



DEVON SPRING DEMOLITION OLD RECYCLING PLANT, DEVONSHIRE

Bermuda

Annex C Specifications

Date: 27 MARCH 2017

Project No. 31-17-100



TECHNICAL SPECIFICATIONS

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Part 1. **General**

1.1 Scope of work

- A. Additional specific scope information may be given in bidding requirement documents which shall be read in conjunction with the following:
- B. The work shall be as defined by the drawings and other contract documents which are intended to provide for and comprise everything necessary for the proper and complete execution of the works, in every part, notwithstanding that every item necessary may not be shown on the drawings nor mentioned in the specification.
- C. Work specifically to be excluded will be marked as "not in contract" or a similar designation.

1.2 Intention

- A. The Contractor shall abide by and comply with the true intention and meaning of the drawings and specifications taken as a whole, and shall not perform any work knowing it involves any errors or omissions, should any exist.
- B. Items mentioned in the specification but not shown on the drawings or vice versa, are to be executed as if occurring in both.
- C. Should any error or discrepancy appear or should any doubt exist or dispute arise as to the true intention or meaning of the drawings or of the specifications, or should any portion of be obscure or ambiguous, the Contractor shall apply to the Engineer's Representative who shall provide a correction or explanation thereof.
- D. All written or figured dimensions shall supersede scaled dimensions.

1.3 The site

- A. The site shall be all the area(s) marked on the site plan, designated for the use of the Contractor, and may temporarily include areas within contract limits off site (e.g. for utility lines) as indicated.
- B. The site is to be maintained throughout the duration of the contract, and debris and waste should not be allowed to accumulate, but should be removed at regular intervals and disposed of in a lawful manner.

1.4 Protection

- A. The Contractor shall take all necessary precautions to adequately protect the site, the works, any existing property, landscaping, features or goods stored on the site, and all property surrounding the site, from damage arising out of the works.
- B. Any damage arising out of the works should immediately be made good by skilled tradesmen under the employment of the Contractor.
- C. Materials and equipment stored on, adjacent to, or offsite, shall be adequately protected from the weather, damage and theft at all times.

1.5 Overtime

- A. Unless it is otherwise stated in bidding requirement documents, the contract is intended to be performed in normal working hours. Any additional work required to meet contract time limits that the Contractor considers necessary, shall be at his own expense, and shall have the prior written approval of the Engineer's Representative.

1.6 Laws, permits and regulations

- A. The Contractor shall obtain and pay for all licenses and permits, other than the general Building Control permit, and all fees and charges for connecting outside services. He shall comply with all laws, acts, regulations and code requirements applicable to the work.
- B. The Contractor shall notify the relevant officer prior to the permanent covering up of work.

1.7 Use of explosives

- A. Except as may be specifically authorized in writing by the Engineer's Representative, the Contractor shall not allow the use of explosives on the site.
- B. When the use of explosives is authorized, the Contractor will be responsible for obtaining any necessary permits from the Police and any other permits necessary.

1.8 Existing conditions

- A. The Contractor shall cooperate with the occupants of existing buildings to minimize conflict and to facilitate the Owner's use.
- B. The Contractor shall conduct his operations to ensure the least inconvenience to the general public.

- C. Information pertaining to existing conditions has been obtained through investigation and has been gathered with reasonable care, but is not warranted, and may be of a schematic nature. The Contractor is to verify all levels and dimensions on site prior to ordering or construction.
- D. The Contractor shall be alert to any indication of or evidence of existing conditions not indicated on the drawings. If the Contractor encounters unexpected existing site conditions, he shall take all necessary precautions to minimize damage, and shall notify the Engineer's Representative immediately, including during the bidding period.

1.9 Emergency arrangements

- A. The Contractor shall, during the period of the Contract, maintain arrangements whereby he can quickly call out labour outside normal working hours for work required to maintain safety to persons or property. The Contractor shall, prior to commencing the works, supply the Engineer's Representative with the name, address and telephone number of a contact who shall be responsible for organising emergency work. Such work shall be put in hand immediately upon the request of the Engineer's Representative.
- B. Claims for additional time or costs for emergency arrangement will be dealt with under the relevant Section of the contract.
- C. Should the Contractor fail to deal with such emergency work as it arises, the Engineer's Representative shall be at liberty to engage others to carry out the work and the Owner may recover the costs attributable thereto from the Contractor.

1.10 Noise and nuisance

- A. The Contractor shall employ the best practicable means to meet the Public Health Act and the Health and Safety Requirements to minimise the noise and vibration resulting from his operations, and shall have regard to current standards.
- B. The Contractor shall ensure that all vehicles, plant and machinery are fitted with effective exhaust silencers, and are operated to minimise noise emissions.
- C. Only 'sound reduced' compressors or other approved alternatives are to be used. Any pneumatically operated percussion tools shall be fitted with approved mufflers or silencers which shall be kept in good repair.

- D. Any machinery which is in intermittent use shall be shut down in intervening periods of non-use or, where this is impracticable, throttled back to a minimum.

1.11 Burning of trash

- A. The Contractor shall not burn trash or other material for disposal on or adjacent to the site. All trash and debris shall be removed from site and disposed of lawfully, unless otherwise stated.

1.12 Making good

- B. The Contractor shall make good all work disturbed to match the existing work, unless directed otherwise by the Engineer's Representative.

Part 1. **General**

1.1 **Definition**

- A. A unit price is an amount proposed by the Contractor and stipulated in the Schedule of Rates (If requested) as a price per unit of net measurement for a described item of work
- B. Unit prices shall be inclusive of all necessary costs of materials, labour, equipment, establishment charges, overheads and fees including all insurances, taxes, freight, duties and other miscellaneous charges.
- C. Unit prices are to be for in-place (net) measured quantities and therefore shall include allowances for waste, bulking factors, handling, fixings etc., and shall be for work of a character and quantity envisaged under the contract.

1.2 **Use**

- A. Only one unit price shall be given for each item required; add/omit rates for the same item will not be entertained.
- B. Unit prices shall be the first option used in valuing variations both additions to, and deductions from, the Contract Sum, by Change Order where the quantities of the work required by the Contract Documents are amended.
- C. Where the nature or character of work differs from that described in a Unit price, the Unit price shall form the basis of the valuation.
- D. Fair rates shall be used for the valuing of variations where Unit prices are not applicable.
- E. Day work or cost / charge shall only be used for valuing variations which are incapable of being measured and priced.
- F. The Contractor's unit prices and other cost information will be treated confidentially and used only for the assessment of tenders and for the administration of the contract should the tender be accepted. Schedules will be returned to unsuccessful bidders if requested.

1.3 **Bills of Quantities**

Part 1. Where Bills of Quantities are used, the terms and method of measurement will be defined in the bidding documents

Part 1 **General**

1.1 **Form of application**

- A. As soon as practicable after being notified of selection for the award of the Contract, the Contractor shall furnish in writing to the Engineer's Representative an itemized cost breakdown of the various trades and sections which comprise the contract, totaled to equal the contract sum: this analysis to be used as a basis for Progress Payment applications.
- B. The cost breakdown shall be, and if not objected to by the Engineer's Representative before the first Progress Payment will be deemed to be, a true reflection of the costs (including overhead and fee) to the Contractor of the respective elements in the contract sum.

1.2 **Frequency of application**

- A. Payments will be made at the frequency indicated in the Appendix to the Conditions of Contract as indicated on the Bid Form.

1.3 **Effect of progress certificates**

- A. The inclusion of any value against an item in a Progress Payment is not of itself conclusive evidence that any work, materials or goods to which it relates are in accordance with the Contract or Specification.

1.4 **Materials or goods not yet incorporated into the works**

- A. The Engineer's Representative will only certify payment for materials or goods not yet incorporated into the works that are on or adjacent to the site always provided that the materials or goods are in accordance with the contract, adequately protected from the weather and other casualties, and have not been prematurely delivered to site.
- B. Under exceptional circumstances, payment may be made for materials or goods stored off-site. When this is the case such materials or goods, in addition to other requirements, shall be covered by insurance and properly identified as belonging to the project.
- C. The Contractor shall furnish original suppliers' (except in-house supply) invoices etc. to substantiate material and shipping costs and customs duties, and payments will be net (i.e. excluding overhead and fee).

1.5 **Retention**

- A. The Owner may deduct and retain, an amount calculated as a percentage (at a rate stated in the Appendix to the Conditions of Contract as indicated on the Bid Form) of the total value of work included for payment under the contract.
- B. Following the issue of the Certificate of Substantial Completion, the retention percentage deductible shall be reduced to a rate stated in the Appendix to the Conditions of Contract. The reduced rate shall be a minimum dependent on the extent of defective or incomplete work
- C. Substantial Completion means the acceptance by the Owner and the Department of Planning and other regulatory agencies of the works as being suitable for occupation, and the approval by the Owner of the Contractor's written list (known as the deficiencies or punch list) of items to be completed during the Warranty Period.
- D. During the Warranty Period, retention in excess of the minimum will be released to the Contractor on rectification of defects with the balance due released on Final Payment

1.6 Issue of certificate

- A. The Engineer's Representative shall, within 7 days of receiving an application for payment, issue a certificate to the Owner for such amount as he determines to be properly due, stating in writing to the Contractor his reasons for any amounts withheld.
- B. No progress payment certificate will be issued for a total amount less than BDA\$10,000.00, unless otherwise stated in bidding requirement documents, or as agreed with the Owner.

Part 1 **General**

1.1 **Definition**

- A. An alternate is an option during the time of bidding. (For product substitutions during the contract see Section 01631).
- B. An alternate will be stated on the Bid Form (or revised Bid Form if an alternate is approved by addendum) for an amount to be added to or deducted from the base bid which the Owner may choose to accept
- C. An alternate may be either changes to the scope of work, or in products, materials, equipment, systems or installation methods described in the bidding documents.

1.2 **Policy**

- A. Contractors shall price the specification and scope of work called for by the bidding documents, and shall only price alternates when they are either called for, or added by addendum.
- B. Prices for alternates shall include for changes for other work affected.

1.3 **Contractor's request for an alternate**

- A. A written request to submit an alternate may be made by a contractor during the bidding period, a minimum of ten calendar days prior to the date for receipt of bids.
- B. Complete data must be provided with any request, to substantiate compliance with requirements, together with all relevant supporting literature, performance and test data, and samples if applicable.
- C. Any approval to allow the pricing of an alternate will be made by addendum to all contractors, and a revised Bid Form issued.

1.4 **Acceptance of an alternate**

Should the Engineer's Representative approve an alternate for use in the contract, the Contractor shall coordinate related work including that of sub-contractors if applicable, and modify or adjust adjacent work as required to ensure that work affected is complete and fully integrated into the project.

Part 1 **General**

1.1 **Records**

- A. The Contractor shall maintain all records required by the Contract Documents, including details relating, but not limited to, ground conditions encountered, weather conditions including temperature, relative humidity and precipitation, daily labour return sheets showing the number of operatives (by trade) employed on the site and the activities in which they were engaged, records of visitors to the site and complete accident reports.

1.2 **Drawings**

- A. During the course of construction, the Contractor shall maintain an accurate record of all deviations and changes between the works indicated on the drawings and the actual construction on site.
- B. Prior to Substantial Completion of the works, the Contractor shall prepare and deliver to the Engineer's Representative, two sets of Record Drawings of all of the work as constructed, including electrical, HVAC and plumbing installations.
- C. Record Drawings shall be provided in the form of one set of negatives and one set of prints. For this purpose, transparencies of the original drawings will be furnished by the Engineer's Representative to the Contractor.
- D. Should the Contractor fail in his obligation to supply such Record Drawings, the Owner shall have the right to employ the Engineer's Representative or any other competent person to produce the said drawings and to recover the costs of such services from the Contractor. (see also Section 01700 Part 1.3)

1.3 **Photographs**

- A. Before commencement of and during the progress of the works, at intervals not exceeding one month, record photographs shall be taken of such subjects as may be reasonably directed by the Engineer's Representative.
- B. The negatives and two copies of 8 x 11 and 10 x 11 prints shall be handed to the Engineer's Representative, at which point copyright shall be vested in the Owner. Each print shall be marked on the back with the date of exposure and a brief description of the subject.
- C. The Contractor may keep copies of progress photographs for his records, but such copies shall not be used for any purpose whatsoever without the Owner's written consent.

1.4 **Conduct**

- A. The Contractor shall treat the details of the Contract Documents as confidential, and shall not publish or disclose them in any trade or technical paper or elsewhere without the prior written consent of the Owner.
- B. During the progress of the works the Contractor shall be responsible for the conduct of his workmen, and shall, upon the direction of the Engineer's Representative cease to employ on the works any person who may, in the opinion of the Engineer's Representative, be incompetent or misconduct himself.

1.5 Site superintendent

- A. The Contractor shall keep up on the site a competent superintendent, and any instructions given to him by the Engineer's Representative or his representatives shall be deemed to have been given to the Contractor.

1.6 Sub-contractors

- A. All sub-contractors shall be employed by the Contractor upon terms and conditions consistent with those of the General and Supplementary Conditions of Contract for Construction.
- B. The Specification generally avoids delineating responsibility of sub-trades (e.g. with regard to builder's work, interface of mechanical and electrical). The Contractor is responsible for all co-ordination and timing of the work of his sub-contractors. The Contractor shall provide all general and special attendances required and shall be responsible for the satisfactory fulfillment of his sub-contracts.
- C. If the Owner has a reasonable objection to any subcontractor proposed by the Contractor, the Contractor shall propose another to whom the Owner has no reasonable objection. If the changing of sub-contractor causes an increase to the bid amount, the increase will only be accepted if the Contractor has acted promptly and responsively, and has provided adequate information for approval.
- D. The Contractor shall only use the sub-contractors listed for the work for which they were proposed and accepted, and shall not change the list without the written approval, of the Engineer's Representative.
- E. Nominated sub-contractors will be dealt with by the provisions of the Bermuda Supplementary Conditions when necessary.

1.7 Suppliers and installation

- A. Prior to starting installation of each major component of the work, the Contractor shall hold a pre-installation conference, attended by each entity involved or affected by planned installation, including technical representatives of product manufacturers and others recognized as expert or otherwise capable of influencing success of the installation.
- B. The Contractor shall comply with the manufacturer's instructions and recommendations where the extent is more detailed or stringent than requirements contained directly in the Contract Documents.

Part 2 **Products**

Not applicable.

Part 3 **Execution**

3.1 **Anchoring work**

- A. Work to be fixed in place shall be securely and properly located by measured line and level and isolated from non-compatible materials sufficiently to prevent deterioration.
- B. Individual units of work shall be mounted at industry-recognised mounting heights, if not otherwise indicated; uncertainties shall be referred to the Engineer's Representative before proceeding.

3.2 **Cleaning and protection**

- A. Installed elements of work shall be cleaned at the time of installation, and provided with sufficient maintenance and protection during construction to ensure freedom from damage and deterioration until the time of Substantial Completion.

Part 1 **General**

1.1 **Utilities and services**

- A. The Contractor shall make all reasonable enquiries and take all reasonable measures to ascertain locations of, and protect, existing mains, services and utilities, and shall ensure continuity of service to existing buildings.
- B. Should any known service passing through the site require adaptation, the Contractor shall carryout such removal, relocation or disconnection as may be required, and shall give sufficient notice to the Engineer's Representative, Owner and others relevant prior to interruption of services.

1.2 **Setting out and dimensions**

- A. Upon taking possession of the site, the Contractor shall verify all levels, angles, grades, rises and dimensions shown on the drawings.
- B. Should any setting out discrepancies or errors be discovered on the drawings, the Contractor shall immediately inform the Engineer's Representative and cease all work which is directly influenced by such discrepancies or errors pending resolution by the Engineer's Representative
- C. The Contractor shall be solely responsible for the accurate setting out of the works and shall employ a qualified surveyor whenever necessary. Any damages which may be incurred as a result of the incorrect setting out of the works shall be the responsibility of the Contractor's
- D. The Contractor shall be responsible for the maintenance of all bench marks on the site.

1.3 **Maintenance of public roads**

- A. The Contractor shall protect and maintain all existing roads, footpaths and tracks within the site boundary, and keep them in a clean and serviceable condition and make good any damage or soiling prior to handing over the site to the Owner on completion.
- B. The Contractor shall be responsible for keeping all roads, footpaths and tracks adjacent to or in the vicinity of the site free from physical damage and mud and other materials deposited by vehicles connected with the works, whether used by the Contractor or not
- C. In the event that the Contractor should fail to make good damage or soiling so caused, the Owner shall have the power to employ a separate contractor to repair or cleanse the roads damaged or soiled, and the cost of such works shall be recoverable from the Contractor.

1.4 Use and protection of the site and environs

- A. The Contractor shall erect temporary barriers, adequate for security and stability, around the construction site for the duration of the contract until Substantial Completion whereupon it shall be removed. The Contractor shall confine his operations (and those of his sub-contractors and suppliers etc.) to within the barriers, except for related off-site work such as roads and utilities which shall be protected in an appropriate manner.

- B. The Contractor shall not pollute, nor cause to be polluted, any watercourse, body of water, surface water sewer, or drain discharging into any of these during the progress of the works, by allowing sand, gravel, cement, sewage or other impurities to escape from the works. The Contractor shall take all necessary preventative measures to ensure that such contamination does not occur.

Part 1 **General**

1.0 **Parties to the Contract**

- A. The "Owner" means the Government of Bermuda, represented by the Minister of Works and Engineering.
- B. The "Contractor" means the person or entity (or his heirs or executors) with whom the Owner has entered into a contract or agreement to carry out the works, including his sub-contractors, suppliers and any person acting on his behalf.

1.1 **Contract Administrator**

- A. When this Specification is used in conjunction with a contract containing the Bermuda Supplementary Conditions, the 'Contract Administrator' will be selected and stated in the Appendix.
- B. The Contract Administrator will normally be "the Engineer's Representative" .The designation "Engineer's Representative" is used throughout the specification to represent the Contract Administrator. When the Contract Administrator is different (i.e. Surveyor or Architect), this will be defined for the particular project.
- C. The "Engineer " means the Chief Engineer, the Ministry of Public Works, Post Office Building, 56 Church Street, Hamilton HM 12, PO Box HM 525 Hamilton HMCX,

and

who is a person employed by the Owner and who is lawfully entitled to practice Engineering in the Islands of Bermuda and is registered as an Engineer.

or

his authorised representatives.

1.2 **Terms**

- A. the "Works" or the "Work" means the construction and services required by the Contract Documents, and includes all labour, materials, equipment and services provided or to be provided to fulfill the Contractor's or his sub-contractors' and suppliers' obligations, or part thereof.
- B. "Notice" shall mean written notice.

- C. "Approval" shall mean written approval.
- D. "Indicated" is used to assist the reader in locating particular information on drawings by notes, graphics or schedules, or written into other portions of contract documents and terms such as "shown", "noted",
- E. "scheduled" and "specified" have the same meaning.
- F. "Directed, Requested, Approved, Accepted, etc" imply "by the Engineer's Representative", unless otherwise indicated.
- G. "Approved by Engineer's Representative" in no case releases the Contractor from the responsibility to fulfill the requirements of the Contract Documents.
- H. "Furnish" or "Supply Only" shall include delivery to the site, unloading, unpacking, and similar subsequent requirements prior to installation.
- I. "Install" or "Fix Only" includes, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- J. "Provide" means furnish and install complete and ready for intended use.
- K. "Remove" means remove from site, unless otherwise stated, and make good where disturbed. K "Bid" means the same as tender.
- L. "Sawn" (in carpentry or formwork) means the same as a rough; "wrot" (or wrought) means planed or finished.
- M. "Aggregates" are the components of a graded mixture of screenings.
- N. "The Owner" may be referred to in engineering contracts as the Employer.
- O. "An Installer" is the operator or entity actually carrying out the installation.

1.3 Abbreviations

- A. Where abbreviations or acronyms are used in Contract Documents, they mean the recognised name or entity in the building construction industry; uncertainties shall be referred to the Engineer's Representative before proceeding.
- Part 1. "N.I.C." means Not in Contract, and indicates work forming part of the overall project, but which is to be carried out by others under a separate contract either prior to, subsequent to or concurrently with the main contract. The Contractor shall not include for work so described.

Part 1 **General**

1.1 Responsibility

- A. It is the Contractor's responsibility to hold all operational site meetings related to the execution of the work (unless it is specifically stated otherwise in bidding requirement documents).

1.2 Scope

- A. The Contractor shall schedule and administer a pre-construction meeting, as well as periodic progress meetings (minimum fortnightly unless stated otherwise), and specially called meetings as necessary, to include the following:
1. Preparing agenda.
 2. Distributing written notice in advance.
 3. Making physical arrangements.
 4. Presiding at meetings.
 5. Recording the minutes including significant proceeding and decisions.
 6. Reproducing minutes and copying within three days to all participants (including three copies to the Engineer's Representative) and to other parties affected.
- B. Representatives at meetings of the Contractor, sub-contractors and suppliers shall be qualified and authorised to act on behalf of the entity they represent.
- C. The Engineer's Representative and Owner's representatives may attend meetings to ascertain that work is expedited in accordance with Contract Documents and schedules.
- D. The Engineer's Representative has the right of approval of the minutes.

1.3 Pre-construction meeting

- A. **The pre-construction** meeting shall be within fifteen days prior to the Contractor commencing site operations, in a central venue convenient to all parties, designated by the Contractor.
- B. The following shall be in attendance:
1. The Contractor's representative.
 2. The resident Project Representative and/or the Contractor's superintendent.
 3. The Owner's representative (optional).
 4. The Engineer's Representative and professional consultants.
 5. Major sub-contractors and suppliers.
 6. Others as appropriate.

C. The suggested agenda is:

1. Distribute and discuss construction schedules including critical work sequencing.
2. Discuss major equipment deliveries and priorities.
3. Discuss project co-ordination and designation of responsible personnel.
4. Confirm procedures for field decisions, proposal requests, submittals, Change Orders, and applications for payments, and general correspondence handling.
5. Discuss and identify locations of fencing, storage areas, site huts, toilets etc., temporary power, water and telephone, site access, condition of site, spoil banks etc.
6. Arrange the location, time and date of subsequent meetings.

1.4 Progress meetings

A. Progress meetings shall be held in the site office of the Contractor.

B. The following shall be in attendance:

1. The resident Project representative and/or the Contractor's superintendent
2. The Engineer's Representative and his professional consultants as required.
3. Major sub-contractors and suppliers as appropriate to the agenda.
4. Others as appropriate.

C. The suggested agenda is:

1. Review and approve previous minutes.
2. Review of work since previous meeting, including field observations etc.
3. Schedule review: including problems, corrective measures, revisions, off-site fabrication, delivery schedules and co-ordination.
4. Submittal review.
5. Quality control.
6. Pending changes, effect on schedule.
7. Other business.

1.5 Engineer's Representative's option to hold meetings

A. At his discretion the Engineer's Representative may assume the responsibility for holding site meetings, if he/she considers the Contractor unable to meet, or is deficient in meeting, the requirements of this Section.

Part 1 **General**

1.1 **Scope**

- A. A Construction or Progress Schedule shall be submitted prior to commencing work on site, indicating a time bar for each significant category of work and sequencing times for submittals, and inspections.
- B. Status of alternates (if any, see Section 01030) sufficient for distribution to all relevant parties shall be issued promptly after award of the contract.
- C. A Schedule of Values in the form of an elemental analysis of the contract sum shall be submitted (see Section 01027) and shall be based on the values in the Bid Form, if provided.
- D. Applications for Payment at intervals specified (see Section 01027).
- E. Physical samples of mock-ups of materials, equipment or workmanship to establish standards as required by technical sections showing where applicable variations in colour, pattern or texture, average condition and extreme range of variations.
- F. The required security, performance bond or indenture submitted prior to the execution of the contract.
- G. A copy of each type of insurance policy submitted prior to commencing work on site.
- H. Copies of prints of the photographs as required (see Section 01040 Part 1.3).
- I. Copies of all warranties, guarantees, operating instructions and the like submitted prior to Substantial Completion.
- J. Copies of maintenance instructions, tools and operating manuals required by technical specifications presented prior to Substantial Completion.
- K. Copies of the "Certificate of Use and Occupancy" and other Government approvals, (including the Fire Department and Department of Health) submitted prior to the issue of a Certificate of Substantial Completion.
- L. Copies of keys for doors, panels, cabinets, valves, equipment etc. submitted upon Substantial Completion.
- M. Record Drawings as required (see Sections 01040 and 01070).
- N. Shop Drawings

1. Initial submittal: one opaque blue/black line print and one correctable, reproducible transparency. The transparency will be processed and returned. After approval, print the processed transparency for job use and distribution.
 2. Final Submittal: after approval, submit 3 prints; if the drawing is required for maintenance manuals submit 5 prints; with final submittal, include additional prints as necessary for job use and distribution. The Engineer's Representative will retain 2 prints, and will return the remainder. One print shall be maintained as mark-up copy for Record Drawings.
- O. Product Data (facsimiles not acceptable)
1. Mark each copy to indicate the actual product to be provided; show selections from among options in the manufacturer's printed product data. Submit 4 copies to Engineer's Representative; submittal is for information and record purposes only. Where the product data is required for maintenance manuals, submit 2 additional copies which will be returned. Maintain one additional copy at the project site for reference purposes.
 2. The Contractor shall not proceed with the installation of manufactured products until a copy of the related product data is in the installer's possession on site.
- P. Form of payment application
1. As soon as practicable after being notified of selection for the award of the Contract, the Contractor shall furnish in writing to the Engineer's Representative an itemized cost breakdown of the various trades and sections which comprise the contract, totaled to equal the contract sum: this analysis to be used as a basis for Progress Payment applications.
 2. The cost breakdown shall be, and if not objected to by the Engineer's Representative before the first Progress Payment will be deemed to be, a true reflection of the costs including overhead and fee) to the Contractor of the respective elements in the contract sum.

Part 1 **General**

1.1 **Environmental Measures**

- A. Meet or exceed the requirements of all Bermuda environmental legislation and regulations, including all amendments up to project date provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.

Part 2 **Execution**

2.1 **Fires**

- A. Fires and burning of rubbish on site will not be permitted.

2.2 **Disposal of Wastes**

- A. Discharge of solid, liquid or gaseous materials into the surrounding environment will not be permitted. The contractor will be responsible for collection and disposal of all waste materials in accordance with the latest editions of the Ministry of Public Works Waste Management Plan.
- B. Do not bury rubbish and waste materials on site.

2.3 **Work In or Adjacent To Water**

- A. Works performed in and around water will be carried out in accordance with regulations of Bermuda authorities having jurisdiction.
- B. Install temporary enclosures, screens, traps or other devices to prevent any excess concrete or other construction materials, waste materials or debris falling into the water.
- C. Remove immediately any solid object inadvertently dropped into the water. On conclusion of construction, dispose of all debris to prevent its entry into the water.
- D. Re-fuelling of machinery must take place at a safe distance from the water under methods approved by the Engineer.

2.4 **Drainage**

- A. Provide temporary drainage and pumping as necessary to keep site free from water.

- B. Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- C. Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Bermuda authority requirements.

2.5 Environmental Protection

- A. When, in opinion of Engineer, negligence of Contractor results in damage or destruction of local flora and or fauna, or other environmental or aesthetic features beyond work areas as shown on contract drawings, the Contractor shall be responsible, at his expense, for complete restoration including replacement to satisfaction of Engineer.

2.6 Pollution Control

- A. Control emissions from equipment and plant to Bermuda authorities' emission requirements.
- B. Prevent extraneous materials from contaminating air, land or water, by vacuum, temporary enclosures, screens, traps or other devices.
- C. Spills of deleterious substances should be immediately contained and cleaned up in accordance with provincial regulatory requirements. Spills should be reported forthwith to the Engineer.

2.7 Storage and Handling of Fuels and Dangerous Fluids

- A. Locate fuel storage facility a minimum of 100 m from any water body in an area approved by the Engineer and construct impermeable dykes so that any spillage is contained.
- B. Prevent spillage of gasoline, diesel fuel and other oil products into the water and on land. Clean up spills promptly at own cost in accordance with Bermuda regulatory requirements. Report any fuel spills immediately to Engineer.
- C. Proper use of primers, grouts, bonding adhesives and other hazardous substances will be undertaken to prevent their entry into the water. Substances are to be stored and mixed on protected surfaces away from site to prevent their entry into waterways and contamination of soils.

- D. Collect and dispose of used oil filter cartridges and other products of equipment maintenance at industrial waste facility to satisfaction of Engineer.

Part 1 General

1.1 Definition

- A. A substitute is a contractor's alternative to a named product, proposed during the contract

1.2 Where substitution is not permitted

- A. No substitute product will be allowed for the following.
 - 1. For products specified by naming only one product and manufacturer.
- B. Under the circumstances in 1.2 A above the Contractor has the option at the time of bidding to request approval of an alternate (see Section 01030), and unless he does so, he shall be deemed to have allowed for a named product.

1.3 Where substitution is permitted

- A. For products proposed as "equal" or "equivalent", (or similar wording), to named products that have such wording appended; the Contractor shall make a substitution submittal (see Part 1.5 of this Section).
- B. For products which the Contractor is unable to procure, or unable to procure in time, for reasons beyond his control; the Contractor shall make a substitution submittal (see Part 1.5 of this Section).

1.4 Where substitution is not required

- A. For products specified by referenced standard; the Contractor may select products meeting that standard, by any manufacturer but shall prefer a locally available product.
- B. For products specified by naming several products or manufacturers; the Contractor may use any of those named which comply with the specification.

1.5 Substitution submittals

- A. A written request must be made allowing reasonable time for review and reasonable time for ordering should there be approval.
- B. Complete data must be provided with any request, to substantiate compliance with requirements, together with all relevant supporting literature, performance and test data, and samples if applicable.

- C. The request must state what, if any, effect the substitution has on dimensions, other trades or contracts, scheduling and costs.

1.6 Acceptance of a substitute

- A. Should the Engineer's Representative approve a substitute as being equal, for use in the contract, the Contractor shall co-ordinate related work, including that of sub-contractors if applicable, and modify or adjust adjacent work as required to ensure that work affected is complete and fully integrated into the project.
- B. Should the Engineer's Representative approve a substitute that is NOT equal, for use in the contract, the Contractor shall co-ordinate related work, including that of sub-contractors if applicable, and modify or adjust adjacent work as required to ensure that work affected is complete and fully integrated into the project, and any cost saving of the unequal product shall accrue to the Owner.
- C. The Engineer's Representative's response to the contractor's submittal must be made with reasonable promptness and be made in writing.

Part 1 **General**

1.1 **Contractor's procedures at Substantial Completion**

- A. The Contractor shall comply with the Contract Conditions and complete the following before requesting the Engineer's Representative to inspect the work, or a designated portion of the work, for certification of Substantial Completion:
- B. The Contractor shall submit executed warranties, workmanship bonds, maintenance agreements, inspection certificates and similar required documentation for specific units of work, enabling the Owner's unrestricted occupancy and use.
- C. The Contractor shall submit record documentation, maintenance manuals, tools, spare parts, keys and similar operational items.
- D. The Contractor shall complete final cleaning, and remove temporary facilities and tools.
- E. The Contractor shall submit copies of "Certificate of Use and Occupancy" and other Government approvals, including Fire and Health.

1.2 **Inspection procedures**

- A. Upon the receipt of the Contractor's request, the Engineer's Representative will either proceed with inspection or advise the Contractor of pre-requisites not fulfilled. Following initial inspection, the Engineer's Representative will either prepare the certificate of Substantial Completion, or advise the Contractor of work which must be performed prior to issuance of the certificate. The Engineer's Representative will repeat the inspection when requested to ensure that the work has been substantially completed. Results of the completed inspection will form the initial "punch-list" for final acceptance.
- B. The Engineer's Representative will re-inspect the work upon receipt of the Contractor's notice that, except for the items whose completion has been delayed due to circumstances that are acceptable to the Engineer's Representative, the work has been completed, including punch-list items from earlier inspections and defective work arising during the Warranty Period. Upon completion of re-inspection, and at the end of the Warranty Period, the Engineer's Representative will either recommend final acceptance and final payment, or will advise the Contractor of work not completed or obligations not fulfilled as required for final acceptance. If necessary, this procedure will be repeated.

1.3 Record documentation

- A. The Contractor shall maintain two complete set of either blue-or black-line prints of the contract drawings and shop drawings for record mark-up purposes throughout the contract time, and mark-up these drawings during the course of the work to show both changes and the actual installation~ in sufficient detail to form a complete record for the Owner's purposes. He shall give particular attention to work which will be concealed and difficult to measure and record later, and work which may require servicing or replacement during the life of the project. He shall require the entities marking prints to sign and date each mark-up, and shall bind prints into manageable sets, with durable paper covers, appropriately labeled, and shall transfer the information onto an additional set of reproducible transparent drawings.
- B. The Contractor shall provide two sets of 3-ring vinyl-covered binders containing required maintenance manuals, properly identified and indexed, including operating and maintenance instructions extended to cover emergencies, spare parts, warranties, inspection procedures, diagrams, safety, security, and similar appropriate data for each system or equipment item.

1.4 Final cleaning

- A. At the time of project close out, the Contractor shall clean or re-clean the works to the condition expected from a normal, commercial building cleaning and maintenance programme, and complete the following cleaning operations before requesting the Engineer's Representative's inspection for certification of Substantial Completion.
1. Remove non-permanent protection and labels.
 2. Polish glass.
 3. Clean exposed finishes.
 4. Touch-up minor finish damage.
 5. Clean or replace mechanical systems filters.
 6. Remove debris.
 7. Broom-dean unoccupied spaces.
 8. Sanitize plumbing and food service facilities, and chlorinate potable water supply system.
 9. Clean light fixtures and replace burned-out lamps.
 10. Sweep and wash paved areas.
 11. Test potable water for contamination not more than 48 hours in advance of Substantial Completion.
 12. Wax resilient flooring, vacuum carpeting and wash ceramic tile work.

1.5 Repair of defective work

- A. Where damage to materials is minor, repair rather than replacement will be acceptable provided the end product is aesthetically and functionally equivalent to adjacent non damaged surfaces as determined by the Engineer's Representative. If unsatisfactory the Engineer's Representative may require that repaired materials be replaced with new.

Part 1 GENERAL

1.1 Materials

- A. Use only cleaning materials recommended by paint manufacturer and as recommended by cleaning material manufacturer.

1.2 Initial Cleaning

- A. Prior to any blasting, perform initial cleaning.
- B. Clean all structural steel on the bridge in accordance with Specification and Standard for the Painting of Metal Surfaces Section 09917.
- C. Ensure that environmental regulations are respected.

1.3 Final Cleaning

- A. In preparation for partial or final acceptance of the project, perform final cleaning.
- B. Remove grease, dust, dirt, stains and other foreign materials from all surfaces.
- C. Remove debris and surplus materials and broom clean abutment and pier surfaces.
- D. Ensure that environmental regulations are respected.

Part 2 PRODUCTS

- 2.1 None

Part 3 EXECUTION

- 3.1 None

Part 1 **General**

1.1 **Location**

- A. The location of selective demolition to the building structure will normally be indicated on the drawings as required to accommodate new construction.
- B. Other work such as cutting concrete floors, roof deck and masonry walls for piping and ducts, and for above grade piping, ducts, and conduit will be required where it can be reasonably seen from the respective mechanical, electrical and other drawings that it is required.

1.2 **Co-ordination**

- A. This Section shall be read in conjunction with related Sections elsewhere in the Specification.

1.3 **Schedule**

- A. The Contractor shall, if requested, submit a schedule indicating the proposed methods and sequence of operations for selective demolition work to the Engineer's Representative for review prior to commencement' of work, including co-ordination for shut-off, capping, and continuation of utility services as required, together with details for dust and noise control protection.
- B. Where demolition is to be carried out within occupied buildings, the Contractor shall provide a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the Owner's site operations, and shall co-operate with the Owner's continuing occupation of portions of the existing building, and with the Owner's partial occupancy of completed new areas.
- C. The Contractor shall provide a minimum of 48 hours' notice to the Owner of demolition activities which will make an impact on the Owner's normal operations.

1.4 **Condition of structure**

- A. The Owner assumes no responsibility for the condition of items or structures to be demolished.

1.5 **Protection**

- A. The Contractor shall provide temporary barricades and other forms of protection as required to protect the Owner's personnel and the general public from injury due to selective demolition work.
- B. Where applicable, the Contractor shall provide protective measures to provide free and safe passage of the Owner's personnel and the general public to and from occupied areas of the building.
- C. Where necessary, the Contractor shall provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of the structure or element to be demolished, and adjacent facilities or work to remain.
- D. The Contractor shall protect from damage any existing finish work that is to remain and becomes exposed during demolition operations, including protecting floors with suitable coverings when necessary.
- E. The Contractor shall construct temporary dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed, and equip partitions with dustproof doors and security locks if required.
- F. The Contractor shall provide temporary weather protection between demolition and removal of existing construction on the exterior surfaces, and the installation of new construction, to ensure that no water leakage or damage occurs to the structure and interior areas of the existing building.
- G. The Contractor shall make provision for the continuity of utility services to occupied areas of the site and shall permanently or temporarily cap off or relocate utility service lines as required.

1.6 Explosives

- A. The use of explosives will not be permitted without the written consent of the Engineer's Representative and without the obtaining of all necessary Government or other permits.

1.7 Temporary signage

- A. During demolition or alteration work in buildings used by the general public, the Contractor shall provide signs directing building users to necessary services of the facility, in addition to signs apologizing for disruption.
- B. Temporary signs shall be produced by a recognized sign maker and shall be in black block letters on a white background painted on 0.75mm (3/4") plywood.
- C. Wording on temporary signs shall be approved by the Engineer's Representative.

Part 2. **Products**

Not applicable.

Part 3. **Execution**

3.1 Order of work

- A. The Contractor shall perform selective demolition work in a systematic manner (see also Part 1.3 of this Section).

3.2 Concrete and masonry

- A. Concrete and masonry shall be demolished in small sections, cut at junctions with construction to remain, using a power-driven masonry saw or hand tools where possible and not power-driven impact tools.
- B. Debris should be promptly removed to avoid imposing excessive loads on supporting walls, floors and framing, and to avoid blocking egress from the site.

3.3 Foundations

- A. Foundation walls shall be demolished to a depth of not less than 300mm (12") below existing ground surface.
- B. Below-grade concrete slabs shall be broken up and removed where necessary.
- C. For interior slabs on grade, removal methods must be used that will not crack or structurally disturb adjacent slabs or partitions, using power saws where possible.
- D. Below-grade areas and voids resulting from demolition work shall be completely filled and compacted with approved earth, gravel or sand, free of trash, debris and stones over 150mm (6") diameter, roots and other organic matter.

3.4 Services

- A. If unexpected mechanical, electrical or structural elements are encountered, the Contractor shall submit details of such to the Engineer's Representative.

3.5 Asbestos and other hazardous materials

- A. If hazardous materials are encountered during demolition or other operations, the Contractor shall cease work in the affected area and submit a report to the Engineer's Representative; any work in such an area shall comply with applicable regulations concerning removal, handling, protection against exposure and environmental pollution, and disposal.

- B. Burning of any removed materials is not permitted on the site.

Part General

1.1 Protection

- A. The contractor shall provide the protection necessary to prevent damage to existing properties, and shall protect existing trees and vegetation which are to remain.

1.2 Site clearing

- A. The Contractor shall not perform any clearing operations until receipt of specific instructions in writing to proceed, from the Engineer's Representative. Trees or shrubs outside the excavations or elsewhere which are to remain shall be protected from injury during construction operations.
- B. The areas affected by the works shall be cleared of all existing structures, fences, walls, debris, or other garbage as directed by the Engineer's Representative.
- C. Underground structures and chambers shall be demolished as directed by the Engineer's Representative, and shall be properly cleaned out and filled solidly with approved material which shall be compacted to the satisfaction of the Engineer's Representative.
- D. The Contractor shall remove trees, shrubs, grass and other vegetation, or obstructions interfering with the installation of new construction, to be deposited on site or as specifically indicated. Removal includes digging out stumps and roots completely and backfilling with approved material and compacting to the same density as that of the surrounding soil.
- E. Walls or other objectionable matter other than soil shall be removed for a depth of at least 600mm (2') below formation level and within a depth of at least 300mm (1') below side slopes. Any parts of structure below these levels shall be cleared out, walls and floors punctured in order to prevent retention of water and the whole filled solidly with approved material and compacted to the satisfaction of the Engineer's Representative.
- F. Depressions caused by clearing and grubbing operations shall be filled with satisfactory soil material, unless further excavation or earthwork is indicated.

1.3 Stripping topsoil

- A. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 100mm (4"). Satisfactory topsoil is reasonably free of subsoil, lumps, stones, and other objects over 50mm (2") diameter, and without weeds, roots, and other objectionable material which on visual examination can be seen to be broken down by agricultural cultivation or is seen to be capable of supporting vegetable growth.
- B. Topsoil shall be stripped to whatever depths encountered in a manner to prevent intermingling with underlying sub-soil or other objectionable material.
- C. In all cases, topsoil shall be deposited on site for re-use on site where directed; surplus topsoil shall remain the property of the Owner and be stockpiled so as to drain surface water freely and shall be covered to prevent wind-blown dust.
- D. The Contractor shall remove heavy growths of grass from areas before stripping.
- E. Where trees are indicated to be left standing, topsoil stripping must be stopped a sufficient distance to prevent damage to the main root systems.

1.4 Disposal

- A. All materials arising from site clearance (excluding topsoil - see Part 1.3.C of this Section) which are surplus to or unsuitable for use in the works shall be disposed of by the Contractor to approved tipping areas or as directed by the Engineer's Representative.
- B. The Owner reserves the right of ownership of any Bermuda stone in existing structures or that can be quarried for building blocks. Any additional works in this connection, extra to normal requirements, will be the subject of a Change Order.

Part 1 **General**

1.1 **Scope**

- A. Work includes, but is not limited, to the following:
 - a. Preparation of the sub-grade for buildings, walks, and pavements.
 - b. All trenches within site lines.
 - c. Excavation and backfilling required in conjunction with underground mechanical and electrical utilities, and buried mechanical and electrical appurtenances.
 - d. Rough grading and excavation to landscaped work, unless otherwise stated.
 - e. Shoring and bracing excavations as required.
 - f. Finish grading
- B. Excavation shall be in or through any materials encountered, including pavements and other obstructions visible on the ground, underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered except those classified as hard rock (see Part 1.2 of this Section) or unauthorised excavation. The classifications for earthwork are as Part 1.3 of this Section.

1.2 **Excavation in rock**

- A. Apart from that which exists on the surface of the ground, or which can be reasonably assumed to exist from visual or reported data, the Contractor shall assume, for the purposes of bidding, that hard rock (as classified in Part 6.3 D of this Section) does not exist, and that earthwork shall be in suitable or unsuitable material (as classified in part 6.3) B and C of this section) or soft rock.
- B. The payment for the removal of rock will be measured and priced as encountered during earthwork and authorised by Change Order.

1.3 **Classifications**

- A. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 100 mm (4"). Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 50 mm (2") in diameter, and without weeds, roots, and other objectionable material which on visual examination can be seen to be broken down by agricultural cultivation or is seen to be capable of supporting vegetable growth.

- B. Suitable material is defined as complying with AS1M 02487 soil classification Groups GW, GP, GM, SM, SW and SP which are acceptable in accordance with the Contract.
- C. Unsuitable material shall mean other than suitable material and unless accepted or otherwise instructed by the Engineer's Representative shall include:
 - a. Peat, logs, stumps, perishable material and soil containing more than 10% organic matter;
 - b. Salty and gypsiferous soil, containing more than 10% of soluble salts;
 - c. Clay of liquid limit exceeding 70 and/or plasticity index exceeding 45;
 - d. Materials having moisture content greater than the maximum permitted for such materials in the Contract unless otherwise permitted by the Engineer's Representative.
- D. Hard rock excavation in trenches and open excavations is defined as that which cannot be excavated by means of heavy duty mechanical excavating equipment having a 0.75 to 1.2 cu. yd. bucket, or which cannot be ripped and excavated with heavy construction equipment. Typical of materials classified as rock are boulders 1.2 cu. yd. or more in volume, hard rock, rock in ledges, and rock, hard cementitious aggregate deposits.
- E. Unauthorised excavation consists of the removal of materials beyond the indicated sub-grade elevations or dimensions without the approval of the Engineer's Representative. The Contractor responsible for re-filling any unauthorised excavation, as well as any remedial work directed by the Engineer's Representative.
- F. Filling of unauthorised excavation under footings, foundation bases, or retaining walls, shall be with grade 15 concrete to bring elevations to proper position. Elsewhere, the Contractor shall backfill and compact as specified for authorised excavations of same classification, unless otherwise directed by the Engineer's Representative.

1.4 Sub-surface data

- A. Any report provided on sub-surface conditions is not intended as a representation or warranty of accuracy or continuity between soil bearings. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn there from by the Contractor. Data are made available for the convenience of the Contractor.

1.5 Existing utilities

- A. The Contractor shall locate the existing underground utilities in areas of work. If utilities are to remain, the Contractor shall provide adequate means of support and protection during earthwork and subsequent operations.
- B. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, the Contractor shall consult the utility owner immediately for directions, and co-operate with the Owner and utility companies in keeping respective services and facilities in operation. The Contractor shall repair damaged utilities to the satisfaction of the utility owner.
- C. Disused soil and surface water drains within 900 mm (3') of formation level, and such larger sewers and culverts at greater depths as the Engineer's Representative specifies, shall be removed and the trenches backfilled with suitable material.
- D. Disused drains and pipes which are not to be taken up shall be filled with grade 7 concrete. The Contractor shall allow for breaking into the drain or pipe at suitable intervals between manholes where necessary to ensure that the pipe is completely filled and for any grouting deemed necessary by the Engineer's Representative as a result of this inspection.
- E. The Contractor shall provide a minimum of 48-hours' notice to the Engineer's Representative, and must receive written notice to proceed before interrupting any utility.
- F. Existing underground utilities indicated to be removed shall be demolished and completely removed from site; the Contractor shall co-ordinate with the utility companies for shut-off of services if lines are active.

1.6 Explosives

- A. The use of explosives will not be permitted without the written consent of the Engineer's Representative, and will be subject to the obtaining of all required permits.

1.7 Protection of persons and property

- A. The Contractor must barricade open excavations and post with warning lights.
- B. The Contractor shall protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

Part 2 Products

2.1 Soil material

- A. Suitable soil materials are defined as those complying with ASTM D2487 soil classification Groups GW, GP, GM, SM, SW and SP.
- B. Sub-base material shall be suitable soil naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.
- C. Backfill and fill materials shall be suitable soil materials free of clay, rock or gravel larger than 50 mm (2") in any dimension, debris, and waste, organic and other deleterious matter. D. Excavated or borrow sub-soil shall be free from roots, rock larger than 75 mm (3") in size and building debris and shall be compactable.
- D. Fill under landscaped areas shall be free from alkali, salt, petroleum products, and may be from the site only if it conforms to specified requirements.

2.2 Granular material for trenches

- A. Gravel shall be angular pit run crushed natural stone, free from shale, clay, friable materials, and debris, graded within the following limits: (Metric equivalent to BS 410)

SIEVE SIZE	% PASSING
1-1/2"	100
1"	95 to 100
3/4"	95 to 100
5/8"	75 to 100
3/8"	55 to 85
No.4	35 to 60
No.16	15 to 35
No.40	10 to 25
No.200	5 to 10

- B. Pea rock for trenches shall be clean natural stone; free from clay, shale and organic matter; 6mm to 13mm (1/4" to 1/2").
- C. Sand for trenches shall be natural sand or sand derived by crushing gravel or stone; free from silt, clay, loam, friable or soluble materials, and organic matter, graded within the following limits:

SIEVE SIZE	% PASSING
No.4	95 to 100

No.8	60 to 100
No.10	30 to 85
No.14	10 to 100
No.48	15 to 90
No.100	0 to 90
No.200	0 to 5

2.3 Granular material for structure foundations

- A. Gravel for structure foundations shall be angular pit run crushed natural stone, free from shale, clay, friable materials, and debris, graded within the following limits:

(Metric equivalent is BS 410)

SIEVE SIZE	% PASSING
2"	100
1"	95
3/4"	95 to 100
5/8"	75 to 100
3/8"	55 to 85
No.4	35 to 60
No.16	15 to 35
No.40	10 to 25
No.200	5 to 10

- B. Pea gravel shall be clean natural stone; free from clay, shale and organic matter; 6mm to 13mm (1/4" to 1/2").
- C. Sand for structure foundations shall be natural sand or sand derived by crushing gravel or stone; free from silt, clay, loam, friable or soluble materials, and organic matter, graded within the following limits:

SIEVE SIZE	% PASSING
No.4	100
No.14	10 to 100
No.48	15 to 90
No.100	4 to 90
No.200	0 to 5

Part 3 Execution

3.1 Method of work

- A. All excavation shall be carried out in approved and orderly manner.

3.2 Levelling

- A. The Contractor shall establish and identify the required lines, levels, contours and datum.
- B. The Contractor shall maintain bench marks, monuments and other reference points, and shall inform the Engineer's Representative if disturbed or destroyed and shall be responsible for reestablishing.

3.3 Grading

- A. Grading shall be within contract limits, including adjacent transition areas to new elevations, levels, profiles and contours indicated.
- B. Surfaces shall be graded to ensure areas drain away from structures and to prevent ponding of surface drainage. Sub-grade surfaces shall be free from irregular surface changes.
- C. Excavations shall be graded to prevent storm water from draining into excavation areas.
- D. The top 150 mm (6") of finished grade not covered with hard surfaces or designated otherwise shall be top-soiled.

3.4 Excavating foundations

- A. The foundation shall be excavated to the depth and sizes shown on the drawings and shall be thoroughly cleaned before being submitted to the Engineer's Representative for approval. The Contractor shall take all necessary precautions to protect approved foundations from sediment run-off, erosion or contamination by other unsuitable material until the works can proceed further.
- B. Any localized pockets of poorly cemented rock or soil shall be removed and the foundations shall be probed using a jackhammer drill as instructed by the Engineer's Representative. Drill penetration rates shall be recorded by the Contractor during probing in order to identify voids and weak stratum.
- C. The Contractor shall notify the Engineer's Representative of any voids detected during construction, whether appearing on the surface or hidden beneath a foundation.

3.5 Excavating utility trenches

- A. The Contractor shall dig trenches to the uniform width required for the particular utility to be installed and sufficiently wide enough to provide working space. The Contractor shall provide a 150 mm to 225 mm (6" to 9") clearance on each side of the pipe or conduit.
- B. Trenches for piping are to be carried to a depth which establishes indicated flow lines and invert elevations.
- C. Where rock is encountered, excavation shall be carried 150 mm (6") below the required elevation and backfilled with 150 mm (6") layer of crushed stone or gravel prior to installation of the pipe (see also Part 1.2 of this Section).
- D. For pipes or conduit 125 mm (5") or less (nominal size) and for flat-bottomed multiple duct conduit units, the Contractor must not excavate beyond indicated depths, and must hand excavate the bottom cut to accurate elevations and support the pipe or conduit on undisturbed soil.
- E. For pipes or conduit 150 mm (6") or larger in nominal size, tanks and other mechanical/electrical work indicated to receive granular base, excavation must be to the depth indicated, or if not otherwise indicated, to 150 mm (6") below the bottom of work to be supported.
- F. Bottoms of trenches must be graded as indicated, notching under pipe bells to provide solid bearing for the entire body of pipe, making allowances for granular bedding.
- G. Trench excavations lower than adjacent walls/ columns shall be backfilled with concrete as follows:
 - a. Trenches within 1 m (3'3") of walls/columns shall be backfilled up to the level of the underside of the adjacent foundation.
 - b. All other trenches adjacent to walls/columns shall be backfilled until the difference in level to the underside of the adjacent foundation is less than the distance between that foundation and the nearside of the trench.
 - c. Concrete backfilling shall have expansion joints at approx. 9 m (30'centres).
 - d. The requirement for backfilling trenches with concrete may be waived if, in the opinion of the Engineer's Representative, the nature of the ground makes it unnecessary.
- H. Backfilling must not be carried out until tests and inspections have been made and backfilling authorised by the Engineer's Representative. Care must be

used in backfilling to avoid damage or displacement of pipe systems. There shall be a laid 150 mm (6") of sand above pipes or conduits prior to general backfilling.

- I. For piping or conduit less than 750 mm (2'6") below the surface of roadways, the Contractor shall provide a 150 mm (6") thick concrete base slab support; and after installation and testing of piping or conduit, shall provide a minimum 150 mm (6") thick encasement (sides and top) of concrete prior to backfilling or placement of the roadway sub-base.

3.6 Disposal

- A. All unsuitable material arising from excavation which is surplus to or unsuitable for use in the works shall be disposed of by the Contractor to an approved spoil area or as directed by the Engineer's Representative.
- B. The Owner reserves the right of ownership of any Bermuda stone that can be quarried for building blocks met with during excavation.

3.7 Laying and compaction of filling

- A. All filling shall be Completed as soon as practicable after deposition.
Compaction shall be in accordance with the following table:

COMPACTION REQUIREMENTS		D = MAX DEPTH OF COMPACTED LAYER (mm) N = MIN NUMBER OF PASSES						
Type of Compaction Plant	Category	Well Graded Granular Fill Material		Uniformly Graded Fill Material		Selected Granular Material for Foundations (Ref c12.3 A)		
	Mass per metre width of roll	D	N	D	N	N for D=110mm	N for D=150mm	N for D=250mm
Smooth Wheeled Roller	over 2100 kg up to 2700 kg	125	10	125	10*			
	over 2700kg up to 5400 kg	125	8	125	8*	16	NS	NS
	over 5400 kg	150	8	NS		8	16	NS
Vibrating Roller (used in vibrating mode)	Mass per metre width of Vibrating roll							
	Over 270kg up to 450kg	75	16	150	16			
	over 450kg up to 700kg	75	12	150	12			
	over 700kg up to 1300kg	125	12	150	6	16	NS	NS
	over 1300kg up to 1800kg	150	8	200	10*	6	16	NS
	over 1800kg up to 2300kg	150	4	225	12*	4	6	10
	over 2300kg up to 2900kg	175	4	250	10*	3	5	9
	over 2900kg up to 3600kg	200	4	275	8*	3	5	8
	over 3600kg up to 4300kg	225	4	300	8*	2	4	7
	over 4300kg up to 5000kg	250	4	300	6*	2	4	6
over 5000 kg	275	4	300	4*	2	3	5	
Vibrating Plate Compactor	Mass per unit area of base plate							
	over 880kg up to 1100kg	NS		75	6			
	over 1100kg up to 1200kg	75	10	100	6			
	over 1200kg up to 1400kg	75	6	150	6			
	over 1400kg up to 1800kg	125	6	150	4	8	NS	NS
	over 1800kg up to 2100kg	150	5	200	4	5	8	NS
over 2100kg	200	5	250	4	3	6	10	
Vibro Tamper	Mass:							
	over 50kg up to 65kg	100	3	150	3	4	8	NS
	over 65kg up to 75kg	125	3	200	3	3	6	10
over 75kg	150	3	225	3	2	4	8	
Power Rammer	Mass:							
	100kg up to 500kg	150	6		NS	5	8	NS
over 500kg	225	12		NS	5	8	12	
Dropping Weight Compactor	Mass over 500kg	600	8	450	8	NS	NS	NS
	Height of drop 1m up to 2m over 2m	600	4		NS	NS	NS	NS

Note: For items marked *, the rollers shall be towed by track-laying trucks; self-propelled rollers are unsuitable.

- B. Variations from the methods of, or equipment for, compaction given in the table, will be permitted only if the Contractor demonstrates at site trials that an equivalent state of compaction is achieved. (See Part 3.8 of this Section for the trial procedure).

- C. Earth-moving plant is not acceptable as compaction equipment.
- D. No rocks exceeding 150 mm (6") in the longest dimension shall be placed within 300 mm (12") below formation level.
- E. Where the maximum particle size exceeds 75 mm (3") the top layer of the filling shall be brought to the required level and profile by a layer of material of consolidated thickness of 50 mm (2") of which the maximum particle size is 25 mm (1").
- F. On completion of compaction and preliminary shaping of the upper course of filling, the necessary excavation for all structures which occur in the area and which extend below its surface shall be carefully made so that the surrounding compacted filling remains compacted after completion of the structure.
- G. Surplus material arising from the excavation shall be removed from the formation.
- H. Any deviation in the finished surface from the correct levels and profiles shall be corrected by loosening and removing or adding material and re-shaping and compacting, but on no account is any further material to be added once the forms for concrete courses have been placed.
- I. The Contractor shall apply in writing to the Engineer's Representative for permission, not less than 24 hours before proposing to carry out compaction processes, to enable proper provision for supervision of compaction in the permanent work.

3.8 Compaction trials and methods

- A. The Engineer's Representative may require the Contractor to carry out compaction trials on each layer of filling as described in Part 3.7 of this Section, to be satisfied that the equipment proposed will achieve an adequate degree of compaction without overstressing the layer or underlying layers.
- B. The trials shall include field density tests to BS 1377 on each layer except where more than 40% of the fill is retained on a 20mm BS sieve. The trial area shall be built up in layered construction as described in Part 3.7 of this Section. It shall be of sufficient overall size to allow a separate portion to be set aside for trials on each layer of each type of fill material. Each portion shall be not less than 15m (50') long nor narrower than four times the width of the largest item of equipment in use in the trials.

- C. The trials shall be carried out on each layer at optimum moisture content and at moisture contents on either side of optimum. Each item of equipment shall be operated at the various loads and speeds recommended by the manufacturers for the type of materials in the layer, and the optimum number of passes at the most satisfactory load speed shall be established.
- D. If necessary, thinner layers than the maximum permitted in Part 3.7 of this Section shall be laid to establish the maximum layer thickness at which the stipulated requirement can be consistently achieved.
- E. Density tests shall be carried out on each compacted layer except where more than 40% of the fill is retained on an 19 mm (3/4") sieve. The results shall be recorded separately for each fill material and thickness of layer.
- F. The recorded densities shall be related to the various types of plant at each load and speed, to the number of passes and to the moisture content of each layer.
- G. As a result of the trials the most efficient combination of moisture content, equipment and conditions of operating, to obtain the stipulated requirement is to be agreed, and the compaction process for each filling material and layer will be approved by the Engineer's Representative Until approval has been given, the general laying of fill material required by the Contractor will not be permitted to start.
- H. The Engineer's Representative may carry out comparative site density tests in accordance with BS1377 on material which he considers may have been inadequately compacted. If the test results, when compared with the results of tests made on adjacent approved work in similar materials show the state of compaction to be inadequate due to the Contractor's failure to comply with the requirements of the contract. The Contractor shall carry out such remedial works as the Engineer's Representative decides.
- I. The table in BS410 at Appendix 2 A1 is ONLY A GUIDE to assist in assessing the compaction requirements. The Contractor will be required to accept the responsibility to compact the filling to the specified requirement

3.9 Completion of formation

- A. Prior to the completion of the formation all trenches and other cuttings which lie within the construction area shall be filled with the appropriate filling, compacted in layers not exceeding 6" (150mm) to the density appropriate to the area through which they run. The completed formation is to be inspected by the Engineer's Representative and any soil in the exposed natural

foundation at formation level which in the opinion of the Engineer's Representative is soft and unsuitable shall be removed and replaced with compacted filling or grade 10 mix mass concrete as directed by the Engineer's Representative.

- B. After all weak places have been made good; the formation shall be finally formed to the required lines and profiles and to levels which will result in the finished surface being to the required levels, all to the approval of the Engineer's Representative.

3.10 Levelling and raking of topsoil

- A. Topsoil shall be fine graded to a smooth even surface. Ridges shall be removed and depressions filled with topsoil.
- B. In areas to be sodded / turfed grading shall be 0.25 mm (1") below adjacent pavement or kerb level.

