation of the telephone system. A handset shall be installed in each office/workstation connected to the necessary exchange equipment. Two persons in a designated area may share a telephone.

A handset shall also be installed in the reception. The Contractor shall provide exclusive telephone direct line outlet points with international (0) call facility in the offices for the Employer's Representatives, construction Manager and Project Engineer. The Contractor will recover the cost of any International calls made by the Employer's staff or the Employer's Representatives.

Note: The Contractor shall provide a separate telephone system for his own use, and the use of Sub-contractor s and Suppliers.

B. Drainage:

The toilets and kitchen shall be properly drained, with the outfall connected to a temporary septic tank specially constructed by the Contractor for the purpose. In the event that a temporary septic tank is utilised, location and construction details shall be to the approval of the Engineer and the Local Authority having jurisdiction. Septic tanks shall be periodically pumped out as required during the course of the work.

Upon completion the contents of the tank shall be totally evacuated, following which the tank shall be sterilized and removed from the site.

C. Environmental Control

The offices shall be fully air-conditioned utilizing individual split type air-conditioning units having a ceiling mounted cassette, external condenser unit and wall mounted controller. Each office and room, including sanitary accommodation, shall be maintained at a maximum steady dry bulb temperature of twenty five (25) degrees Centigrade at a relative humidity of fifty (50) percent under the worst operating conditions. Extract fans capable of ten (10) air changes per hour shall be provided in the kitchen(s) and toilet areas.

D. Fire Protection

The Contractor shall provide fire protection equipment consisting of 1.5 kg BCF fire extinguishers, fire blankets and sand buckets, the number and location shall be agreed with the Employer's Representative having due regard for compliance with the terms of the insurance company insuring the works and the Local Authority having jurisdiction. Fire protection equipment shall be regularly maintained during the period of the Contract, all in accordance with the Manufacturer's written instructions and recommendations.

1.5 TEMPORARY ELECTRICITY AND LIGHTING

- A. The Contractor shall provide adequate temporary electrical power for the construction site. Generating equipment shall be of sufficient capacity to adequately supply all electrical needs of the construction site. Generating equipment area distribution boxes, circuits and branch wiring shall be approved by the Employer prior to installation.
- B. Make all arrangements with the Electricity Company for temporary electrical service to the construction Site, pay all expenses, and provide all equipment necessary for temporary power and lighting. The electrical service shall be of adequate capacity for all construction tools and equipment without overloading the temporary facilities and shall be made available for power, lighting and construction operations of all trades. If temporary supply is not granted by Electricity Company, then the Contractor must make his own arrangements for providing supply of electricity in order to complete the Works.
- C. Provide power distribution as required throughout the Works for power tools of all kinds. Termination of power distribution shall be at locations approved by the Engineer. Termination shall be provided complete with circuit breakers, disconnect switches and other electrical devices as required to protect the power supply system.
- D. The Contractor shall install circuit and branch wiring with area distribution boxes located so that power and lighting is available throughout the construction by the use of construction type power cords.

- E. The Contractor shall provide adequate artificial lighting for all areas of work when natural light is not adequate for work and for areas accessible to the public.

1.6 TEMPORARY HEATING AND VENTILATION

- A. Provide temporary heating, cooling and ventilation as required to maintain adequate environmental conditions to facilities progress of the work, to meet specified minimum conditions for the installation of materials and to protect materials and finishes from damage due to temperature or humidity.
- B. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.
- C. Portable heaters shall be standard approved units complete with controls.
- D. Make periodic inspections of the cooling equipment and controls to ensure proper operation of the system, as conditions require and pay cost of energy consumed by all trades.

1.7 TEMPORARY TELEPHONE SERVICE

- A. Provide a minimum of six direct line telephone services at the construction site for the use of the Employer's personnel and employees from a connection point indicated by the Employer.
- B. Provide adequate direct line telephone service at the construction site for the use of the Contractor and Sub-contractors.

1.8 TEMPORARY WATER

- A. The Contractor shall provide and pay for adequate temporary water supply for construction and temporary facility purposes on the site and maintain it. If the existing supply is inadequate for the construction, the Contractor shall obtain water from another source on his own expenses.
- B. Install and pay for adequate supply of water for the construction (such as tanks with adequate capacity) and branch piping with taps located so that water is available throughout the construction by the use of hoses.
- C. Provide and pay for an adequate supply of drinking water from approved sources of acceptable quality, satisfactorily cooled, for Contractor's employees and those of his subcontractors. Furnish drinking water in suitable containers and provide disposable cups for use of employees. Drinking water dispensers shall be conveniently located in buildings where work is in progress.
- D. Provide and pay for an adequate supply of drinking water from approved sources of acceptable quality, satisfactorily cooled, for Employer's employees. Furnish drinking water in suitable containers and provide disposable cups for use of Employer's employees.

- E. Provide and pay for adequate quantities of suitable quality irrigation water to the approval of the Employer during the execution of the Landscape Works.

1.9 FIRE PROTECTION

- A. The Contractor shall provide adequate fire protection by means of water tanks, fire extinguishers and the like. All inflammable liquids, gases and the like shall be stored in an isolated and secured area of the Site with adequate signs posted. Such areas containing inflammable materials shall be security locked. Construction should be in accordance with the National Fire Protection Association Practice.

1.10 DISPOSAL OF SURFACE WATER

- A. The Contractor shall be responsible for forming all ditches, sumps, run offs and the like for disposing of natural water, including the use of pumps and apparatus necessary to prevent excavations and the site becoming flooded or unworkable.

1.11 SITE TOILETS

- A. The Contractor shall provide suitable toilets in the Employer's office and in the Contractor's offices, as well as temporary site toilets for the use of his workforce and that of the Sub-contractors. Such toilets shall be flush toilets in sufficient number to properly serve the needs of the entire workforce. Such toilets shall be continuously maintained and disinfected and upon completion of the Works shall be cleared away, septic tanks or access pits (if any) shall be emptied and removed and the ground reinstated. Siting of the toilets is to be approved by the Employer

1.12 TEMPORARY BENCHMARKS

- A. The Contractor shall establish temporary bench-marks on permanent blocks in locations on the site to be agreed with the Engineer, from which the levels to which the Works are to be constructed may be transferred. An existing bench-mark will indicated by the Engineer for this purpose.

1.13 VEHICULAR ACCESS

- A. Construct temporary access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.
- B. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.
- C. Location approved by Engineer.

1.14 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing spaces.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

1.15 TRAFFIC REGULATION

- A. Signs, Signals and Devices:
 - 1. Post Mounted and Wall Mounted Traffic Control and Informational Signs: As approved by authority having jurisdiction.
 - 2. Traffic Control Signals: As approved by local jurisdictions.
 - 3. Traffic Cones and Drums, Flares and Lights: As approved by authority having jurisdiction.
 - 4. Flagperson Equipment: As required by authority having jurisdiction.
- B. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
- C. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.
- D. Haul Routes:
 - 1. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
 - 2. Confine construction traffic to designated haul routes.
 - 3. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.
- E. Removal:
 - 1. Remove equipment and devices when no longer required.
 - 2. Repair damage caused by installation.
 - 3. Remove post settings to depth of 600 mm minimum.

1.16 FIRE PREVENTION FACILITIES

- A. Prohibit smoking with buildings under construction. Designate area on site where smoking is permitted. Provide approved ashtrays in designated smoking areas.
- B. Establish fire watch for cutting and welding and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.
- C. Portable Fire Extinguishers: NFPA 10; 10 pound capacity, 4A-60B: C UL rating.

1. Provide one fire extinguisher at each stair on each floor of buildings under construction.
2. Provide minimum one fire extinguisher in every construction trailer and storage shed.
3. Provide three fire extinguisher at the site offices.
4. Provide minimum one fire extinguisher on roof during roofing operations using heat producing equipment.

1.17 PROJECT IDENTIFICATION SIGN

A. Project Identification Sign:

1. 1 No. Illuminated Primary sign boards shall be provided in Arabic or English. The sign board shall be illuminated adequately and as indicated on drawings. The perspective view will be as agreed with the Engineer.

2. Project identification sign board shall of sufficient size and construction to incorporate all name plates and three dimensional view, size lettering for legibility at 30 m distance. The Contractor shall be responsible for the complete design, graphics, foundations, and structural support.

3. Project identification sign board shall be illuminated.

4. Content:

- a. Project title.
- b. Name and logo of Employer & Donor.
- c. Name of Contractor
- d. Names of design and supervision Consultants.
- e. The duration of contract and major subcontractors.
- f. Names and titles of authorities.
- g. Any other information as required by Engineer.

B. Design sign and structure to withstand 100 km/hr wind velocity.

C. Sign Painter: Experienced as professional sign painter for minimum three years.

D. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

E. Sign Materials:

1. Structure and Framing: New metal, structurally adequate.
2. Sign Surfaces: 0.5mm Thick metal plate.
3. Rough Hardware: Steel.
4. Paint and Primers: Exterior quality, two coats. Colors designated by Engineer.

5. Lettering: Exterior quality paint, contrasting colors designated by the Engineer.
Languages: English.

F. Installation:

1. Install project identification sign within 15 calendar days after date fixed by Letter of Acceptance.
2. Erect at designated location.
3. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
4. Install sign surface plumb and level, with butt joints. Anchor securely.
5. Paint exposed surfaces of sign, supports, and framing.

G. Maintenance: Maintain signs and supports clean, repair deterioration and damage.

Removal: Remove signs, framing, supports, and foundations at completion of Project and restore area.

1.18 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way.
- C. Provide protection for plants designated to remain. Replace damaged plants.

1.19 ENCLOSURES AND FENCING

- A. Construction: Galvanized corrugated steel sheets 0.5 mm thick with timber transoms, galvanized corrugated steel sheets shall be new.
- B. Provide 3.0 m minimum high fence around construction site; hoarding fence shall be constructed from painted steel tubes faced with corrugated sheets, equip with vehicular gates with locks. Shop drawings shall be submitted to the Engineer for his approval prior to execution.

1.20 SECURITY

- A. Security Program:
 1. Protect Work from theft, vandalism, and unauthorized entry.
 2. Initiate program at project mobilization.
 3. Maintain program throughout construction period until directed by Engineer.
- B. Entry Control:
 1. Restrict entrance of persons and vehicles into Project site.
 2. Allow entrance only to authorized persons with proper identification.
 3. Maintain log of workers and visitors, make available to Employer on request.
- C. Personnel Identification:

1. Provide identification badge to each person authorized to enter premises.
2. Badge To Include: Personal photograph, name and employer.
3. Maintain list of accredited persons, submit copy to Employer on request.
4. Require return of badges at expiration of their employment on the Work.

D. Security Service:

1. Employ uniformed guard service to provide watchpersons at site during non-working hours.

1.21 WATER CONTROL

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water.

1.22 DUST CONTROL

- A. Execute Work by methods to minimize raising dust from construction operations.
- B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

1.23 EROSION AND SEDIMENT CONTROL

- A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- B. Minimize surface area of bare soil exposed at one time.
- C. Provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow.
- D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
- E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.24 POLLUTION CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. Comply with pollution and environmental control requirements of related authorities.

1.25 RODENT CONTROL

- A. Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

1.26 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

- B. Remove underground installations to minimum depth of 600 mm.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02050

DEMOLITION WORKS

PART 1: GENERAL

1.01 SCOP OF WORK:

- A. Demolition and remove of site existing boundary walls and fences.
- B. Demolition of all services lines and removal/ blanking off to the approval of the concerned authorities.
- C. Provide as-built drawings for all elements to be partially demolished, showing foundations size and depth prior of any demolition works to Engineer approval.
- D. Protect all existing elements & boundary walls adjust to existing elements to be demolished.
- E. Liaise and obtain all necessary permits from all concerned local authorities i.e. municipality, police, services authorities, etc.
- F. Obtain all necessary NOCs as required from various authorities having jurisdiction.
- G. Carry out all relocating/ rerouting of services, through agencies authorized/ approved by governing authorities in compliance with their rules and regulations.
- H. Cart away all heaps of debris from site.
- I. Remove all debris and demolished structures/items to municipality approved tip.
- J. Provide necessary hoarding, screening, and dust suppressive measures as approved by the concerned authorities.
- K. All other temporary facilities associated with this contract shall be removed upon completion or as directed by the engineer.
- L. Liaise and obtain all necessary permits from all concerned local authorities i.e. municipality, police, services authorities, etc.

1.02 RELATED SECTIONS

- A. Section 01300 - Submittals.
- B. Section 01700 - Contract Closeout: Project record documents.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of barricades, fences and temporary work.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01700.
- B. Accurately record actual locations of capped utilities and subsurface obstructions.

1.05 QUALIFICATIONS

- A. Demolition Firm: Company specializing in performing the Work of this Section with minimum five years documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for demolition of structures, safety of adjacent structures, dust control, runoff control and disposal.
- B. Obtain required permits from authorities.
- C. Notify affected utility companies before starting work and comply with their requirements.
- D. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.
- E. Test soils around buried tanks for contamination.

1.07 MATERIALS ARISING

- A. All materials arising from the demolitions shall become the property of the Contractor unless otherwise specified hereinafter, and shall be cleared from the site as the work proceeds to an approved Government tip.
- B. Items or materials indicated to remain Employer's property, shall be labeled and stored to the Employer's approval
- C. Recover, preserve and arrange for safe discharge of all items of outdoor furniture, fitting and equipment to employer store.
- D. Materials arising from the demolitions shall not be burnt on site.
- E. Items or materials indicated to remain Employer's property, shall be labeled and stored to the Employer's approval.
- F. Commemorative plaques and tablets, antiques, and other items of interest or value to Employer that may be encountered during building demolition remain

Employer's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Employer

1.08 SAFETY

- A. Members of the public shall be kept at a safe distance during demolition operations by the erection of barriers, screens, etc., and outside working hours, by watching.
- B. All persons employed on the site shall be provided with protective clothing and equipment suitable for the type of work being undertaken.
- C. The Contractor shall at all times comply with the requirements of the police and fire departments, and of safety officers acting on behalf of the Engineer.

PART 2: PRODUCTS

Not used.

PART 3: EXECUTION

3.01 PREPARATION

- A. Provide, erect, and maintain temporary barriers and security devices.
- B. Mark location of utilities.

3.02 DEMOLITION REQUIREMENTS

- A. Conduct operations with minimum interference to public or private accesses.
- B. Sprinkle Work with water to minimize dust. Provide hoses and water connections for this purpose.
- C. Examine existing elements indicated to be demolished before demolition.

3.03 DEMOLITION

- A. Disconnect and remove utilities within demolition areas.
- B. Remove foundation, walls and footings.
- C. Remove concrete slabs on grade.
- D. Empty buried tanks located within demolition area. Remove buried tanks, components, and piping from site.
- E. Remove services (electrical installation, plumbing installations, water supply, fire fighting works, plumbing works, paved roads, etc.) on the site.

JHCO Warehouses Enabling works package

- F. Remove from site all demolished materials and plug and stop off all disused drains and outlets. The resultant voids shall be filled and compacted to the required levels with approved fill or lean mix concrete as directed by the engineer.
- G. Do not burn or bury materials on site. Leave site in clean condition.
- H. Debris shall not be allowed to build up on the floors, against walls or other parts of the building so as to overload them.
- I. Independently supported platforms shall be provided to avoid working from that part of the structure being demolished.
- J. Demolition shall be carried out using techniques, which will not be detrimental to adjacent or adjoining properties, structures, services, etc. it shall be the responsibility of the contractor to ensure that all the rules and regulations laid out by the various authorities are strictly followed. The contractor shall ensure that all the concerned authorities are notified about the demolition works in advance as per the prevailing rules and regulations and in accordance with the procedure agreed with the engineer.
- K. The contractor shall submit a method statement as to how he intends to carry out the demolition works for the approval of the engineer. Approval accorded for the method shall not relieve the contractor of any of his obligations to execute the works in a safe workmanlike manner.
- L. The contractor shall be responsible for any damages to existing services. Subsidence, any neglect or default by the contractor during the execution of the demolition works or any interruption of services or any interruption to the on going operations of the adjoining structures. The contractor shall make good such damage and shall make full compensation for any loss sustained due to the above at no addition cost or time implication to employer.
- M. Protect persons and property throughout progress of work. Provide safe working conditions for personnel.
- N. Unless otherwise indicated on the Design Drawings or directed by the Engineer, complete the demolition and removal of buildings and structures together with all foundations and retaining walls, piers, partitions and columns down to a plane 300mm below the ultimate grade in the area.
 - 1. Walls shall be broken into pieces not exceeding 6000mm² for any area of surface.
 - 2. Basement floor slabs shall be broken and displaced into pieces not exceeding 6000mm² for any area of surface.
- O. Complete demolition work on upper levels before disturbing supporting members on lower levels.
- P. Provide for the removal and disposal of excess debris, the removal of all other foundations, concrete floor slabs, sidewalks, signs, sheds, garages and fences and all other incidental and collateral work necessary to fully complete the removal of the buildings and appurtenances.

- Q. Concrete slabs resting on earth and forming walks, driveways, or the first floor slabs of buildings without basements except as indicated on the Design Drawings shall be broken up and removed from the Site.

3.04 ADJUSTING

- A. Restoration: Repair damaged items or remove items that are damaged beyond repair. Repair and install damaged items to condition at least equal to that which existed prior to start of work.

3.05 ASBESTOS HANDLING

- A. Should asbestos materials or asbestos component be found on site or be part of any demolished item(s), the contractor has to strictly observe the international and local regulation with regard to handling, transportation and disposal of asbestos materials and its components.
- B. Contractor has to co-ordinate with Municipality and or other concerned authorities for the approved procedures, precautions, disposal and location of disposal of asbestos.

3.06 DUST CONTROL

- A. Contractor has to control the dissipation of dust produced during demolishing process or in handling, loading and transportation of debris and other dismantled items.
- B. Method statement of how the contractor is proposing to control dust must be submitted with the tender dust control by water spraying method and of by any other method to the municipality approval and engineer instruction shall be observed by the contractor.
- C. Should the tendered opt not to insert a separate price for this item of work, the cost of the same shall be deemed to be build in other prices submitted in the tender.

3.07 METHOD OF DISPOSAL

- A. All debris, waste material rubbish and other by-products of demolition works, where of no salvage value, shall be cleared and disposed-off to designated land-fill locations away from site in a manner dictated by the engineer and/or prescribed by authorities having jurisdiction. Under no circumstances will disposal of such matter into adjoining sea-water, whether directly or otherwise, be permissible, in addition the contractor shall take any and all necessary precautions and safety measures to insure that no debris are dumped or discharged into the sea next to or in the vicinity of the site. The cost of all such precautions and measures will be deemed to have been included in the tender price, and no consequent variation claim whatsoever will be allowed in this regards.

3.08 SITE VISIT AND AFFECTION PLAN

- A. The tenderer shall visit the site of the proposed demolition works and shall be responsible for obtaining all information, which may be necessary for the purpose of submitting a tender and entering, into a contract. He shall carefully examine the tender documents and satisfy himself as to the risks, obligations and responsibilities to be undertaken in the execution of the contract.
- B. Regardless of whether the tenderer visits the site or not, he shall be deemed to have done so for contractual purposes.
- C. The tenderer and any of his employees or agents will be granted permission by the client to enter upon the site and lands for the purpose of inspection in concoction with the proposed tender, but only on this express condition that the tenderer will release and indemnify the client and his contractors, sub-contractors and his and their personnel, servants and agents against all liability in respect of personal injury (including disease) loss of or damage to property and any other loss, damage, cost and expense (including legal costs and experts' fees) howsoever caused in connection with any such visit.

3.09 GENERAL SITE CLEARANCE

- A. The areas indicated on the Drawings shall be cleared of all trees, shrubs and other vegetation, buildings and other obstructions, hard surfacing and rubbish.
- B. Trees outside the clearance area shall not be cut down without the prior written consent of the Engineer.
- C. Trees, shrubs, walls, buildings, instrumentation and other items which are to be preserved as indicated on the Drawings or instructed by the Engineer shall be protected from injury or damage arising from the operations of the Contractor, his sub-contractors and other persons under his control and from any other injury or damage which is the responsibility of the contractor under the Contract.
- D. Where underground structures, manholes, wells and similar items are discovered, their presence shall be reported immediately to the Engineer and they shall not be further disturbed until the Engineer has given his instructions for their disposal.
- E. Where underground structures, manholes, wells and similar items are demolished, and removed from the areas which are to be occupied by Permanent Works, any holes or depressions resulting from such removal shall be filled with material similar to that in the surrounding ground and compacted to a density equal to that of the surrounding ground unless other treatment is shown on the Drawings or instructed by the Engineer.
- F. The Contractor shall remove or divert pipelines, drains and services as shown on the Drawings or instructed by the Engineer.
- G. Drains and services which are to be removed shall be cut and stopped off at points shown on the drawings or instructed by the Engineer in a manner acceptable to the Engineer. Such cutting and stopping off shall only be carried out upon receipt of a written notification from the Engineer.

END OF SECTION

SECTION 02100

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removing surface debris.
 - 2. Removing designated trees, shrubs, and other plant life.
 - 3. Removing abandoned utilities.
 - 4. Excavating topsoil.
- B. Related Sections:
 - 1. Section 02200 – Earth Work.

1.2 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.
- C. Site Conditions: Submit to the Engineer's Representative for review photographs or videotape sufficient detailed existing conditions of trees, planting, adjoining constructions and any other relevant details.

1.3 QUALITY ASSURANCE

- A. Contractor shall conform to local codes and regulations for disposal of debris.
- B. Contractor shall obtain all approvals from authorities having jurisdiction for underground utilities and dumping areas.

1.4 PROJECT CONDITIONS

- A. Traffic: minimize interference with adjoining roads, street walks and other adjacent occupied or used facilities during site clearing operations.
- B. Provide alternative routes around closed or obstructed traffic way if required by authorities having jurisdiction.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

- A. Call Local authorities having jurisdiction not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.

3.2 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees and shrubs.
- C. Remove rocks and stones
- D. Clear undergrowth and deadwood, without disturbing subsoil.
- E. Apply herbicide to remaining stumps to inhibit growth.

3.3 REMOVAL

- A. Remove debris, rocks in any size, and extracted plant life from site.
- B. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
- C. Do not burn or bury materials on site. Leave site in clean condition.
- D. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

3.4 TOPSOIL EXCAVATION

- A. Excavate topsoil, up to 300mm from existing level, from areas to be further excavated, re-landscaped, or regraded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site and protect from erosion. Stockpile material on impervious material, until disposal.

- D. Remove excess topsoil not intended for reuse, from site to authorized dump area outside Project Site.

3.5 PROTECTION

- A. Protect bench marks from damage or displacement.
- B. Protect trees, plant growth, and features designated to remain, as final landscaping
- C. Maintain designated site access on the site layout organization plan(s) for vehicle and pedestrian traffic.
- D. Protect existing services facilities (if any) in accordance with requirements of relevant authorities.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals necessary to perform all excavation, additional testing, backfill, fill and grading required to complete the work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to: excavation for site leveling, structures, footings (raft, isolated or continuous), trenches, paved areas, manholes, electrical manholes, handholds; all backfilling and fill; embankment and grading; disposal of waste and surplus materials; and all related work such as sheeting, bracing and pumping.
- B. All excavation, trenching, and related sheeting, bracing, etc., shall comply with the requirements of OSHA excavation safety standards 29 CFR Part 1926.650 Subpart P and local regulations and requirements. Where conflict between OSHA and local regulations exists, the more stringent requirements shall apply.
- C. Related Sections:
 - 1. Section 02100 – Site Clearing.

1.02 REFERENCE STANDARDS

A. BRITISH STANDARDS

- 1. BS 2782 : Methods of testing plastics. Chemical properties - Sieve analysis of vinyl chloride homopolymer and copolymer resins using air-jet sieve apparatus.
- 2. BS 812 : Testing Aggregate
- 3. BS6031 : Code of Practice for Earthworks.
- 4. BS 3882 : Specification for topsoil
- 5. BS 1377-2: Methods of test for soils for civil engineering purposes. Classification tests and determination of geotechnical properties.
- 6. BS 410 : Test sieves, technical requirements and testing.
- 7. BS 5930 : Code of practice for site investigation
- 8. BS EN 1997: Geotechnical Design ground investigation and testing

B. American Society for Testing and Materials (ASTM)

- 1. ASTM C136 : Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- 2. ASTM D698 : Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).

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3. ASTM D 1556 : Test Method for Density of Soil in Place by the Sand-Cone Method.
4. ASTM D 1557 : Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³(2,700 kN-m/m³)).
5. ASTM D 2167 : Test Method for Density of Soil in Place by Rubber Balloon Method.
6. ASTM D2922 : Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
7. ASTM D3017 : Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
8. ASTM D3282 : Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.
9. ASTM D4253 : Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
10. ASTM D 4318 : Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

C. American Association of State Highway and Transportation Officials:

1. AASHTO T180 : Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

1.03 SUBMITTALS

- A. Submit full details, calculations and shop drawings showing the method of excavation, filling, temporary protection, water table control, Equipment to be used, any other details pertinent to excavation and filling for the review and approval of the Engineer's Representative before commencing the excavations and dewatering. Contractor to submit soil specification detail that will be used for backfill for approval. Contractor shall refer to soil investigation report recommendations.
- B. Prior to beginning of the work, the Contractor shall submit a Method Statement to the Employer for approval, describing the proposed procedures for placing of fill or backfill materials and their compaction in respect of equipment to be used, moisture conditioning of fill, layer thickness and number of passes as well as the testing procedures.
- C. Field density and moisture content tests results as well as all laboratory test results shall be submitted to the Employer on a monthly basis, and shall also be kept on hand in the Contractor's on-site office so that they may be inspected at any time by the Employer. All test results shall be signed accepting to their accuracy by both the laboratory technician who conducted test, and Contractor's on-site manager.
- D. Test Report:
 1. Submit the following reports to Engineer's Representative from the testing laboratory:
 - a. Report and certification of granular fill and drainage fill.

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- b. Test reports on borrow materials or site material.
- c. Report on the actual unconfined compressive strength.
- d. Core optimum moisture-maximum density curve for each type of soil encountered.
- e. Field density test reports.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:

- 1. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Weekly Quality Control Report: Present the Employer with a Quality Control Report at weekly intervals summarizing the following:

- 1. Daily Inspection Reports.
- 2. Material Delivery Records.
- 3. Test Results (from previous weeks' samples).
- 4. Samples taken this week (and amount of work represented by each individual sample).
- 5. Quality Control Performance.

C. Monthly Quality Control Report: Present the Employer with a Monthly Quality Control Report at monthly intervals summarizing the following:

- 1. Weekly Quality Control Reports.
- 2. Control Charts (showing previous 60 days plotted test results/control measurements, etc.)
- 3. Proposed Quality Control Programme improvements.
- 4. Revisions to frequency of testing.
- 5. Work for which acceptance is requested.

The monthly Quality Control Report shall be approved by the Employer before being admissible as a contract record.

D. Testing and Inspection:

- 1. Submit proposed name of independent Testing Agency for the approval of the Engineer's Representative. Employ, at no extra cost to the Employer, the approved Testing Agency to perform all tests and submit reports specified in this section. Approval may be withdrawn at the discretion of the Engineer's Representative and an alternative Testing Agency approved.

2. The independent Testing Agency shall be responsible for the conducting and interpreting the tests, shall state in each report whether or not the test specimens comply with the requirements of the Contract Documents and shall specifically note any deviations there from.

1.05 PROTECTION

A. Sheeting and Bracing

1. Furnish, put in place and maintain such sheeting and bracing as may be required to support the sides of excavations; to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction; and to protect adjacent structures from undermining or other damage. If the Engineer is of the opinion that at any points sufficient or proper supports have not been provided, he may order additional supports put in, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill.
2. Construct the sheeting outside the neat lines of the foundation, unless indicated otherwise, to the extent deemed desirable for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressures to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected to provide the necessary clearances and dimensions.
3. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property.

1.06 SOIL TESTING

- A. Previous to the general placement of the fill and during such placement, the Engineer may select areas within the limits of the fill for testing the degree of compaction obtained. The Contractor shall cooperate fully in obtaining the information desired.
- B. Payment for testing will be made by the Contractor. If test results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the Engineer will be borne by the Contractor.

PART 2: PRODUCTS

2.01 MATERIALS

A- Satisfactory soil materials:

1. Satisfactory soil materials for backfilling and fill are defined as those belonging to soil classification groups / sub groups A-1, A-2-4 and A-2-5 in accordance with BS 1377.
2. Soils of classification group A-2 not having a CBR value in excess of 30 and any other materials having this deficiency, shall not be used for the top 150mm layer comprising the subgrade.

B- Unsatisfactory soil materials:

1. Unsatisfactory soil materials for backfill and fill are those described in BS 1377 as belonging to soil classification groups A-2-6, A-2-7, A-4, A-5, A-6 and A-7, peat and other highly organic soils, unless otherwise acceptable to the Employers.

C- Structural Fill

- 1- Structural Fill shall be sound, clean, durable, granular materials free from deleterious matter and group as per BS 1377/ ASTM D3282/AASHTO classification system as defined in section 02220- Structural Excavation and Backfilling.
- 2- Structural fill is classified as well-graded granular soils – Group 1 (non-plastic soils with a uniform coefficient exceeding 10).
- 3- If sufficient structural fill material is not available from site excavations under this Contract, then additional fill, suitable for use, shall be brought to the site from other approved sources at the Contractor own expense. Both excavated material from the site for use as structural fill and material brought to the site for use as structural fill, shall meet the above requirements.
- 4- The Contractor shall submit a representative sample of proposed structural fill, weighing approximately 25 kg, at least five days prior to the date of anticipated use of such material.
- 5- Suitable fill material shall generally comprise either cohesionless soils, or cohesive soils containing not more than 20 per cent by dry mass passing the 75-micron sieve determined in accordance with BS 1377/ ASTM D 136, or having a Liquid Limit not exceeding 30 or a Plasticity Index not exceeding 8, determined in accordance with BS 1377/ASTM D 4318. Cohesive soils with characteristics exceeding these limits may or may not be suitable. Therefore, their use will be subject to prior approval by the Employer based on the Contractor's report and

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recommendations. The maximum particle size shall be 100mm unless the inclusion of larger particle sizes is recommended by the Contractor and specifically approved by the Employer.

- 6- Unsuitable fill material shall include but not be limited to the following:
 - a. Material not meeting the requirements specified in paragraphs above.
 - b. Material from Sabkha areas.
 - c. Perishable and organic materials.
 - d. Materials containing scrap, debris and garbage.
- 7- Fill material shall be from one or more of the sources listed below:
 - a. Suitable material from required excavations within the site of the work covered under this contract. This shall be the primary source of fill material.
 - b. Borrow areas designated by the Employer.
 - c. Borrow areas provided by the Contractor and approved by the Employer.
 - d. Commercial sources approved by the Employer.
- 8- Designation or approval of a borrow area does not mean that all material within that area is suitable fill material. Only suitable soils from such areas shall be placed in the works and any unsuitable materials in lenses, layers or other types of inclusions in these areas shall be carefully removed and discarded. The Contractor shall be responsible for ensuring that materials obtained from borrow areas complies with the requirements of the specification.
- 9- The Contractor shall supply all water required for construction including dust control, moisture-conditioning of fill material during compaction and any other of his needs.
- D- Common Fill shall consist of mineral soil substantially free from organic materials, loan, wood, trash and other objectionable materials having a plasticity index no greater than 30, which may be compressible or which cannot be properly compacted. Common fill shall not contain stones larger than 38 mm in largest diameter and shall be well graded. Common fill shall not contain stone blocks, broken concrete, masonry rubble or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling.

PART 3: EXECUTION

3.01 EXCAVATION BELOW GRADE

- A. Additional excavation: If the bottom of any excavation is taken below the limits shown on the Drawings, specified, or directed by the Engineer, it shall be refilled at the Contractor's expense with plain concrete (Grade 15) up to the level of bottom of

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blinding concrete or other material satisfactory to the Engineer. The type of material to be used shall be at the Engineer's option.

- B. If the Contractor does not care for water properly, through failure to postpone final excavation immediately above the subgrade until shortly before placing of the new work thereon, or other failure or neglect to conduct the excavation work properly so that the surface of the subgrade is in proper condition when he is ready for construction, the Contractor shall remove the unsuitable material and replace it with concrete, compacted structural fill, or other approved material at his own expense so that the condition of the subgrade meets with the approval of the Engineer before any work is placed thereon.
- C. If, in the opinion of the Engineer, the material, in its undisturbed natural condition, at or below the normal grade of the excavation as indicated on the Drawings is unsuitable for foundations, it shall be removed to such depth and width as he may direct and be replaced with suitable material as directed by the Engineer.

3.02 STRUCTURE EXCAVATION

- A. Excavation shall be made to the grades shown on the Drawings and to such widths as will give suitable room for construction of the structures, for bracing and supporting, pumping and draining. The bottom of the excavations shall be rendered firm and dry and in all respects acceptable to the Engineer.
- B. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Exposed subgrades shall be proofrolled with at least two coverage of the specified equipment. The Engineer shall waive this requirement if, in his opinion, the subgrade will be rendered unsuitable by such compaction. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory for support of structures as a result of inadequate excavation, dewatering, proofrolling, or other construction methods shall be removed and replaced by structural fill as required by the Engineer at the Contractor's expense.
- C. Excavation equipment shall be satisfactory for carrying out the work in accordance with the Specifications. In no case shall the earth be plowed, scraped, or dug with machinery so near to the finished subgrade as to result in excavation of, or disturbance of, material below grade, the last of the excavated material being removed with pick and shovel just before placing of concrete or working mat thereon.
- E. When excavation for foundations has reached prescribed depths, the Engineer or soil specification shall be notified and will inspect conditions. If materials and conditions are not satisfactory to the Engineer, the Engineer will issue instructions as to the procedures and if additional costs are involved, adjustments of the Contract Price will be made on the basis of unit prices agreed upon by the Employer and the Contractor in accordance with the provisions of the Contract Documents.
- F. During final excavation to subgrade level, take whatever precautions are required to prevent disturbance and remolding. Material which has become softened and mixed with water shall be removed. Hand excavation of the final 75 mm to 150 mm will be

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required as necessary to obtain a satisfactory undisturbed bottom. The Engineer will be the sole judge as to whether the work has been accomplished satisfactorily.

3.03 EXCAVATION AND BACKFILLING FOR FOOTINGS AND UNDERSLAB TRENCHES

- A. Excavation for all footings shall be carried out with the excavating equipment operating from the subgrade for the structure. The excavation shall be carried out "in-the-dry" and in a manner which will preserve the undisturbed state of the subgrade soils. The excavations may be completed with shoring and bracing of open cuts if needed.
- B. All excavation beneath structures shall be backfilled with structural fill. Where it is impractical to use large equipment for compaction or when such methods, in the opinion of the Engineer, are disturbing the surrounding natural subgrade, the fill shall be compacted using hand-operated mechanical compactors. The lift thickness shall not exceed 200 mm measured before compaction when hand-operated equipment is used.

3.04 EXCAVATION FOR TRENCHES AND UTILITY STRUCTURES

- A. The Contractor shall comply with the following instructions in execution of this work:
 - 1. Excavate as far as possible to a uniform width and as close as possible to such width as is just sufficient to provide all the working room required for the particular item to be installed. In case of a pipe, excavation from a point at least 300mm above its crown to the trench bottom shall be to a uniform width, which is the minimum necessary to provide adequate working space on its sides and is approved by the Employer as the maximum permissible width for this part of the trench.
 - 2. Make good any excavation in excess of the above-mentioned maximum allowable trench width for a pipe, with plain concrete utilizing formwork to achieve the approved trench width below a point at least 300mm above its crown.
 - 3. In materials other than rocks, leave at least the last 15 cm, both vertically and horizontally, to such final surface on or against which some materials shall be placed, to be excavated only at such short time before the placing of covering materials, as in approved by the Employer. Carry out the whole or part of this last stage of excavation, as required, manually and protect the final surface from all disturbance and flooding until the covering materials are placed.
 - 4. For foundations of underground structures, i.e. manholes, chambers, and for channels and drains, on materials other than rock, excavate by hand for a depth of at least 5cm to final grade and elevation. Trim and compact bottoms to the required lines and grades to leave a solid base to receive the structure, and take care not to disturb the bottom of the excavation till it is covered by concrete.

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5. Excavate trenches to the depth indicated or required. Carry the depth of trenches for pipes to below the invert elevations as required for pipe bedding or other supports.
 6. Where rock is encountered in trench excavation carry the excavation to at least 150mm below the pipe and backfill and compact with granular bedding material.
 7. Grade bottoms of trenches as indicated. In case of trenches for pipes to be supported on granular material, fill and compact to the pipe support level, shaping the bedding surface to fit the lower portion of the pipe and making notches in the bedding under pipe bells, sleeves, flanges or other protuberances at joints and intersections, to allow joints to be properly made and to provide solid bearing for the entire length of the pipe. If concrete surround or cradle is to be provided, hold pipe with joints ready firmly in position by concrete blocks and carefully place concrete, working it thoroughly under the pipe to provide a solid and uniform bedding.
 8. Do not backfill until tests and inspections have been made and backfilling is authorized by the Employer. Use care in backfilling to avoid damage to structures and/or displacements of pipe systems.
- B. Trenches shall not remain open for more than 5 days (120 hours), which shall be counted from the completion of excavation to the start of backfilling.

3.05 MISCELLANEOUS EXCAVATION

- A. The Contractor shall perform all the remaining miscellaneous excavation. The Contractor shall make all excavations necessary to permit the placing of loam and plants, for constructing roadways, and any other miscellaneous earth excavation required under this Contract.

3.06 EXCESS EXCAVATION

- A. Excess excavation means excavation outside the lines, levels and profiles shown on the Contract Drawings or as directed or approved by the Employer. The Contractor shall remove and dispose of all material resulting from excess excavation and shall make good excess excavation with fill compacted as specified herein, or concrete as may be required by the Employer, all at his own expense.
- B. When during the progress of the Work but subsequent to the acceptance of an excavation the material forming the bottom of an excavation becomes puddled, soft or loose the Contractor shall remove such damaged, softened or loosened material and excavate further to material acceptable to the Employer. Such further excavation shall be deemed to be excess excavation.

3.07 STABILITY OF EXCAVATION

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- A. Contractor shall slope the sides of excavation to the angle of repose of the in -situ material excavated, or provide shores, timbering, struts and sheeting, as required, and brace where sloping is not possible either because of space restrictions or is to be avoided because of the trenching requirements described later.
- B. Sides slopes of excavations shall be maintained in a safe condition until completion of backfilling.
- C. Precautions shall be taken to prevent slides or cave-ins in excavation.

3.08 ADDITIONAL EXCAVATION

- A. Completion of excavation to specified levels, limits or depths shall constitute "hold points" and the exposed ground shall be inspected and reviewed in accordance with Contractor's Quality Control Programme. The Contractor shall carry out any further excavation as may be required by the Employer. Such further excavation shall be refilled to the specified levels, limits or depths with suitable fill material compacted as specified herein.

3.09 DEWATERING:

- A. The Contractor shall prevent surface water and subsurface or ground water from flowing into excavations and flooding the work site and surrounding area.
- B. If water is encountered in excavation, it shall be removed without allowing it to accumulate, in order to prevent soil changes detrimental to the stability of subgrades. The Contractor shall provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components necessary to convey the water away from the site.
- C. Water removed from excavations and rain water shall be conveyed to collecting or run-off areas. Trench excavations for utilities shall not be used as temporary drainage ditches.

3.10 MATERIAL STORAGE:

- A. The Contractor shall stockpile excavated materials classified as satisfactory soil material in approved locations, until required for backfill or fill, and place, grade and shape stockpiles for proper drainage.
- B. The Contractor shall retain materials required in the work and locate them a sufficient distance from the edge of excavations, even though such excavations may be sheeted and braced, to prevent such material falling or sliding into the excavations and to prevent cave-ins.
- C. The Contractor shall Stockpile materials on site at the location approved by Engineer, Stockpile in sufficient quantities to meet Project schedule and requirements, Separate

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differing materials with dividers or stockpile apart to prevent mixing and prevent intermixing of soil types or contamination.

3.11 BACKFILLING - COMMON FILL

- A. Common Fill may be used as fill against exterior walls of structures (except water and retention structures); as embankment fill; or in other areas as designated by the Engineer. Material conforming to the requirements of Common Fill shall be placed in layers having a maximum thickness of 200 mm measured before compaction.
- B. Common Fill shall be compacted to at least 95 percent of maximum density as determined by BS 1377 / ASTM D1557, Method D.
- C. Materials placed in fill areas shall be deposited to the lines and grades shown on the Drawings making due allowance for settlement of the material and for the placing of loam thereon.
- D. The surfaces of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan and no soft spots or uncompacted areas will be allowed in the work.
- E. No compacting shall be done when the material is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper compaction.

3.12 BACKFILLING - STRUCTURAL FILL

- A. Structural Fill shall be placed in layers having a maximum thickness of 200 mm including points where conduit and piping join structures, measured before compaction. Each layer of fill shall be compacted to at least 95 percent of maximum dry density determined by the related British standard by methods approved by the Engineer. The limits of structural fill adjacent to structures shall extend as shown on the Drawings.
- B. Structural fill shall not be placed on a frozen surface or one covered by snow or ice, nor shall snow, ice or frozen earth be incorporated in the compacted fill.
- C. Compaction of structural fill in open areas shall be performed by a suitably weighted roller specifically designed for compacting earthen material which will not create lamination or instability in the fill, or any other method approved by the Engineer. Compaction of structural fill in confined areas shall be accomplished by hand operated vibratory equipment or mechanical tampers approved by the Engineer. As a minimum, compaction of structural fill shall consist of a minimum of four coverage of the approved equipment; however, this procedure shall not take precedence when the resultant compaction does not meet the specified requirements.

- D. Where the construction area levels are less than the proposed foundation level, filling below the foundation level shall be carried out in layers not exceeding 250mm and each layer shall be compacted to at least 95% of the maximum dry density of the soil in case of fine material or to 98% in case of granular fill (road base). The compaction percentages attained shall be confirmed by carrying out in situ density test for each compacted layer. For backfills up to 1.0m, plate load tests shall be carried out to confirm the efficiency of the backfill. In case the backfill exceeds 1.0m cone penetration tests (CPT) shall be carried out to confirm the same

3.13 EARTH EMBANKMENTS-COMMON FILL

- A. All organic materials, including peat and loam, and loose inorganic silt material (loess) shall be removed from areas beneath new embankments. If the subgrade slopes are excessive, the subgrade shall be stepped to produce a stable surface for the placement of the embankments. The natural subgrade shall then be compacted by at least two coverages of a loaded six-wheel or ten-wheel truck. The Engineer will waive this requirement, if, in his opinion, the subgrade will be rendered unstable by such compaction. The prepared subgrade shall be inspected and approved by the Engineer prior to the placement of structural fill.

- B. Compaction of Cohesive Fill Materials:

All cohesive fill materials shall be compacted with moisture content within two per cent (2%) of the optimum moisture content as determined by British Standards, using Method D, unless otherwise specified, at least to the minimum percentages of the maximum dry density from the same test specified.

- C. Compaction of Cohesionless Fill Materials:

All cohesionless fill materials shall be compacted using towed vibratory equipment. Self propelled vibratory equipment shall not be used without prior approval of the Employer. Where such equipment is proposed in the Contractor's Report, shall explain how this equipment can be used without undue discomfort to the operator by proper insulation of the cab from the vibrator unit.

A demonstration of the equipment in operation may be requested before approval is granted. Cohesionless fill material shall be compacted to at least the minimum specified relative densities, as determined according to related British Standard, in case a well-defined density vs moisture curve cannot be determined according to related British Standard,.

- D. The minimum requirements for compaction of cohesive and cohesionless fill materials for both general and structural fill shall be given as Table 3-1.

Table 3-1

MINIMUM COMPACTION REQUIREMENTS

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Type of Fill	Type of Material Compaction	Minimum Relative (% of Max. Dry Density)	Minimum Relative Density in percent
General fill	Cohesive	90	-
	Cohesion less	90	70
Structural	Cohesive	95	-
	Cohesion less	95	74

- D. A trial shall be made at the start of the Work, by placing a volume of fill requiring a series of ten (10) compaction tests in accordance with Table 3-2. The results shall be presented to and approved by the Employer before the Contractor continues with the placement of additional fill material. Upon approval, the compaction procedure shall apply to all work of a like nature. Any change in fill materials, subsoil conditions or environment shall require this approval process to be repeated.

The fill shall be tested in a manner which will give representative results for the whole. From each set no more than one test result is permitted to fall below the minimum relative compaction requirement of Table 3-1.

If more than one test result falls below the minimum relative compaction requirements of Table 3-1, the volume of fill represented by the ten (10) consecutive test results shall be repeated until the whole volume of the fill meets the requirements of this Specification.

E. Requirements prior to backfill placement

1. Excavations shall be backfilled as promptly as the work permits, but not until completion of the following:
 - a. Approval by the Employer of construction below the finished grade.
 - b. Inspection, testing, approval and recording of locations of underground utilities.
 - c. Removal of concrete formwork, except that approved to be left in place.
 - d. Removal of shoring and bracing, except that required to remain, and backfilling of voids with satisfactory materials.
 - e. Cut-off of temporary sheet piling driven below bottom of structures if required to be left in place. Otherwise their removal in a manner to prevent settlement of the structures or utilities.
 - f. Removal of trash and debris.

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2. Supports and bracing designated as permanent, and temporary bracing installed to provide horizontal support to walls, shall be left in place during backfill.
- F. Preparation of surfaces to receive backfill and fill
1. The Contractor shall remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface or excavation bottom, prior to placement of backfills and fills.
 2. When the soil below the surface of existing ground or excavation bottom has a density less than that required for its area classification, it shall be broken up, pulverized, moisture-conditioned to the optimum moisture content, and compacted to such depth and density as are required by the Employer.
- G. Density requirements:
1. Soil compaction for backfill in trenches / around associated structures, for subgrade below transformer pads and for fill elsewhere shall not be less than the percentages of maximum dry density given below in sub-paras (a) and (b) for soils which exhibit a well defined density- moisture relationship determined in accordance with related British Standard, and not less than the relative densities in percent values given in the same sub-paras determined in accordance with related British Standard, for soils which do not exhibit a well-defined moisture- density relationship.
 - a. Under road-ways or shoulders and under transformer pads:
 - i) The top 300mm comprising the subgrade: 100% of maximum dry density, or 78% relative density if required in case of cohesionless soils.
 - ii) Other layers of backfill and fill: 95% of maximum dry density, or 74% relative density if required for cohesionless soils.
 - b. Under paved areas other than roadways or shoulders:
 - i) The top 300mm comprising the subgrade: 95% of maximum dry density, or 74% relative density if required for cohesionless soils.
 - ii) Other layers of backfill and fill: 90% of maximum dry density, or 70% relative density if required for cohesionless soils.
 - c. Under paved areas other than roadways or shoulders:
 - ii) 90% of maximum dry density, or 70% relative density if required for cohesionless soils.

H. Moisture control :

1. Where the moisture content of a layer of the subgrade or other soil must be increased before compaction, water shall be applied uniformly to its surface and in such a manner that free water is prevented from appearing on the surface during the compaction operation.
2. Soil which is too wet to permit compaction to specified density shall either be removed and replaced, or scarified and dried.
3. Soil material, which has been removed because it is too wet to permit compaction may be stockpiled or spread in approved locations and permitted to dry. Drying shall be assisted by harrowing or pulverizing, until the moisture content is reduced to a satisfactory value as determined by moisture-density relation tests.
4. Moisture in soil being compacted shall be uniform and maintained within + or - 3% of the optimum moisture content as determined by related British Standard or, if required in case of cohesionless soils, by field trials, unless directed or approved otherwise by the Employer. Sands may be compacted dry only if this method is approved by the Employer and the required field density is consistently achieved.

3.14 FIELD QUALITY CONTROL

- A. Testing of Materials: The independent Testing Agency shall perform all tests herein specified and any additional tests as may be required and submit test reports to the Engineer's Representative, including the following:
1. One optimum moisture - maximum density curve for each type of soil encountered in subgrades and fills under isolated and continuous footings, slabs on grade and paved areas. Determine maximum densities in accordance with related British Standard.
 2. Each type of borrow material shall receive:
 - a. Mechanical Analysis. related British Standard/ ASTM D3282/AASHTO T88.
 - b. Plasticity Index Determination. related British Standard /ASTM D4318/AASHTO T91.
 - c. Moisture-Density Curve Determination. related British Standard ASTM D1557.
 - d. CBR test as a measure for bearing capacity when required.
 3. The independent Testing Agency shall determine the suitability of materials to be used for fills and to the approval of the Engineer's Representative.

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- B. Testing of Subgrade and Fill Layers: Subgrades and fill layers shall be approved by the independent Testing Agency and the Engineer's Representative before construction of any further work thereon. Tests of subgrades and fill layers shall be taken as follows:
 - 1. The top 300 mm of subgrade resulting from excavation shall have the maximum density at optimum moisture as hereinbefore specified. In fill areas, each layer of fill shall meet the required density as hereinbefore specified. Make at least one (1) field density test of the subgrade for every two hundred square metres (200 m²) of isolated and continuous footings, paved area or slabs on grade, but in no case less than three (3) tests. In each compacted fill layer, make one (1) field density test for every overlain two hundred square metres (200 m²) of isolated and continuous footings, paved area or slabs on grade, but in no case less than three (3) tests. Perform field density tests in accordance with related British Standard.
 - 2. At foundation wall backfill take at least three (3) field density tests (related British Standard) at locations and elevations as directed by the Engineer's Representative. In case of longer wall length, at least one test for each 30 m or less of wall length.
- C. Cooperate with the independent Testing Agency in every respect in the performance of the required tests.
- D. If, based on reports of the independent Testing Agency and inspection, the subgrade or backfills are found to be below the specified density, the Engineer's Representative may require additional compaction and testing and all this shall be carried out at the expense of the Contractor.

3.15 DISPOSAL OF SURPLUS OR UNSUITABLE MATERIAL

- A. Suitable excavated material shall be used for fill embankments or backfill on the different parts of the work as required.
- B. Surplus or unsuitable material shall become the property of the Contractor and shall be removed and disposed of by him off the site.

3.16 DISPOSAL AND REPLACING OF ROCK

- A. The Contractor shall remove and dispose of all pieces of ledge and boulders which are not suitable for use in other parts of the work. Rock disposed of by hauling away to spoil areas is to be replaced by approved surplus excavation obtained elsewhere on the work, insofar as it is available. Any deficiency in the backfill material shall be made up with acceptable material approved by the Engineer.

3.17 GRADING

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- A. Grading in preparation for placing of loam, planting areas, paved walks and drives and appurtenances shall be performed at all places that are indicated on the Drawings, to the lines, grades and elevations shown and otherwise as directed by the Engineer and shall be performed in such a manner that the requirements for formation of embankments can be followed. All material encountered, of whatever nature, within the limits indicated, shall be removed and disposed of as directed. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.
- B. If at the time of grading it is not possible to place any material in its final location, it shall be stockpiled in approved areas for later use. No extra payment will be made for the stockpiling or double handling of excavated material.
- C. The right is reserved to make minor adjustments or revisions in lines or grades if found necessary as the work progresses, in order to obtain satisfactory construction.
- D. Stones or rock fragments larger than 100 mm in their greatest dimensions will not be permitted in the top 150 mm of the finished subgrade of all fills or embankments.
- E. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings or as directed by the Engineer.

3.18 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1: GENERAL

1.01 SCOPE OF SECTION

- A. The work covered by this section includes the provision of labor, materials and plant necessary for the concrete formwork in any part of the works.

1.02 RELATED SECTIONS

- A. Section 03200 Reinforcement.
- B. Section 03300 Cast in Place Concrete

1.03 DEFINITIONS

- A. Formwork means the container or mould in which concrete is placed and hardens to form a structural element with the desired dimensions and surfaces, together with all the immediate supports to retain it in position while concrete is placed.
- B. False work means the structural elements supporting both the formwork and the concrete until the concrete becomes self supporting.
- C. A formed face is one which has been cast against formwork.
- D. An exposed face is one which will remain visible when construction has been completed.

PART 2: PRODUCTS

2.01 MATERIALS

- A. Temporary formwork shall be constructed of timbers; metal sheet or other approved material such that the concrete mass with the required dimensions and standard of surface finish will be produced.
- B. Proprietary moulds shall be used for the forming of ribbed and waffle slabs.
- C. Permanent formwork shall be constructed of slabs or blocks of precast concrete, natural stone, brickwork or other approved material, with joints so filled as to prevent the leakage of cement paste or slurry from the concrete. Breezeblocks or other porous materials shall not be used as permanent formwork.
- D. The type and treatment of any lining to the forms shall be appropriate to the concrete finish required.

PART 3: EXECUTION

3.01 DESIGN

- A. Before construction begins, the Contractor shall submit to the Owner drawings showing details of the proposed formwork and false work. The design of formwork shall be the responsibility of the Contractor.
- B. Formwork and false work shall be so constructed that they will support the loads imposed on them by fresh concrete, together with additional stresses from vibrating equipment and construction traffic, so that after the concrete has hardened the formed faces shall be in the position and have the shape and profile as shown on the drawings within the limits of the dimensional tolerances.

3.02 DEFLECTION AND CAMBER

- A. The Contractor shall make allowances for any settlement or deflection of formwork that is likely to arise during construction so that the hardened concrete conforms accurately to the specified line and level. Unless otherwise shown on the drawings the formwork of all beams and slabs shall be constructed with the following upward cambers:

Spanning between supports	: 0.2% of the span at its center
Canilevers	: 0.4% of the span at its free end

3.03 SUPPORT

- A. The formwork shall be so arranged as to be readily dismantled and removed from the cast concrete without shock, disturbance or damage. The responsibility for the safe removal of the props shall rest with the Contractor.
- B. Props shall be of sufficient strength and number and placed in such a manner that they adequately and without excessive deflection support the loads likely to be imposed on them. Props should be adequately cross braced.
- C. Props shall be carried down to construction which is sufficiently strong to afford the necessary support without injury to any portion of the structure. This may mean in some cases that they be carried down to the foundations or other suitable bases.

3.04 JOINTS AND EDGES

- A. All joints in formwork shall be close fitting to prevent leakage of current paste or slurry from the concrete.
- B. At construction joints in concrete, the formwork shall be tightly secured against previous or hardened concrete to prevent the formation of steps or ridges in the concrete.
- C. Formwork shall be constructed to provide straight and true angles, arisses or edges. Where chamfers are required, the fillets shall be accurately cut to size to provide a smooth and continuous chamfer.

- D. Formwork panels shall have true angles to permit accurate alignment at the sides and provide a clean line at construction joints in the concrete.
- E. Formwork panels shall be fixed with their joints either vertical or horizontal unless otherwise specified.
- F. Formwork shall be provided to the top surface of concrete where the slope or nature of the work requires it. Horizontal or inclined formwork to the upper surface of concrete shall be adequately secured against uplift due to the pressure of fresh concrete.

3.05 FORMWORK TIES

- A. The materials and position of any ties passing through the concrete shall be to the Owner's approval. It shall be possible to remove a tie so that no part of it remaining in the concrete shall be nearer to the finished surface of the concrete than the specified thickness of cover to reinforcement. Any holes left after the removal of ties shall be filled with concrete or mortar of approved composition to provide matching of color, texture and finish with the adjacent concrete surface, unless otherwise specified.
- B. In waterproof concrete any tie in the concrete shall be of a type with a baffle.

3.06 HOLES, INSERTS AND FIXINGS

- A. Unless otherwise shown on the drawings or specifically approved, all holes shall be formed and all inserts and fixings cast in at the time of pouring.
- B. Approval for size, type and position of any hole, insert or fixing required by the Contractor or any sub-contractor shall be obtained before the start of form work.
- C. No part of the concrete works shall be drilled or cut away without the specific approval of the Owner.
- D. If such drilling or cutting is carried out without approval the affected parts shall be classed as defective work. It shall be the Contractor's responsibility to ensure that each of his sub-contractors, nominated or otherwise, is provided with a copy of this clause and abides by it.

3.07 DEFECTIVE FORMWORK

- A. Where in the opinion of the Owner any piece of formwork is damaged, deformed, worn or otherwise incapable of producing an acceptable finished concrete surface, he may declare such formwork defective. Such formwork shall be repaired to the satisfaction of the Owner or removed from the site.

3.08 RELEASE AGENTS

- A. Release agents shall be materials marketed as such and shall be one of the following types:-
 - a) cream emulsion
 - b) neat oil with surfactant added
 - c) chemical release agent

- B. Release agents shall be stored and used strictly in accordance with the manufacturer's instructions.
- C. Where the concrete surface is to be permanently exposed only one agent shall be used throughout the entire area.
- D. Where the surface is to receive an applied finish, care shall be taken to ensure the compatibility of the release agent with the finish.
- E. Release agents shall not come in contact with the reinforcement.

3.09 FINAL PREPARATIONS

- A. Immediately before the concrete is placed in any section of the formwork the interior of that section shall be completely cleared of all extraneous materials including water.
- B. Before concrete placing commences, all wedges and other adjusting devices shall be secured against movement during concrete placing and the Contractor shall maintain a watch on the formwork during placing to ensure no movement occurs.

3.10 STRIKING OF FORMWORK

- A. The Owner shall be informed in advance when the Contractor intends to strike any formwork.
- B. The time at which the formwork is struck shall be the Contractor's responsibility, but the minimum periods between concreting and the removal of forms shall be as follows:-

TABLE 1 - Minimum Period Before Striking

Surface Temperature of Concrete Containing OPC in Degrees Centigrade

Location	Not less than 16°C	Not less than 7°C
Beam sides, walls and columns	9 hours	12 hours
Slab soffits (formwork props undisturbed)	4 days	7 days
Formwork props to slabs	11 days	14 days
Beam soffits (formwork props undisturbed)	8 days	14 days
Formwork props to beams	15 days	21 days

- C. If the Contractor wishes to strip formwork from the soffits before the expiry of the period for props set out above, it shall be designed so that it can be removed without disturbing the props. The Contractor shall not remove props temporarily for the purpose of stripping formwork and subsequently replace them.
- D. Unless otherwise directed, no treatment of any kind, other than that required for curing the concrete, shall be applied to the concrete after removal of the forms until it has been inspected.

3.11 SUBSEQUENT POUR

- A. Concrete may not be poured against an existing concrete face until 24 hours after that concrete was cast.

3.12 FINISHED CONCRETE SURFACES

- A. General:

Unless otherwise specified all concrete faces to be exposed in the finished works shall be left as struck.

- B. Treatment of Concrete Face:

Unless otherwise directed by the Owner, no treatment of any kind except that required for curing the concrete and the removal of fins shall be applied to concrete surfaces until the Owner has inspected them.

3.13 FORMED CONCRETE FINISHES

- A. Where a particular type of finish is to be applied to formed surfaces it will be indicated on the drawings.

- B. Type A Finish:

This finish is obtained by the use of properly designed formwork or moulds of closely-jointed sawn boards. The surfaces will be imprinted with the grain of the sawn boards and their joints. In addition, small blemishes caused by entrapped air or water may be expected, but the surface should be free from voids, honeycombing or other large blemishes.

- C. Type B Finish:

This finish is obtained by the use of properly designed forms of closely jointed wrought boards. The surfaces will be imprinted with the slight grain of wrought boards and their joints. Alternatively, steel or other suitable material may be used for the forms. Small blemishes caused by entrapped air or water may be expected, but the surface should be free from voids, honeycombing or other large blemishes.

Plywood sheeting may be used in lieu of sawn or wrought boards.

D. Type C Finish (Fair Faced):

This is to be a smooth even finish for exposed concrete work on the external face, obtained by using an impervious sheet material. Parts of formwork panels are not to be replaced where this may cause a change of color in the concrete.

Abrupt irregularities are not to be greater than 2mm and gradual irregularities, expressed as maximum permissible deviation from 1m straight edge, are not to be greater than 3mm.

The surface shall be free from discoloration due to contamination or grout leakage.

Blowholes less than 5mm in diameter will be permitted but otherwise the surface shall be free from voids, honeycombing, segregation and other defects.

Projecting fins shall be removed and rubbed down with a carborundum stone. Making good will not normally be permitted and areas which have been rubbed down will not necessarily be accepted.

Arisses shall be chamfered at 45° and the chamfered face is to measure 25mm across unless otherwise indicated.

Form tie holes shall be made to appear as a regular pattern, and as shown on the drawings. Concrete should be poured evenly and continuously - measures being taken to prevent rise of concrete in form at a rate which exceeds that on which their design is based.

Formwork should be waterproof, seals being used at connection to prevent escape of grout.

Any damaged formwork shall not be used.

Great care shall be taken to ensure that all foreign matter is removed before concrete is poured.

Release agents shall not be used without prior approval.

3.14 TRIAL PANELS

- A. In order to ensure that the specified formed or worked finishes can be obtained by the method of construction proposed and to provide a standard by which the finishes in the Works can be assessed, trial panels shall be cast on site. These panels shall be approved before similar construction is begun in the Works.
- B. The trial panels shall employ the materials, plant and concrete mix proposed for the Works. They shall be at least storey height and 1m wide. They shall be of similar thickness and similarly reinforced to the elements they represent and shall incorporate all features which may contribute to the final appearance of the work, e.g. such as:
- horizontal and vertical construction joints.
 - horizontal and vertical panel joints
 - arisses and chamfers

3.15 UNFORMED CONCRETE SURFACES

- A. Unless other noted or specified, all unformed surfaces shall be leveled and screeded to produce a uniform plain or ridged surface, surplus concrete being struck off by a straight edge immediately after compaction.
- B. Surface of basement slabs not shown to receive screed shall have a power float finish. The surface shall be floated when the surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats. The surface shall be consolidated using power-driven floats, or by hand-floating if the area is small or inaccessible to power units.
- C. Concrete to receive waterproofing membrane - steel troweled smooth finish.
- D. Concrete to receive tiles, Pavers and horizontal cementitious finish - Consolidate screed and wood float finish to required grades.

3.16 DIMENSIONAL CONSTRUCTION TOLERANCES

- A. Formwork shall be erected such that dimensions of concrete construction are within the tolerances quoted in BS 5606: 1978, British Standard Code of Practice for Accuracy in Building, except where the tolerances given in the Specification are more onerous.
- B. The difference between dimensions shown on the drawing and the corresponding as-built dimension shall not be greater than the following:

Structure Parts	In plan dimension		In level
	Less than 2m		More than 2m
Foundations	15mm	25mm	15mm
Elsewhere	5mm	10mm	5mm

Unless specified otherwise in this document.

- C. As-built dimensions to grid lines shall be measured from setting out lines.
- D. The tolerance for the following shall be 5mm:
 - 1. Plumb (in each 3m lift)
 - 2. Bow and camber
 - 3. Twist (distance of any corner from the plane containing the other three corners).

4. Squareness of corners (the longer of the two adjacent sides shall be taken as the base line and the deviation measured to the end of the shorter side).

The Contractor shall advise the Owner when these tolerances are exceeded.

Any part of the works in which variations in any respect exceed the tolerances stated above may, at the discretion of the Owner, be classed as defective work.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1: GENERAL

1.01 SCOPE OF SECTION

- A. The work covered by this section includes the provision of labour, materials and plant necessary for the incorporation of steel reinforcement into the concrete in any part of the works but does not include prestressing tendons or any other embedded steel.

1.02 QUALITY STANDARDS

- A. The following standards are referred to or implied by this technical specification.
 - BS 4449 Specification for carbon steel bars for the reinforcement of concrete.
 - BS 4466 Specification for bending dimensions and scheduling of reinforcement for concrete.
 - BS 4483 Specification for steel fabric for the reinforcement of concrete.
 - BS 5135 Specification for arc welding of carbon and carbon manganese steels.

1.03 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Submit for Owners review all items described in this specification section.

PART 2: PRODUCTS

2.01 REINFORCEMENT

- A. Bars for reinforcement shall be new, shall conform to the following material specification:-
 - 1. Bars, Except Weldable JS/441/96 with a yield strength not less than 420N/mm², plain bars shall be conforming to JS/442 with a yield strength not less than 300N/mm², deformed.
 - 2. Bars, Weldable BS 5135.
- B. Deformed bars shall be a bar with transverse ribs (or continuous helical ribs where present), at a substantially uniform spacing not greater than 0.8 dia having a mean area of ribs above the core of the bar projected on a plane normal to the axis of the bar, not less than 0.15D² area, where D is the nominal bar size.

2.02 TYING DEVICES

- A. Tying devices shall be:
 - 1. Black annealed mild steel wire of 1.6mm diameter.
 - 2. Approved rustproof binding wire, or
 - 3. Approved proprietary ties.

2.03 SPACER BLOCKS

- A. Spacer blocks shall be used for ensuring that the correct cover is maintained to the reinforcement.
- B. Blocks shall be of such materials and design as will be durable and not lead to corrosion of the reinforcement.
- C. Spacer blocks made from cement, sand and small aggregate shall not exceed 50mm square in section and shall be securely wired to the reinforcement to ensure that they are not displaced when the concrete is poured. They shall be made of similar mix proportions and strength as the adjacent concrete. Plastic spaces shall be of approved design, and may not be permitted where heavy loads are to be carried.

PART 3: EXECUTION

3.01 REINFORCEMENT TESTS

- A. The manufacturer's test certificate for ultimate strength, elongation and cold bending together with the chemical analysis of the steel may be called for by the Owner for any consignment of reinforcing steel direct from the manufacturer. Where steel is obtained from an indirect supplier, the Owner may require tests in an approved laboratory to prove compliance with the appropriate British Standard.
- B. The frequency of testing shall be as set out in the British Standards which include:
 - 1. Tensile tests for each diameter and grade of steel to be used in the works.
 - 2. Bend tests for all bars with a diameter greater than 20mm.
 - 3. Rebend tests for all bars with a diameter greater than 20mm.

The Contractor shall carry out additional tests as instructed by the Owner.

- C. Any reinforcement which does not comply with the Specification shall be immediately removed from site.

3.02 STORAGE OF MATERIALS

- A. Reinforcement of all types shall be stored on site in racks above ground in an approved manner so as to avoid damage.
- B. All reinforcement shall be free from loose scale, rust, oil, grease or any other material that may impair the bond between the concrete and the reinforcement. Any reinforcement which has become corroded or pitted to an extent which, in the opinion of the Owner, will affect its properties shall be removed from site.
- C. Mild steel reinforcement shall be stored separately from high yield reinforcement.

3.03 CUTTING AND BENDING

- A. Reinforcement shall be bent to the dimensions shown in approved bar schedules prepared by the Contractor in accordance with BS 4466 and approved by the Engineer; unless otherwise stated. The Contractor should check that schedules for each part of the structure.
- B. No reinforcement shall be heated before bending.
- C. Cold worked bars and hot rolled high yield bars shall not be straightened or bent again once having been bent. Where it is necessary to bend mild steel reinforcement already cast in the concrete, the internal radius of bend shall not be less than twice the diameter of the bar.
- D. After bending, bars shall be securely tied together in bundles or groups and legibly labeled as set out in BS 4466.

3.04 SPLICING AND WELDING

- A. Reinforcement shall not be welded except where required by the Contract or agreed by the Owner. If welding is employed the procedures shall be as set out in BS 5135. Details of all welding techniques to be used shall be submitted for approval and such trials made as are required to demonstrate the effect of the welding. No welding or splicing shall be made to the reinforcement except where described on the drawings, or where approved by the Owner.
- B. Except as otherwise indicated on the drawings, lap splices shall be detailed as tension lap splices in accordance with ACI 318.

3.05 CLEANING OF REINFORCEMENT

- A. Reinforcement shall be free of all loose mill scale or rust, oil, grease, concrete or other harmful matter at the time of concreting.

3.06 FIXING OF REINFORCEMENT

- A. All reinforcement shall be accurately placed with the correct cover and securely fixed in the positions shown on the drawings and to the satisfaction of the Owner, who shall be given reasonable notice before pouring concrete that the reinforcement fixing is complete.
- B. At intersections the reinforcement bars shall be bound together with tying wire and the loose ends of the wire shall be turned towards the inside of the member.

- C. The Contractor shall supply and fix all chairs required to support the top mat of slab reinforcement or space the mats of all reinforcement adequately. In particular slab chairs must be close enough to prevent the reinforcement from being bent or sagging.
- D. The actual concrete cover shall be not less than the required nominal cover minus 5mm. No metal part of any device used for connecting bars or for maintaining reinforcement in the correct position shall remain within the specified minimum cover. The Contractor shall provide adequate mortar or plastic spacers to ensure that the correct cover is achieved. The use of spacer blocks will not generally be permitted against a concrete face which is to be permanently exposed in the finished works.

3.07 PROJECTING REINFORCEMENT

- A. The Contractor shall protect projecting reinforcement without affecting its bond properties and shall ensure that it does not cause rust staining to any part of the works.

END OF SECTION

SECTION 03300

CAST IN PLACE CONCRETE

PART 1: GENERAL

1.01 SCOPE OF SECTION

- A. This technical specification establishes the quality of materials and workmanship and defines how quality is measured for concrete work.

1.02 QUALITY STANDARDS

- A. The following standards are referred to or implied by this technical specification
- JBC - Jordanian building code
 - BS EN197 - Specification for ordinary and rapid hardening Portland Cement
 - BS 812 - Testing Aggregate
 - BS 882 - Specification for aggregates from natural sources for concrete
 - BS 1014 - Specification for pigments for Portland cement and Portland cement products
 - BS 1305 - Specification for batch type mixers
 - BS 1377 - Methods of test for soils for civil engineering purposes
 - BS 1881 - Testing concrete
 - BS 3148 - Methods of test for water for making concrete
 - BS 3892 - Specification for Pulverized Fuel Ash
 - BS 4027 - Specification for sulphate resisting Portland cement
 - BS 4550 - Methods of Testing Cement
 - BS 5075 - Concrete Admixtures
 - BS 5328 - Methods of Specifying Concrete
 - BS 8007 - Code of practice for design of concrete structures for retaining aqueous liquids
 - BS 8110 - Structural use of concrete
 - BS 8102 - Code of practice for protection of buildings against water from the ground.
 - ASTM C150 - "Portland Cement" **or to BS EN197.**

1.03 DEFINITIONS

- A. Structural concrete is any class of concrete which is used in reinforced, prestressed or unreinforced concrete construction which is subject to stress and which is required to comply with Clause 3.02, 3.03 and 3.04 of this section of the Specification.
- B. Non-structural concrete is composed of materials complying with this Specification but for which no strength requirements are specified and which is used only for filling voids and similar purposes where it is not subjected to significant stresses.
- C. Lightweight screed is non-structural concrete made with light aggregate, but otherwise complying with this specification. Density shall not be greater than 1000 kg/m^3 .
- D. A pour refers to the operation of placing concrete into any mould, bay or formwork etc, and also to the volume which has to be filled. Pours in vertical succession are also referred to as lifts.
- E. Water/Cement ratio is the ratio by weight of the free water in the mix divided by the weight of cement in the mix. Free water is the water in the mix excluding water absorbed by the aggregate.

1.04 DESIGN

- A. The design of the structural concrete has been carried out in accordance with Jordanian building code and as in general structure note drawing. Any concrete design carried out by the Contractor shall conform to those standards unless otherwise instructed by the Owner. The provisions of these standards, unless otherwise stated, shall be held to be incorporated in this Specification.

1.05 VARIATIONS

- A. No variations to the Specification or drawing may be made without approval. The Contractor shall submit details of any reasons for any proposed variations from this Specification, the drawings, and/or the Owner's written or drawn instructions for approval.

1.06 MARKING

- A. The Contractor shall mark, document and identify materials so as to ensure that they are used as specified.

1.07 DRAWINGS

- A. All reinforced concrete work shall be carried out strictly in accordance with the reinforcement drawings and the reinforcement standard details.

PART 2: PRODUCTS

2.01 MATERIALS

- A. The Contractor shall submit to the Owner full details of all materials which he proposes to use for making concrete. No concrete shall be placed in the permanent works until the Owner has approved the materials of which it is composed. Approved materials shall not thereafter be altered or replaced by other materials without the consent of the Owner.

2.02 CEMENT

- A. Cement shall generally be as follows:
 - 1- For all concrete elements: cement shall be Ordinary Portland Cement (OPC), complying with ASTM C150, **Type1** or CEM I to BS EN197.
- B. The cement shall be obtained directly from an approved manufacturer or an approved supplier and shall be delivered either in bulk by purpose built vehicles or in sealed bags. All cement shall be free flowing and free of lumps.
- C. The tricalcium aluminate (C₃A) content of any cement shall not exceed 4 up to 8.0%.
- D. The heat of hydration, when measured as set out in BS 4550, shall not exceed 250 kJ/kg when tested at 7 days, nor exceed 290 kJ/kg when tested at 28 days.
- E. Certificates of cement tests by the manufacturer will be called for by the Owner. If such certificate is not made available, or if the Owner considers that the manufacturers tests are inadequate, samples for testing shall be taken from different consignments as the Owner may direct. Such samples shall weigh not less than 7 kg and shall be selected and tested in accordance with BS 4550.

2.03 STORAGE OF CEMENT

- A. Storage of bulk cement shall be in weatherproof silos which shall bear a clear indication of the types of cement contained in them. Different types of cement shall not be mixed in the same silo. Storage silos shall be drawn down frequently to prevent cement caking.
- B. Cement in bags shall be stored in a suitable weatherproof structure of which the interior shall be dry and well ventilated at all times. The floor shall be raised above the surrounding ground level and shall be so constructed that no moisture rises through it. Each delivery of cement in bags shall be closely stacked but shall not be stacked against an outside wall. Different types of cement in bags shall be clearly distinguished by visible markings and shall be stored in separate stocks. Cement in bags shall be used in the order in which they are delivered. Cement from broken bags shall not be used in the permanent works.
- C. The Contractor shall provide sufficient storage capacity on site to ensure that his anticipated programme of work is not interrupted due to lack of cement.

2.04 AGGREGATES

- A. Aggregates for concrete shall conform to the requirements for fine and coarse aggregates in **BS EN 12620:2002 & A1:2008**.
- B. Aggregates shall consist of crushed or naturally occurring materials having hard, durable, strong particles. All aggregates are to be washed with clean water to ensure compliance with the requirements of the specification. The use of marine aggregates will not be approved.
- C. At least 30 days before concreting operations are due to commence, the Contractor shall submit for approval the names of the pits, quarries or manufacturing plants from which he proposes to obtain aggregates, together with evidence showing that the material complies with the requirements of the appropriate British Standards.
- D. Fine aggregate shall either consist of natural sand or be obtained by crushing clean hard rock or be a mixture of these. Fine aggregate shall conform to BS 882 Table 5, Zone C or M. In order to achieve an acceptable grading, it may be necessary to blend materials from more than one source.
- E. Fine aggregate shall contain no excessive quantities of dust, soft or flaky particles, shells, congealed lumps, shale or other contaminations likely to adversely affect the strength or durability of the concrete or to attack the reinforcement.
- F. Coarse aggregates shall consist of naturally occurring gravel or crushed granite and shall not contain harmful materials in sufficient quantity to affect adversely the strength or durability of the concrete or to attack the reinforcement.
- G. Coarse aggregates shall be supplied in the nominal sizes specified and shall be graded in accordance with BS 882 or (ASTM C33) for single sized aggregates.
- H. Aggregates shall comply with the mechanical properties in BS 882 and in addition the flakiness index, when determined by the sieve method described in BS 812, shall not exceed 40 for 40 mm aggregates, nor shall it exceed 35 for 20 mm aggregates. In construction specified on the drawings as watertight the coarse aggregates shall not have combined indices for flakiness and elongation exceeding 35, nor shall the flakiness index exceed 15.
- J. The sulphate content (as SO₃) of both the fine and coarse aggregates shall not exceed 0.4% by weight. The total sulphate content of all the ingredients in a mix including cement, water and admixtures shall not exceed 4.0% of the weight of cement within the mix.
- K. The chloride content (as Na Cl) shall not exceed 0.30% by weight. The total chloride content arising from all ingredients in a mix including cement, water and admixtures shall not exceed the following limits expressed as a percentage of the weight of the cement in the mix :-

For prestressed concrete, steam cured concrete or concrete containing sulphate resisting cement: 0.15%

For any other reinforced concrete: 0.25% in 95% of all test results providing no result is more than 0.4%

- L. The coarse aggregate should not have water absorption of more than 3.0% when tested as defined in BS 812. If the proposed aggregate has absorption of more than 3.0%, the Contractor shall demonstrate by trial mixes and tests that the strength and durability of the concrete are not adversely affected and that adequate workability can be maintained during the placing and compacting processes.
- M. The "10% Fines" values, when determined in accordance with BS 812, shall not be less than 50kN for the coarse aggregates. Where aggregates are to be used for concrete wearing surfaces, the "10% Fines" value shall not be less than 100kN.
- N. After the magnesium sulphate soundness test, the weight loss shall not be more than 15% for the fine aggregate and 18% for the coarse aggregate.
- O. No part of the aggregates shall contain any mineral known to have a potential to cause alkali silica, alkali silicate, alkali carbonate or any other damaging chemical reactions between alkalis and aggregates.
- P. The grading of an all-in aggregate, when analyzed as described in BS 812, shall be in accordance with Table 6 of BS 882 for the nominal size of aggregate specified.
- Q. The Contractor shall carry out routine testing of aggregates for compliance with the specification during the period in which concrete is being produced for the Permanent Works. The routine tests include but are not limited to grading, silt and clay content, moisture content, check on organic impurities and chloride content. These tests shall be performed on aggregates from each separate source on the basis of one set of tests for each day on which aggregates are delivered to site provided that no set of tests shall represent more than 250 tones of coarse aggregate and provided also that the aggregates are of uniform quality.

2.05 DELIVERY AND STORAGE OF AGGREGATES

- A. Aggregates shall be delivered to site in clean and suitable vehicles. Different types or sizes of aggregates shall not be delivered in one vehicle.
- B. Aggregates shall not be stored in contact with the ground and shall be protected against the intrusion of the ground and other foreign matter. There shall be a physical partition between the stores heaps of fine and coarse aggregates and between separate heaped sizes of coarse aggregate which may have been segregated for mix control. When concreting is not being carried out, the store heaps shall be covered to prevent contamination by wind blown material.
- C. Aggregates, which in the opinion of the Owner are not clean or which have become mixed due to defective storage, shall be removed from site immediately.

2.06 ADMIXTURES

- A. Suitable admixtures may be used only with the prior written approval of the Owner. Both the proposed dosage and method of use shall be submitted to the Owner together with the following data:
1. The typical dosage and detrimental effects of underdosage and overdosage
 2. The chemical name(s) of the main active ingredient(s) in the admixture
 3. Whether or not the admixtures contain chlorides and, if so, the chloride content of the admixture expressed as a percentage of equivalent anhydrous calcium chloride by weight of admixture
 4. Whether or not the admixture leads to the entrainment of air when used at the manufacturer's recommended dosage
- B. Unless otherwise agreed on, an admixture shall comply with one of the following standards:
- BS **BS EN 12878: 1999** Pigments for cement, magnesium oxychloride and concrete.
BS 3892 Pulverized-fuel ash for use in concrete.
BS 5057 Concrete admixtures.
- C. The use of calcium chloride as an admixture will not be approved.

2.07 WATER

- A. The water to be used in mixing concrete shall be clean and free from all harmful matter in suspension or solution and shall satisfy the recommendations given in BS 3148. If directed by the Owner, the Contractor shall carry out tests in accordance with BS 3148 to establish compliance with the Specification.

2.08 REJECTED MATERIALS

- A. All materials which have been damaged or are contaminated or unidentifiable or do not in all respects comply with the Specification shall be rejected and removed immediately from the site at the Contractor's expense.

2.09 TESTING LABORATORY AND EQUIPMENT

- A. The Contractor shall submit for approval the name of the Testing Authority he proposes to employ. He shall, in addition maintain at the site the following apparatus which shall be kept in good repair throughout the Contract:
1. Apparatus for assessing workability in accordance with BS 1881.
 2. Apparatus for making concrete cubes in accordance with BS 1881.
 3. A maximum and minimum thermometer to be kept on the Site close to the Works for measuring atmospheric shade temperature.
 4. Two soil thermometers for measuring concrete and ground temperature.

5. A wet and dry bulb thermometer for measuring relative humidities.

2.11 TESTS

- A. All tests and checks carried out on site shall be in the presence of or as directed by the Owner. The Contractor shall be responsible for carrying out all tests required by the Specification or called for by the Owner. Unless otherwise specified the costs of all tests required are to be met by the Contractor whether the test results show the material or workmanship to be satisfactory for the work or not.
- B. If the Contractor proposes to adopt a designed concrete mix then he shall be responsible for carrying out the preliminary tests in accordance with Clause 3.03 of this section of the Specification and send the results to the Owner before placing any structural grade concrete made from the materials to be tested. No structural concrete shall be placed in the works until the relevant mix has been approved by the Owner. The preliminary tests shall be carried out at the start of the contract on samples of the materials the Contractor intends to use on structural concrete grades. The preliminary tests shall be repeated whenever the Contractor proposes to change his source of supply and whenever in the opinion of the Owner there was sufficient variation from the previously approved sample that new tests are required.

2.12 RECORDS

- A. Temperature: A daily record shall be kept of maximum and minimum outside shade temperatures.
- B. Concreting and Test Cubes/Cylinder: The Contractor shall submit weekly to the Owner a complete record of concreting, giving the date, location, concrete grade and mixer (if more than one).
- C. These records shall be set out in such a way that the test Cube /Cylinder results may be easily referred to the works concrete to which they relate.

PART 3: EXECUTION

3.01 CONSTITUENTS

- A. Concrete shall be made from cement, aggregate and water, all as specified and approved. No other ingredients shall be added without the prior approval of the Owner.

3.02 CONCRETE CLASSES

- A. Classes of concrete to be used in various locations indicated on the drawings shall be as shown in Table 1. The class of concrete is denoted by the minimum 28 day characteristic Cylinder strength and the type of cement. The strength and other parameters specified are those assumed for the design of the structure and must be achieved by the Contractor in the finished buildings.

TABLE 1

JHCO Warehouses
Enabling works package

Class of Concrete Cylinder/ Cube Strength	Minimum Cement Content kg/m ³	Maximum Water Cement Ratios	Nominal Maximum Aggregate size mm	Characteristic Strength at 28 days N/mm ²	
				Cube Strength to ASTM C 39	
C20/25 C28/35	320 350	0.50 0.45	20 20	20 35	Blinding under foundation Reinforced concrete

- B. Where Cylinder is used for determining concrete compressive strength in accordance with ASTM C 39, the corresponding cube strength is to be 0.8 times the cube concrete strength.
- C. The measured slump of different classes of concrete shall be between 100 to 200mm in accordance with the requirements of **BS 8500-1: 2002, BS 8500-2: 2002 & BS EN 206-1:2000**

D. **DESIGNED MIXES**

a. Target Mean Strength:

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

- b. 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 1. or 2.
- i) 1.64 times the standard deviation of cube tests on at least 100 separate batches of concrete of nominally similar proportions 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 of concrete of grade 15, or 3.75 N/mm² for concrete of grade 30 or above.
 - ii) 1.64 times the standard deviation of cube tests of 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 15 or 7.5 N/mm² for concrete of grade 30 or above.
- c. Where there is insufficient data to satisfy 1. or 2. above, the margin for the initial mix design should be taken as two-thirds of the characteristic strength for concrete of grade 15 or 15N/mm² for concrete of grade 30 or above.

- d. On the basis of satisfactory and consistent works cube results the Owner may at his discretion reduce this figure but to not less than 7N/mm^2 and the mix may be redesigned accordingly.

E. Change of Current Margin:

A recalculated margin should not be adopted unless it differs from the current margin by at least 18% when based on 40 separate batches, 11% when based on 100 batches, or 5% when based on 500 batches.

3.03 QUALITY CONTROL OF CONCRETE PRODUCTION

- A. For each class of concrete in production at each plant for use in the Permanent Works, samples of concrete shall be taken at the point of discharge from the mixer or the ready mix delivery vehicle as instructed by the Owner and in the presence of a representative of the Owner, all in accordance with the sampling procedures described in BS 1881. A slump test shall be carried out in accordance with the requirements of BS 1881 whenever the Owner may require it.
- B. Concrete cubes shall be 150 mm cubes. Samples shall be taken for every 20 cubic meters of concrete placed with a minimum of one sample taken every day on which the mix is used. From each sample cubes shall be made, one for testing seven days after casting and two for testing 28 days after casting. The average strength of the two cubes crushed at 28 days shall be referred to as one test result.
- C. All cubes shall be clearly marked with the date of casting and accurate records shall be supplied to the Owner, stating the dates of taking and testing of samples, together with the results of tests and the exact position from which the sample was taken.
- D. If in the opinion of the Owner, from the evidence of the cube test, the concrete is not likely to be capable of fulfilling its purpose, the Owner shall require 3 cores to be taken from the area represented by the test cubes. The actual location shall be decided by the Owner. These cores shall be taken and tested in accordance with the requirements of BS 1881 and if the average of the three cores when reduced to the corrected equivalent test cube strength at 28 days falls below the specified strength, further cores are to be cut in order to determine the extent of the unsatisfactory concrete. The volume of concrete shown to be below the required strength shall be taken out and replaced at the Contractor's expense.

3.04 EVIDENCE OF SUITABILITY OF PROPOSED MIX PROPORTIONS

- A. Evidence shall be submitted to the Owner for each grade of concrete that the mix has been designed to give sufficient workability to be placed and compacted by the methods to be used on site.
- B. If adequate data for "target mean strength" is not available, trial mixes shall be prepared.
- C. Information to be supplied:

The following information shall be provided before any design 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.

1. Nature and source of each material, and for aggregates, grading curves.
2. Appropriate existing data as evidence of satisfactory previous performance for target mean strength and current margin and if required workability and w/c ratio.
3. Proposed quantities of each ingredient per cubic metre of fully compacted concrete.

3.05 TRIAL MIXES

- A. 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. Sampling and testing shall be in accordance with B.S. 1881 and 3148.
- B. 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 7 days if required. The trial mix proportions will be approved if the average strength of the nine cubes tested at 28 days exceeds the specified characteristic strength by the current margin minus 3.5N/mm^2 or if nine tests at 7 days indicate that it is likely to be exceeded by this amount.
- C. If trial mixes are required to demonstrate that the maximum free water / cement ratio is not exceeded, two batches shall be made in a laboratory with cement and surface dry aggregates known from past records of the supplier of the material to be typical. The proposed mix proportions will not be accepted unless both batches have the correct cement content and free water / cement ratio below the maximum specified value at the proposed degree of workability.

3.06 TESTING PLAN FOR CONCRETE CUBES

- A. Concrete test cubes shall be 150mm cubes, made, cured, and tested in accordance with B.S. 1881 and 3148.
- B. Cubes shall be taken at the point of discharge from the mixer or the ready mix delivery vehicle.
- C. Cubes shall be made individually.
- D. Compliance with the specified characteristic strength may be assumed if:
 1. 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

2. each individual test result is greater than 85% of the specified characteristic strength.
- E. The Contractor shall make all necessary arrangements for curing and delivery of samples and test pieces to the Testing Authority.

3.07 ACCEPTANCE OF WORKS CONCRETE

- A. The Contractor shall take four cubes from each sample, two for test at 7 days, and the other for test at 28 days. Sampling shall be at the rate of 4 per day for the first 10 days or for the first 40 samples, and at one per 20m³ thereafter.
- B. If any cube fails to meet the strength required, then the Contractor shall carry out full investigation into the cause. If the Owner is not satisfied with the results of the Contractor's investigation or any additional tests which shall be carried out at the Contractor's expense, then the works made from concrete mixed between the times of the sampling for the previous and subsequent satisfactory sets of cubes shall be classed as defective work.

3.08 MIXING CONCRETE

- A. Unless otherwise agreed by the Owner concrete shall be mixed in an approved type of mechanical weigh-batcher. No hand mixing will be allowed.
- B. The weighing and water-dispensing mechanisms shall be maintained in good order. Their accuracy shall be maintained within the tolerance described in BS 1305 and checked against accurate weights and volumes when required by the Owner.
- C. The weights of cement and each size of aggregate as indicated by the mechanisms employed shall be within a tolerance of +/- 2 percent of the respective weights per batch agreed by the Owner. The weight of the fine and coarse aggregates shall be adjusted to allow for the free water contained in the fine and coarse aggregates which shall be determined by the Contractor by a method approved by the Owner immediately before mixing begins, and further as the Owner requires.
- D. The materials shall be mixed until they are uniformly distributed and the mass is of uniform consistency and color, but in no case shall the mixing time be less than two minutes after all the materials have been added to the drum. The drums on all mixers shall revolve at the speeds recommended by the manufacturer.
- E. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before any fresh concrete is mixed. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.
- F. Delivery notes with each batch delivered shall record the following:-
 1. Date and time of arrival
 2. Time and place of mixing
 3. Registration of truck and depot
 4. Time and place of adding water
 5. Mix class

6. Details of any approved additives.

3.09 TRANSPORT AND PLACING OF CONCRETE

- A. The method of transporting and placing concrete shall be to the approval of the Owner. Concrete shall be so transported and placed that contamination, segregation or loss of constituent materials does not occur.
- B. All formwork and reinforcement contained in it shall be clean and free from standing water immediately before the placing of the concrete.
- C. Concrete shall not be placed in any part of the structure until the Owner's approval has been given.
- D. If concreting is not started within 24 hours of approval being given, approval shall again be obtained from the Owner. Concreting shall then proceed continuously over the area between construction joints. Fresh concrete shall not be placed against in situ concrete which has been in position for more than 30 minutes unless a construction joint is formed in accordance with this specification. When in situ concrete has been in place for 4-hours no further concrete shall be placed against it for further 20-hours.
- E. Concrete when deposited shall have a temperature of not less than 5°C and not more than 32°C except with the approval of the Owner.
- F. Except in the case of columns or where otherwise agreed by the Owner, concrete shall be deposited in horizontal layers to a compacted depth not exceeding 300 mm and each layer shall be well consolidated before the subsequent layer is placed.
- G. Except in the case of columns or unless otherwise agreed by the Owner, concrete shall not be dropped into place from a height exceeding 2 metres. When trunking or chutes are used they shall be kept clean and used in such a way as to avoid segregation.
- H. Concrete shall not be pumped or discharge through aluminium or alloy conduits. Concreting shall be carried out continuously and no concrete shall be placed on concrete which has sufficiently set as to cause the formation of seams or planes of weakness with the section. Where concrete cannot be placed continuously, construction joints as specified shall be formed, only where shown on the drawings or approved by the Owner.
- I. The time elapsing between mixing and placing a batch of concrete shall be as short as practicable. The time should be no longer than will permit completion of placing and compaction before the onset of initial set and in any case no longer than one hour from the time the water is added to the mix.

3.10 INTERRUPTIONS TO PLACING

- A. If concrete placing is interrupted for any reason and the duration of the interruption cannot be forecast or is likely to be prolonged, the Contractor shall immediately take the necessary action to form a construction joint so as to eliminate as far as possible feather edges and sloping top surfaces and shall

thoroughly compact the concrete already placed. All work on the concrete shall be completed while it is still plastic and it shall not thereafter be disturbed until it is hard enough to resist damage. Plant and materials to comply with this requirement shall be readily available at all times during concrete placing.

- B. Before concreting is resumed after such an interruption the Contractor shall cut out and remove all damaged or uncompacted concrete, feather edges or any other undesirable features and shall leave a clean sound surface against which the fresh concrete may be placed.
- C. If it becomes possible to resume concrete placing without contravening the Specification and the Owner consents to resumption, the new concrete shall be thoroughly worked in and compacted against the existing concrete so as to eliminate any cold joints.

3.10 FAIR FACE FINISH FOR CONCRETE SURFACES

- A. Fair-Faced Finish:
 - 1. Fair-faced finish shall be achieved by casting high quality well compacted concrete into properly designed forms having a hard and smooth surface.
 - 2. Formwork shall be of impervious sheet material such as steel, waterproof plywood sheet or other suitable material. Unfaced wrought boarding shall not be used. The material for the form shall be provided in panels as large as practicable and arranged in an approved uniform pattern. Joints between sheets shall be made sufficiently watertight to prevent loss of liquid from the concrete. All joints between sheets shall be accurately aligned and in plane. Joints shall, where ever possible, be arranged to coincide with architectural features all to the approval of the Engineer.
 - 3. Concrete surfaces which are described as finished fair shall be finished free from honeycombing and excessive air holes, fins, and projections arising from defective mixing, placing, or formwork and shall, if necessary, be filled with mortar and rubbed with fine carborundum stone. The finish shall be integral with the body of the concrete and shall not be obtained by means of an applied rendering.
 - 4. The quality of the surface of concrete exposed to view shall be consistent throughout the Project.
 - 5. Crack Repairs: Where shrinkage cracking, early thermal cracking or compaction cracking occurs, cracks equal to or exceeding 02 mm wide shall be sealed by epoxy resin injection.
 - 6. The injected resin shall have the following properties:
 - a. At 30°C pot life shall not be less than 25 minutes; viscosity shall not be more than 70 centipoises and cure time not more than 6 hours.
 - b. Where cracks are less than 0.2 mm, cracks shall be painted with a latex filler primer prior to painting.
- B. Approval by Engineer of Fair-Faced Finishes:
 - 1. Submit for the approval of the Engineer, a sample panel of not less than 60 x 120 cm and complete circular column mock-up to demonstrate the quality of the exposed concrete to be produced by forms.
 - 2. The quality of the finished Work shall be measured against the quality of the approved sample panel and the Work of inferior quality shall be repaired or replaced as directed by the Engineer, without any additional cost.

3. Construction joints, in special cases of weather conditions and if approved by the Engineer, shall be studied in detail ahead of time and the joints shall be grooved in a predetermined pattern approved by the Engineer.

3.11 PUMPED CONCRETE

- A. If it is the Contractor's intention to transport concrete by pumping he is to obtain the Owner's written approval at the commencement of the contract. When submitting his proposals to the Owner the Contractor must furnish the Owner with full details of the mix design, the area and volume of concrete that he intends to place in an operation and the distance over which the concrete is to be pumped. The foregoing Clause on mix design will apply equally to a concrete that is designed to be "pumped".

3.12 COMPACTION OF CONCRETE

- A. All concrete shall be compacted to produce a dense homogeneous mass. Unless otherwise agreed by the Owner, it shall be compacted with the assistance of mechanical vibrators, and sufficient mechanical vibrators in serviceable condition shall be on site so that spare equipment is always available in the event of breakdowns.
- B. Mechanical vibrators shall be of the immersion type capable of operating at between 7,000 and 10,000 cycles per minute.
- C. No vibrator shall be operated by a workman who has had insufficient training in its use.
- D. With immersion vibrators the tubular part of the tool shall be inserted vertically into the full depth of the concrete to be vibrated at points 600 mm apart and at least 100 mm away from any formwork. The vibrators shall be kept constantly moving whilst in action to prevent segregation. Vibration shall not be applied directly or through the formwork or reinforcement to sections or layers of concrete which have taken their initial set or to concrete which has ceased to become plastic under vibration. Vibration shall be stopped after the decrease in volume is no longer apparent or before localized areas of grout or laitance are formed. Should the supply of concrete from the mixer be interrupted the vibrators should be lifted clear from the work.
- E. Care shall be taken to ensure that concrete is fully compacted around water stops without distorting, displacing or damaging the water stops.
- F. If the surface of a floor slab exhibits cracking while the concrete is still plastic it shall be reworked to close the cracks.

3.13 PROTECTION OF FRESH CONCRETE

- A. Freshly placed concrete shall be protected from rainfall and from water running over the surface until it is sufficiently hard to resist damage from this cause.
- B. No traffic shall be allowed on any concrete surface until such time as it is hard enough to resist damage by such traffic.

- C. Concrete placed in the Permanent Works shall not be subjected to any structural loading until it has attained at least its minimum average strength as defined previously.

3.14 CONCRETING IN HOT WEATHER

- A. On exposed concrete surface in high sun temperatures and/or strong drying wind conditions the Contractor shall use a curing method which also shields the concrete and this shall be placed in position no later than half an hour after final tamping. If the surface exhibits cracking while the concrete is still plastic then it shall be retamped to close the cracks.
- B. No concrete shall be mixed and placed whilst the shade temperature is above 42°C on a rising thermometer or above 43°C on a falling thermometer. The Contractor shall supply an accurate maximum and minimum thermometer and hang it in an approved place in the works.
- C. The Contractor shall plan the day's concreting in such a manner as to ensure that each bay or panel is completed at a proper construction joint before the temperature rises above the permissible limit.
- D. The temperature of fresh mixed concrete should not exceed 32°C and the Contractor should take all necessary precautions to ensure that the limit is not exceeded. Concrete with a temperature less than 32°C can be produced by combinations of the following methods:
 - 1. use of sliced, flaked or crushed ice to reduce temperature of mixing water. All ice shall be melted before adding to concrete.
 - 2. night casting (subject to the prior approval of the Owner).
 - 3. shading of aggregates.
 - 4. moistening of aggregates with potable water.
 - 5. cooling of formwork and reinforcement.
 - 6. using cement with a temperature of less than 77°C.
 - 7. use of white or light reflective paints on mixer drums and water storage tanks.
 - 8. shading of the mixing area.

3.15 PROTECTION TO SUBSTRUCTURE

- A. A layer of polyethylene sheeting shall be laid over the prepared formation or compacted subbase under slabs on grade and at other locations designated by the Owner prior to concreting and carried up the sides of such members to ground level or other level defined by the Owner.
- B. Hot Bituminous waterproofing coating shall be provided to the underside of slabs and vertical faces of concrete walls in basements and underground storage tanks where indicated on the drawings. Hot Bituminous waterproofing coating shall be installed in accordance with the requirements of Section 07005.
- C. Waterstops shall be installed in accordance with Section 03250: CONCRETE ACCESSORIES.

3.16 LIQUID CONTAINING CONSTRUCTION

- A. All liquid containing construction shall be tested to ensure no leakage or damp penetration. The testing shall be carried out before waterproof backing or other finishes are applied to the construction and before back-filling any excavation.
- B. The Contractor shall seal completely all drains and fill the construction with clean water to a predetermined level. Once filled the level is to be recorded at daily intervals for a period of fourteen days or as otherwise directed by the Owner. Measures shall be taken by the Contractor to ensure that the level of water is not affected by rainfall or undue evaporation.
- C. Should it be apparent from the test results, external inspection or any other source that leakage or damp penetration has occurred then remedial work to make the construction completely watertight shall be carried out at the Contractors expense and to the Owners approval. The construction shall be retested until the results are satisfactory.

3.17 DEFECTIVE WORK

- A. Any remedial treatment to surfaces shall be agreed with the Owner following inspection immediately after removing the formwork and shall be carried out without delay.
- B. Any concrete, the surface of which has been treated before being inspected by the Owner, shall be liable for rejection.
- C. Any concrete which in the opinion of the Owner is damaged or is in any way defective due to lack of compliance with any of the foregoing Clauses, or is not true to an acceptable line or level compatible with the requirements of second fixings and finishes, then this work will be deemed unacceptable and rejected.
- D. Where rejected work has to be cut out or re-built, the operation shall be carried out by the Contractor at his own expense and without delay.
- E. The extent of the work to be removed and the methods to be used in the removal and replacement of this work shall be proposed by the Contractor for the Owner's approval.
- F. The Owner's approval must be obtained before any cutting of concrete is carried out. If such cutting of concrete is carried out without the Owners approval the affected areas shall be classified as defective. The Contractor is responsible for ensuring that a copy of this clause is given to each of his subcontractors, nominated or otherwise, and that they abide by it.

END OF SECTION

SECTION 03370

CONCRETE CURING

PART 1: GENERAL

1.01 DESCRIPTION

- A. The work covered in this section includes the methods to be employed for the correct curing of cast-in-place and precast concrete.

PART 2: PRODUCT

2.01 CURING COMPOUNDS

- A. Suitable curing compounds may be used only with the written approval of the Owner. Both the proposed dosage and method of use shall be submitted to the Owner.
- B. The use of the curing compound on surfaces which are to receive a bonded finish shall only be approved if it is proven that the use of the compound has no detrimental effect on the applied finish.
- C. Curing compounds shall contain a dye to enable the extent of the spread to be seen easily.
- D. Curing compounds used on surfaces exposed to the sky shall, if instructed by the Owner, contain sufficiently finely divided flake aluminium in suspension to produce a complete coverage of the surface with a metallic finish when applied at the rate recommended by the manufacturer.
- E. Curing compounds shall become stable and impervious to the evaporation of water from the concrete surface within sixty minutes of application. The material shall not react chemically with the concrete and shall not crack, peel or disintegrate within three weeks after application.

2.02 WATER

- A. Water used for curing shall be of the same quality as that used for mixing concrete as described in Clause 2.07 of Division 03300 of this Specification.

PART 3: EXECUTION

3.01 GENERAL

- A. Immediately after compaction and for 7 days thereafter, concrete shall be protected against harmful effects of weather, including rain, rapid temperature changes, and from drying out. The methods of protection used shall be subject to the approval of the Owner.
- B. The method of curing used shall prevent loss of moisture from the concrete. On concrete surfaces which are to be waterproofed, curing compounds shall not be used. Details of all curing methods to be used shall be subject to the approval of the Owner.

3.02 METHODS OF CURING

- A. For formed surfaces all formwork must remain in place for at least 48 hours, unless otherwise agreed by the Owner. If removal occurs within 7 days from casting, the exposed surface must be cured. Formwork which remains in place should be insulated steel or timber formwork.
- B. In cases where formwork is removed within 7 days of casting, the exposed concrete surfaces shall be closely covered with impermeable sheeting, properly secured to prevent its removal by wind and the development of air spaces beneath it. Alternatively the Contractor shall keep the exposed surfaces continuously wet by means of a water spray or by covering with a water absorbent material which is kept wet. Subject to the approval of the Owner a pigmented reflective curing compound shall be applied immediately to the surface.
- C. For other surfaces the above methods are acceptable subject to the additional requirement that if the area considered is exposed to the effects of sun or wind, ponding to a depth of at least 50 mm shall be provided. Ponding shall take place as soon as possible at the end of concreting, but not before the concrete can resist surface damage.
- D. When the humidity is less than 50% and the wind speed exceeds 4 m/second, sheltering of the concrete, during casting and for a period of at least 24 hours after casting, shall be provided. Such sheltering shall be in addition to the curing procedures described previously. Formwork left in place shall be regarded as sheltering.
- E. The Contractor shall limit the development of temperature differentials in concrete after placing by any means appropriate to the circumstances as accepted by the Owner.

END OF SECTION

SECTION 07005

WATERPROOFING AND DAMPPROOFING

PART1: GENERAL

1.01 SCOPE OF WORK

- A Furnish all materials, labor, and equipment required to perform all waterproofing of cast-in-place concrete, waterproofing exterior block masonry, dampproofing, protection board and related work necessary for the proper completion of the project as required by the drawings and as specified herein.
- B Work required in conjunction with the cement plaster waterproofing shall be conducted by an organization which specializes in waterproofing and has an established reputation for having satisfactorily done such work. The work shall not be done by workmen regularly employed on general contract work. Specifications for this work must be read with care by bidders before bids are received and by all parties during construction.
- C All Waterproofing membrane that would be used in the project shall not have chlorine-based materials including Polyvinyl Chloride (PVC), Chlorinated polyethylene (CPE), Chlorinated polyvinyl chloride (CPVC), Chlorosulfonated polyethylene (CSPE), and Polychloroprene

1.02 GUARANTY

- A As a condition of this Section furnish the Employer with a written guaranty that the dampproofing membrane and the liquid waterproofing work upon completion will be waterproof for a period of **10 ten** years and that during this time all defects in the waterproofing or bonding, or leaks which may develop through the surface, shall be promptly repaired at no expense to the Employer, provided such leaks and defects are not due to causes beyond control of this section.

1.03 APPLICATION SCHEDULE

- A Dampproof all surfaces of all cast-in-place concrete walls, foundations, columns and ground beams in contact with soil from the bottom of the footings up to floors dampproofing layer, and shall be applied below foundations and footings, or as show.
- B Masonry waterproofing material shall be applied to all exterior above grade block masonry surfaces.
- C Floors dampproofing membrane shall be applied below ground slabs and wet areas and planters, as shown on drawings.

1.04 SUBMITTALS

- A Submit to the Employer, as provided in Submittals Section for shop drawings, detailed information on materials proposed and installation methods.

- B Submit two sets of representative samples of any or all proposed materials required for the work of this Section as requested by the Employer.
- C Submit to the Employer for review, the manufacturer's specifications and instructions for materials and installation. These specifications and instructions shall be as required to provide the detailed drawings.

1.05 DELIVERY, STORAGE AND HANDLING

- A All perishable materials for the work of this Section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with identification of material and maker. Materials in broken containers, or in packages showing water marks or other evidence of damage, shall not be used and shall be removed from the site.

1.06 JOB CONDITIONS

- A Hot Weather Requirements
 - 1. Protect fresh membrane from hot sun as approved.
 - 2. Provide artificial shade, wind breaks and use cooled materials, as required.

PART2: PRODUCTS

2.01 BELOW GROUND WATERPROOFING MATERIALS

- A Materials for below ground surfaces of under foundations, tie beams, basement walls, below ground slabs and other surfaces in contact with soil shall be Liquid applied waterproofing membrane shall be a cold applied, rubberized flexible bitumen, material in liquid form which when applied dried within 3 hours @ 20 °C. The membrane shall form a tough durable resilient, impermeable barrier to water and most aqueous reagents, adhering to the structural surface. The membrane shall be suitable for hot climates.

A primer or bonding agent if recommended by the manufacturer of the membrane shall be provided, before the application of the liquid membrane.

The minimum thickness of the membrane shall be 1.5mm unless otherwise indicated on Drawings

2.02 PROTECTION MATERIALS

- A. Protection board for surfaces in contact with soil, internal bids under slab on grade, all concrete surfaces in contact with soil and basement walls: shall be 5mm thick one layer Semi Flexible Polypropylene based board, consist of double layered with 3mm integrated perpendicular support spacers at 2mm intervals, and shall be capable to resist puncture at over 1000 Newton as per

ASTM E – 154 and shall not be affected by mineral oils, solvents, acids, bases and salts, as recommended by bituminous sheet manufacturer

- B Protection board for wet area, external bays under slab on grade and under foundations shall be double layer of 250 micron (each) polyethylene sheet with a vapor transmission rating of 0.20 perms or less. Provide with polyethylene tape recommended to seal joints in vapor barrier.

PART 3: EXECUTION

3.01 GENERAL

- A All installation shall conform to the acceptable shop drawings and the system and materials manufacturer's specifications and instructions as submitted and reviewed.

3.02 SUBSTRATE SURFACE

- A Concrete surfaces shall be free of roughness or projections, with a clean surface, finished as specified under concrete finishes section which will allow an even application of the membrane and insulation.
- B Surfaces shall not contain any grease, oil or any other contaminants which could affect the complete bonding of the membrane to the concrete surface.
- C Surfaces shall be visibly dry and thoroughly cleaned, (remove all dust, dirt, and loose materials) immediately prior to application of membrane. Compressed air, vacuum cleaner or other suitable means shall be used.

3.03 INSTALLATION

1. Dry surfaces: dampen before applying water based bitumen emulsion.
2. Apply coatings generally in accordance with manufacturer's recommendations to clean, dry surfaces, in dry atmospheric conditions, after primer has dried and after previous coats have hardened.
3. Ventilation: spaces in which coatings are to be applied are to be well ventilated.
4. Cold and Hot applied bitumen: apply number of coats to thickness and at rate of application recommended by coating manufacturer or as stated in bill of quantities.
5. Chemical waterproof coating: mix dry powder with water on site and apply mixture to pre-wetted surfaces in number of coats and at rate of application recommended by coating manufacturer.
6. Brushing: work coating into recesses, edges, joints, intersections and over surfaces generally to obtain uniform and continuous film.

7. Intersections: ensure continuity of coatings including at junctions with other membranes.
8. Covering: final covering is to be laid/applied as soon as possible after coating has hardened.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sealants, gaskets and joint backing, and accessories. Work includes but is not limited to the following:
 - 1. Control joints in concrete and masonry
 - 2. To expansion joints.
 - 3. Joints between different materials
 - 4. Perimeter joints between materials listed and frames of doors and windows
 - 5. Other joints as indicated.
- B. Related Sections:
 - 1. Section 03300 - Cast-In-Place Concrete

1.2 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Samples: Submit two samples, 20x20 mm in size illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.
- E. Warranty: Include coverage for installed sealants and accessories failing to achieve airtight seal, watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.3 QUALITY ASSURANCE

- A. Installer Qualification: Installer shall be a firm experienced in application of materials required.
- B. Source Quality Control: Testing methods shall be in accordance with the relevant standard specification to which joint fillers are to conform.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years experience, and approved by manufacturer.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Products Requirements.
- B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.6 WARRANTY

- A. Special Project Warranty: Submit a written warranty, executed by the Contractor and Installer agreeing to replace components which fail in materials or workmanship within the specified warranty period. Failure includes but is not necessary limited to failure of joint due to loss of cohesion or adhesion.
- B. Warranty period for Joint Fillers and Gaskets shall be Ten (10) years after the date of Substantial Completion.

1.7 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with sections referencing this section.

PART 2 PRODUCTS

2.1 JOINT SEALERS

- A. The products and manufacturers specified hereinafter are specified for the purpose of establishing minimum quality standards. Products equal in quality to, or better than those specified, may be acceptable subject to the Engineer's approval.
- B. Products Description:
 - 1. High grade, polysulphide based sealant possessing outstanding resistance to deterioration due to weathering.

- a. Color: Standard colors matching finished surfaces, as selected.
 - b. Applications: Use for:
 - 1) Exterior joints for Facades.
2. Technical Data:
- a. Solid content % : >99%
 - b. Viscosity: thixotropic paste.
 - c. Tack free at 20°C : 24 hours
 - d. Staining: none.
 - e. Slump gun grade : all
 - f. Resistance to ozone : non-crack
 - g. Hardness shore A : 25
 - h. Operating temperature: -30°C to 90°C
 - i. Recommended Movement: transverse $\pm 25\%$ M.A.F (Movement Accommodation Factor)

2.2 ELASTOMERIC JOINT SEALANTS

- A. Silicone sealant: One part, non-sag, silicone sealant; capable of +50% movement as measured in compliance with ASTM C 719; ASTM C920, Type S, Grade NS, Class 25, use 'O' related to joint substrate for vertical joints.
- B. Mildew Resistant Silicone Sealant: One part, non-sag, elastomeric silicone sealant formulated with fungicide for mildew resistance; ASTM C920, Type S, Grade NS, Class 25, for use around plumbing fixtures and ceramic tile joints in wet areas and counter tops to walls.
- C. Two-component, urethane - based elastomeric sealant, self-leveling, capable of +25% movement as measured in compliance with ASTM C719, ASTM C920, Type M, Grade P, Class 25, use T. for use in typical exterior and interior horizontal traffic joints.
- D. Single component, urethane elastomeric sealant, capable of +25% movement as measured in compliance with ASTM C719, ASTM C920, Type S, Grade NS, Class 25, use T for use in exterior traffic joints where slopes occur.

2.3 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces and joint openings are ready to receive work.
- C. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter impairing adhesion of sealant.
- B. Clean and prime joints.
- C. Perform preparation in accordance with ASTM C1193.
- D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

- A. Perform installation in accordance with ASTM C1193.
- B. Perform acoustical sealant application work in accordance with ASTM C919.
- C. Apply in continuous runs without voids or interruptions, except as may be otherwise shown. Trim for tight fit around obstructions or elements penetrating the joint.
- D. Do not puncture the surface or self-skin on molded or extruded types of cellular joint fillers.
- E. Depress face edge of joint fillers accurately, wherever used as backup for sealant, as shown or as specified by sealant manufacturer for proper application of sealant.
- F. Recess exposed edges of joint fillers and gaskets slightly behind face of adjoining surfaces, unless shown otherwise.
- G. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

3.4 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Protect joint fillers and gaskets during the remainder of the construction period so that they will be without indication of deterioration or damage at the time of Substantial Completion of the Works.

END OF SECTION