DIVISION 2

SITE WORK

BUILDING WORK

DIVISION 2

SITE WORK

INDEX

SECTION 02100
EXCAVATIONS AND EARTHWORKS

PART 1 GENERAL

This Section shall be read in conjunction with Sections 02110, 02210 and 02219. In case of discrepancy between this specification and the above sections, this specification shall take precedence.

1.01 Scope Of Work

The Contractor shall provide all requisite equipment, labor and materials, necessary for executing the excavation works, in a manner that will meet the Engineer's acceptance and approval.

The work to be carried out by the Contractor, shall include, not by way of limitation, but in amplification to what is shown on the drawings and /or, the existing site conditions and/or the structural engineering requirements, or all, for the full and proper execution of the proposed Project, the following:

A. Removal of all vegetation including the grubbing out of roots, within the site area.

B. Excavations to reduce level within the Site area.

C. Grading to required levels and sub - grade preparations.

D. Stock piling of the suitable excavated soil for back-filling under the Engineer's supervision.

E. Loading and carting away of surplus and /or unsuitable excavated material, and the disposal of same to an approved dumping area.

1.02 Inspection Of The Site Documents

A. The Report on Geotechnical Investigations for the Project Site (Which includes the results of the field and laboratory investigation, geotechnical analysis and interpretation of the findings, and conclusions and recommendations to aid the design and construction of foundations) may be inspected at the Engineer's office. This inspection shall be for the Contractor's information and guidance only, but without guarantee of accuracy, and therefore does not form part of the Contract Documents.

1.02 Inspection Of The Site Documents (Cont'd)

B. No claim for extra compensation or extension of time will be allowed on account of subsurface conditions inconsistent with the data given in the Report on "Geotechnical Investigations" or for want of knowledge of the Site or the nature of the sub-soil.

C. The contractor shall visit the Site and make all investigation which he deems necessary to ascertain the nature of the existing ground and the sub-soil to be excavated, and shall if he wishes to do so, drill as much boreholes as he deems necessary to satisfy himself as to the form and nature of the sub soil, and the existing site conditions in general.

D. The plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the contractor shall have examined them for himself during the bidding period, as no additional compensation will be made for errors or inaccuracies that may be found therein.

1.03 Profiles

The Contractor shall provide and erect profiles, templates, sight rails and the like and properly set out the proposed works from the base lines, levels, coordinates or datum given by the Engineer's, and/or indicated on the drawings, or both.

1.04 Bench Marks

Establish permanent bench marks determined by an approved land surveyor or professional civil Engineer. Maintain all established bounds and bench marks and replace as directed those which are destroyed or disturbed due to the excavation operations, at no cost to the Employer.

1.05 Site Survey

A. As soon as the Site is handed over to the Contractor, and before commencing any excavation works, the contractor shall at his own expense, carry out a check on the Site survey submitted by the Employer for the whole project Site; prepare and submit for the Engineer approval a grid plan; the grid sides shall be 5 meters with levels taken at the corners, and all levels shall be referred to the approved bench mark; verify all levels and dimensions and notify the Engineer in writing of any discrepancies. Do not proceed with excavation works until discrepancies have been corrected and are acceptable to the Engineer.

1.05 Site Survey (Cont'd)

B. The Contractor shall also be responsible for the accurate setting out of excavations and for keeping all reference axes and bench marks reasonably clear, and far from the working area.

PART 2 PREPARATION

2.01 Site Clearance

A. The Contractor shall carry out Site clearance which shall include clearing out the whole site area of all kinds of vegetation, debris, rubbish, etc., including the grubbing out of roots, including loading and carting away to an approved dumping area prior to any site preparation and /or setting - out is begun.

2.02 Preparation And Setting - Out

A. Before any particular excavation is begun, the Contractor shall submit for the Engineer approval his proposals for marking the area to be excavated and for controlling the depth and profile of the excavation to the dimensions and levels shown on the drawings. The Contractor shall give the Engineer not less than 24 hours notice in writing of his intention to set out the works to enable the Engineer to make arrangements for checking. The check by the Engineer shall in no way absolve the Contractor from his responsibility for setting-out the Works correctly.

B. Establish extent of excavation by area and elevation; designate and identify datum elevation.

C. Set required lines and levels.

D. Maintain bench marks, and other reference points.

PART 3 EXECUTION

3.01 Excavations Generally

A. Excavation works shall be carried out in any type of soil met with during the course of excavation, whether earth, clay, gravel, sand, conglomerates, boulders, solid rock or any other material to any depth, as shown on the drawings or as directed and instructed by the Engineer.

3.01 Excavations Generally (Cont'd)

B. Where excavation works are carried out by power excavating equipment such as bulldozers, power shovels and bachoes, power drills, or any other equipment which the contractor may propose to use, sufficient depth shall be left unexcavated to enable the exact depth required to be obtained by hand excavation.

C. Excavations shall be to the lines, levels and dimensions indicated on the drawings, or instructed by the Engineer.

D. All foundations shall be placed on undisturbed soil.

E. Should any excavation be made below the levels shown on the drawings, or those required by the Engineer's, the excess depth of excavation shall be filled with concrete of 15 Mpa characteristic compressive strength, at the contractor's own expense.

F. The use of explosives on site is strictly forbidden, and in no case shall the contractor or his employees revert to the use of explosives of whatever type or size.

G. The Contractor shall keep the area around excavations clear for a distance of one meter in all directions until concrete is placed and has set.

H. The bottom of footings and foundation excavations shall be cut true to level and kept clean of loose material and debris at all times. Bottoms of excavations will be inspected and approved by the Engineer's before foundations or pipes are laid.

I. The Contractor will be held responsible for upholding the sides of excavations, and no claim for additional excavations, concrete, or other material will be considered in this respect, not withstanding the methods the Contractor elects to adopt for upholding the sides of excavation.

3.02 Excavation's Safety

A. All excavation works shall be carried out in a safe manner to the lines and levels shown on the drawings or to such lines and levels as the Engineer may direct as the work proceeds, depending on the nature of the ground exposed. The Contractor shall provide timbering, or use other approved methods to support the sides of excavations in such a way as to minimize ground movement.

B. The Contractor shall be responsible for all safety measures needed to support the sides of the excavations for the safety of workers in particular, and the works in general.

C. The from time-to-time directions by the Engineer shall not relieve the Contractor of his Contractual obligations to maintain the sides of excavation's safety and to ensure safety of the workers and the works.

3.03 Reducing Levels

A. All excavations for reducing levels shall be carried out to the lines and levels shown on the drawings or to such lines and levels as ordered by the Engineer.

B. If, from any cause whatsoever, excavations are carried out beyond their true line and level other than that ordered by the Contractor shall, at his own cost, make good to the required lines and levels with mass concrete as instructed by the Engineer.

C. All Excavations shall be performed so that the works are continually and effectively drained.

3.04 Inspection

A. All excavation shall be inspected and approved by the Engineer as the work proceeds and/or upon completion.

B. The Contractor shall advice the Engineer with adequate time when the excavation, or part thereof, is ready for such inspection. The Contractor must not proceed with other phasing until it has been inspected and/or authorized by the Engineer.

3.05 Dewatering

A. Prior to commencing excavation works, all dewatering proposals shall be submitted to the Engineer for his written approval.

B. The Contractor shall provide, maintain, alter and/or improve, and clear away on completion all dewatering equipment, temporary drains and the like.

C. The Contractor shall use all necessary measures to keep the excavation free from surface water, storm water, percolating water and subsoil water by the use of pumping or any other means approved by the Engineer.

D. Where deemed necessary by the Engineer, protective filter shall be used at pumping location to prevent the removal of the fine materials from the surrounding ground.

3.06 Haulage And Transportation Of Excavated Materials

A. The Contractor shall regulate the loading and carting away of excavated materials, debris, rubbish, etc. day by day, to an approved dumping area, as the excavation works proceed.

3.07 Surplus Excavated Material

All surplus excavated material not used in backfilling or leveling shall be loaded and removed from the site and disposed-off at the Contractor's expense to a dump to be selected by the Contractor and approved by the Municipality or local authorities

END OF SECTION

SECTION 02110
CLEARING

PART 1 GENERAL

1.01 Work Included

A. Clear site of trees, shrubs, plant life and grass.

B. Remove root system of trees and shrubs 75 mm and over in diameter at base.

C. Remove rocks, boulders and other debris.

1.02 Related Work

A. Section 02100; Excavation & Earthwork

B. Section 02210; Site Grading

1.03 Protection

A. Protect bench marks and existing structures, roads, sidewalks, paving and curbs against damage from vehicular or foot traffic.

B. Maintain designated temporary roadways, walkways and detours, for vehicular and pedestrian traffic.

PART 2 PRODUCTS

(Not applicable).

PART 3 EXECUTION

3.01 Preparation

A. Maintain bench marks, monuments and other reference points. Re-establish if disturbed or destroyed, at no cost to Employer.

3.02 Clearing

A. Clear areas as required for access to site excavation and performance of Work.

B. Cut down trees and shrubs within marked areas. Grub out stumps, roots, embedded rocks, boulders and abandoned concrete.

C. Clear out undergrowth and deadwood, without disturbing sub-soil.

3.03 Removal Of Debris

A. Promptly remove cleared debris from site. Burning of debris on site is not permitted, unless permission is obtained from applicable regulatory authority.

B. Obtain permission from applicable regulatory authority for disposal of debris to waste disposal site.

END OF SECTION

SECTION 02210

SITE GRADING

PART 1 GENERAL

1.01 Work Included

A. Remove any topsoil and stockpile on site for later use.

B. Upon The Engineer's instructions and recommendations load and cart away.

C. Excavate sub-soil and reform to grades, contours and levels.

D. Excavate for roadways, walks, curbs, parking areas and landscaped areas.

1.02 Related Work

A. Section 02110: Clearing

B. Section 02211: Rock Removal

1.03 Existing Conditions

A. Known underground, surface and aerial utility lines, and buried objects are indicated on the Drawings.

1.04 Protection

A. Protect bench marks, and existing structures, fences, roads, sidewalks, paving and curbs against damage from equipment and vehicular traffic.

B. Protect aerial, surface, or underground utility lines or appurtenances which are to remain.

C. Repair damage.

PART 2 PRODUCTS

NOT APPLICABLE

PART 3 EXECUTION

3.01 Preparation

A. Establish and identify required lines, levels, contours and datum.

B. Maintain bench marks, monuments, and other reference points. Re-establish if disturbed or destroyed, at no cost to Employer.

C. Before start of grading, establish the location and extent of utilities in the work areas. Notify utility Authorities and arrange to remove and relocate lines which are in the way of construction.

D. Maintain, protect, reroute or extend as required existing utilities to remain which pass through the work area.

E. All vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish and other unsatisfactory material within the areas upon which fill is to be placed shall be stripped or otherwise removed before the fill is placed; in no case will unsatisfactory material remain in or under the fill area.

3.02 Grading

A. Grade site to required levels, profiles, contours and elevations as shown on the drawings.

B. All unsatisfactory material including any soil which is disturbed by the contractor's operations or softened due to exposure to the elements and water, and surplus material shall be removed from site.

C. In the event that it is necessary to remove unsatisfactory material to a depth greater than specified, the Engineer shall be notified.

D. Excavation shall be performed in a manner and sequence that will provide drainage at all times, thus ensuring that excavations are kept free from water.

3.03 Surplus Material

A. Remove part of the surplus materials from site as per the Engineer's instructions..

END OF SECTION

SECTION 02211
ROCK REMOVAL

PART 1 GENERAL

1.01 Work Included

A. Removal of rock materials from site.

B. Security measures to prevent unauthorized persons from entering work area.

1.02 Related Work

A. Section 02110: Clearing.

B. Section 02210: Site Grading.

1.03 References

Not Used.

1.04 Definitions

A. Rock: this material all of which cannot be removed with a 0.60 cubic meter capacity power shovel without drilling or blasting. Rock is also interpreted as solid boulders with a volume of more than 0.25 cubic meter. Blasting will not be permitted on this Contract.

1.05 Seismic Survey

NOT USED.

1.06 Soils Report

A. Location of test boreholes is indicated in Soil Investigation Data enclosed the Instructions to Tenderer.

1.07 Existing Conditions

A. Visit site and note characteristics and irregularities affecting work of this section.

B. Proceeding with work means, acceptance of conditions, and failure to comply with site visit requirements will in no sense form basis for any claims.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 Rock Removal

A. Perform rock removal by experienced personnel in accordance with the Engineer's approval.

B. In utility trenches, excavate 150 mm below invert elevation of pipe and 600 mm wider than pipe diameter or as shown on drawings.

C. Remove rock to provide sound and unshattered base for footings and foundations.

D. Remove excavated material from site.

END OF SECTION

SECTION 02219
STRUCTURE EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 Work Included

A. Excavate for isolated column bases and strip footings and stockpile the suitable excavated material for backfilling and remove the unsuitable materials from the site to an approved dumping area as per the Engineer's approval.

B. Cap off and seal discontinued utility services and remove portions of lines within excavated areas.

C. Dewater excavations.

D. Backfilling around foundations and walls to the levels as required.

E. The Contractor shall be responsible for remove the Cave In Material which occurs in the sides of the excavations and on the contractor's own expense.

1.02 Related Work

Section 02110: Clearing

1.03 Site Compaction And Testing

A. Testing of compacted fill materials shall be performed by an approved Testing Laboratory.

B. Compaction shall be accomplished by approved equipment well suited to the soil being compacted.

C. Laboratory tests shall be performed for each type of fill material used, to obtain the maximum density according to Engineer's Instructions.

D. All compaction requirements stated relate to the laboratory maximum density.

1.03 Site Compaction And Testing (Cont'd)

E. The moisture content of the fill materials and subgrade at the time of compaction shall be uniform and as close as possible to the optimum moisture content as determined by laboratory testing.

F. All test results shall be submitted to the Engineer within 3 days of placing fill.

G. If, during progress of the work, test results indicate that compacted materials do not meet specified requirements, all defective work shall be removed (or replaced) and recompacted and retested at the Contractor's expense.

H. Ensure compacted fills are tested and passed before proceeding with placement of surface materials.

I. The frequency and type of testing shall be as follows:

One test shall be made for every 50 cubic meters of fill material placed. A minimum of four tests shall be allowed for at areas to be chosen by the Engineer.

1.04 Submittals

A. Submit minimum, samples of each type of excavated and additional fill material to be used. Forward samples to appointed testing laboratory, packed tightly in containers to prevent contamination.

B. If recent test results are available for fill materials to be used, disregard samples submission. Such test results are to clearly indicate types of materials and composition, hardness, compactability and suitability for proposed usage.

1.05 Protection

A. Protect bench marks and against damage from equipment and vehicular or foot traffic.

B. Notify the Engineer of unexpected sub- surface conditions and discontinue work in area until the Engineer provides notification to resume work.

C. Protect bottom of excavations and soil around and beneath foundations from flooding.

PART 2 PRODUCTS

2.01 Fill Materials

A. Gravel: angular or pit run crushed natural stone; free from shale, clay, friable materials, and debris; graded within the following limits:

Sieve Size	%Passing
50 mm	100
25 mm	95
20 mm	95 to 100
16 mm	75 to 100
10 mm	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: Clean natural stone; free from clay, shale and organic matter; 6 mm to 13 mm size.

C. Sand: Clean natural river or bank sand; 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	5 to 90
No. 100	4 to 30
No. 200	0

D. Sub-soil: Free from roots, rock larger than 75 mm in size and building debris.

E. Unsatisfactory materials include PT, CH, MH, OL, OH and gypsiferous soils: also rock, man-made fills, refuse or backfills from previous construction

PART 3 EXECUTION

3.01 Preparation And Layout

A. Establish extent of excavation by area and elevation; designate and identify datum elevation.

B. Set required lines and levels.
C. Maintain bench marks, monuments and other reference points.

3.02 Utilities

A. Before starting excavation, establish location and extent of underground utilities occurring in work area.

B. Notify utility Authorities to remove and relocate lines which are in the way of excavation.

C. Maintain, re-route or extend as required, existing utility lines to remain which pass through work area.

D. Pay costs for this work, except those covered by utility Authorities.

E. Protect utility services uncovered by excavation.

F. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.

G. Accurately locate and record abandoned and active utility lines routed or extended, on Project Record Documents.

3.03 Excavation

A. Excavate sub-soil in accordance with lines and levels required for construction of the work, including space for forms, bracing and shoring, applying dampproofing, waterproofing and to permit inspection.

B. Do additional excavation only by written authorization of the Engineer.

C. Hand trim excavations and leave free from loose or organic matter.

D. When complete, verify soil bearing capacities, depths and, dimensions.

E. Correct unauthorized excavation as directed, at no cost to Employer.

F. If the Contractor excavates below grade through error or for his own convenience, or fails to properly control groundwater in the trench, or disturbs the subgrade before groundwater control is sufficiently complete, or otherwise fails or neglects to conduct the excavation work so that the surface of the subgrade is in proper condition for construction, remove all unsuitable materials and replace them with Class 20 concrete or structural fill compacted to at least 95 percent of maximum dry density as determined by ASTM D1557, or other acceptable material at his own expense so that the condition of the subgrade is acceptable to the Engineer before any Work is placed thereon.

G. 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 directed

and be replaced with structural fill or other suitable material as directed by the Engineer. Removal and replacement of unsuitable material when directed by the Engineer will be paid for under the Provisional Sum

H. The method of excavation and its protection which the Contractor desires to use shall be entirely at his discretion and no additional cost will be paid to the Contractor due to want of knowledge or to any misjudgment in excavation method and procedure etc.

I. Stockpile excavated sub-soil for re-use where directed. Remove excess or unsuitable excavated sub-soil from site.

J. Excavations shall be performed so that the works are continually and effectively drained.

K. Where excavated sub-grade surfaces are porous, wet or spongy. Cut out soft areas of excavated sub-grade and backfill with sub soil or selected fill materials as directed by the Engineer.

L. Compact excavated sub-grade by heavy vibratory roller until 10ton/m2 allowable bearing capacity is achieved. Two (2) number of plate bearing tests at main building and one number at annex building shall be carried out at location directed by the Engineer.

3.04 Backfilling

A. The Contractor shall stockpile fill materials at his own responsibility in area(s) that do not affect the progress of works, provided the Engineer's approval is obtained prior to proceeding with the works.

B. Do not start backfilling operations until all associated works have been inspected and approved.

C. Ensure areas to be backfilled are free from debris, ice and water, and that ground surfaces are not in a frozen condition.

D. Do not backfill over existing sub-grade surface, which are porous, wet or spongy.

E. Compact existing sub-grade surfaces if densities are not equal to that required for backfill materials.

F. Cut out soft areas of existing sub-grade. Backfill with suitable fill material and compact to required density.

G. Backfill areas to grades, contours, levels and elevations.

H. Backfill systematically and as early as possible to allow maximum time for natural settlement and compaction.

I. Place and compact fill materials in continuous layers not exceeding 200 mm loose depth. Use a method so as not to disturb or damage other works.

J. Maintain optimum moisture content of backfill materials to attain required compacting density.

K. Backfill simultaneously on each side of foundation walls to equalize soil pressures. Do not backfill against foundation walls until the main floor is in place.

L. Where temporary unbalanced pressures are liable to develop on walls before floor slabs are placed, erect necessary shoring to counteract imbalance. Leave in place until their removal is approved by the Engineer.

3.05 Compaction

A. Compaction shall be achieved using suitable compaction equipment.

B. Each layer shall be compacted to not less than the percentage of 95 % of the maximum dry density.

3.06 Surplus Materials

A. Remove surplus backfill materials from site.

B. Leave stockpile areas completely free of all excess fill materials.

END OF SECTION

SECTION 02221
TRENCHING

PART 1 GENERAL

1.01 Work Included

A. Excavate trenches for utilities.

B. Compacted bed and compacted fill over utilities.

C. Compaction requirements.

1.02 Related Work

A. Section 01410 Testing Laboratory Services: Compaction requirements of backfill.

B. Section 02211 Rock Removal.

1.03 Tests

A. Tests and analysis of fill materials will be performed in accordance with ANSI/ASTM D1557 and with Section 01410.

1.04 Reference Standards

A. ANSI/ASTM C136 Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D1556 Density of Soil in Place by Sand-Cone Method.

C. ANSI/ASTM D1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 10 lb (4.54kg) Rammer and 18 inch (457mm) Drop.

1.05 Samples

A. Submit Samples in accordance with Section 01410.

B. Submit 5 Kg. Sample of each type of fill to testing laboratory, in air-tight containers.

1.06 Protection

A. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil from falling into excavation.

B. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

1.06 Protection (Contd.)

C. Notify the Engineer of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.

D. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

E. Grade excavation top perimeter to prevent surface water run-off into excavation.

PART 2 PRODUCTS

2.01 Select Bed And Fill Materials

A. Type A-Coarse Stone: Gravel: (Pit run, Angular, Crushed, or natural stone): free of shale, clay, friable materials and debris; graded in accordance with ANSI/ASTM C136 within the following limits:

Sieve Size	Percent Passing
50 mm	100
25 mm	95
19 mm	95 to 100
16 mm	75 to 100
9 mm	55 to 85
No. 4(4.75 mm)	35] to 60
No. 16(1.18 mm)	15 to 35
No. 4(450 micro m)	10 to 25

B. Type B - Pea Gravel: Natural stone, free of clay, shale, organic matter; 6 mm minimum to 16 mm maximum size graded in accordance with ANSI/ASTM C136.

C. Type C - Sand: Natural wadi or bank sand; free of silt, clay, loam, friable or soluble materials and organic matter; graded in accordance with ANSI/ASTM C136 within the following limits:

Sieve Size	Percent Passing
No. 4(4.75 mm)	100
No. 14 (1.40 mm)	10 to 100
No. 50 (300 micro m)	5 to 90
No. 100 (150 micro m)	4 to 30
No. 200 (75 micro m)	0

2.02 Common Fill Materials

A. Subsoil: Reused; Imported; free of gravel larger than 75 mm size, and debris.

PART 3 EXECUTION

3.01 Inspection

A. Verify stockpiled fill to be reused as approved.

B. Verify foundation perimeter drainage installation when shown on plans has been inspected.

C. Verify areas to be backfilled are free of debris or water.

3.02 Preparation

A. Identify required lines, levels, contours and datum.

B. When necessary, compact subgrade surfaces to density requirements for backfill material.

3.03 Excavation

A. Excavate subsoil required for sanitary sewer, water piping; also for power and telecommunication cables.

B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

C. Hand trim excavation and leave free of loose matter. Hand trim for bell and spigot pipe joints.

D. Remove lumped subsoil, boulders, and rock up to 0.25 cu\m, measured by volume. Remove larger material under Section 02211.

E. Excavation shall not interfere with normal 45 degrees bearing splay of foundations.

F. Correct unauthorized excavation at no cost to Employer.

G. Fill over-excavated areas under pipe bearing surfaces in accordance with direction by the Engineer.

H. Stockpile excavated material in area designated on site and remove excess subsoil not being reused, from site.

3.04 Backfilling

A. Support pipe and conduit during placement and compaction of bedding fill.

B. Backfill trenches to contours and elevations. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet or spongy subgrade surfaces.

3.03 Excavation (cont'd)

C. Place and compact select fill materials in continuous layers not exceeding 150 mm loose depth.

D. Place and compact common fill material in continuous layers not exceeding 150 mm loose depth.

E. Employ a placement method so as not to disturb or damage foundation dampproofing.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Remove surplus backfill materials from site.

H. Leave stockpile areas completely free of excess fill materials.

3.05 Tolerances

A. Top Surface of Backfilling: Plus or minus 12.5 mm.

3.06 Compaction Testing

A. Compaction testing will be performed in accordance with ANSI/ASTM D1557 and with Section 01410.

END OF SECTION

SECTION 02260
FINISH GRADING

PART 1 GENERAL

1.01 Work Included

A. Finish grade sub-soil in areas where paving or structures do not occur.

B. Place, finish grade and compact top soil.

1.02 Related Work

A. Section 02210: Site Grading.

1.03 Protection

A. Prevent damage to existing trees, landscaping, natural features, bench marks, pavement, utility lines and other works. Correct damage at no cost to the Employer.

PART 2 PRODUCTS

2.01 Materials

A. Topsoil: friable loam free from subsoil, roots, grass, excessive amount of weeds, stones and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4% and a maximum of 25% organic matter.

PART 3 EXECUTION

3.01 Sub Soil Preparation

A. Rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, etc. in excess of 75 mm in size. Remove sub-soil which has been contaminated with petroleum products.

B. Cut out areas, to sub-grade elevation, which are to receive stabilizing base for paving and are to be used for construction of buildings.

C. Bring sub-soil to required levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

3.01 Sub Soil Preparation (cont'd)

D. Slope grade away from building minimum 50 mm in 3 m unless indicated otherwise on drawings.

E. Cultivate sub-grade to a depth of 75 mm where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

F. Compact sub-soil to the following:

1) 90% maximum density for cohesive materials, and 95% for cohesionless materials, where topsoil is to be placed.

2) 95% maximum density for cohesive materials, and 100% for cohesionless materials, under tiled areas.

3.02 Placing Topsoil

A. Place topsoil in areas where seeding, sodding or planting is to be performed. Place to the following minimum depths, up to finished grade elevations:

1. 150 mm for seeded areas.
2. 115 mm for sodded areas.
3. 600 mm for shrub beds.
4. 460 mm for flower beds.

B. Use topsoil in relatively dry state. Place during dry weather.

C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles and contours of sub-grades.

D. Remove stone, roots, grass, weeds, debris and other foreign material while spreading.

E. Manually spread topsoil around trees, plants, and other obstructions to prevent damage which may be caused by rading equipment.

F. Lightly compact placed topsoil.

3.03 Surplus Material

A. Remove surplus sub-soil and topsoil from site.

B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 02480
LANDSCAPE DEVELOPMENT

PART 1 GENERAL

This Section pertains to structures, street furniture, site amenities and special paving related to Landscape Development.

1.01 Work Included

A. Provide labor and materials to construct landscape structures, including planters, edging, divider strips, steps, other constructs as indicated on the Landscape Plans.

B. Provide and install pre-cast concrete pavers, interlocking tiles concrete tiles, stone flooring, as indicated on the landscape plans.

1.02 Related Work

Section 02480	Landscape Planting.
Section 02521	Precast Concrete Units
Section 02513	Asphalt Paving.
Section 02517	Interlocking Concrete Tiles
Section 02577	Pavement Marking

1.03 Submittals

A. Shop Drawings:

1) Upon instructions by the Engineer provide shop drawings for any of the items listed under this section for verification and approval.

B. **Samples**:

1) Concrete Pavers.
2) Interlocking Tiles Pavers
3) Stone Flooring

PART 2 PRODUCTS

2.01 Materials

A. Cast - In - Place concrete: Where applicable for walls, planter boxes, steps, edging and other items as indicated on the Landscape Development Plans shall conform to the requirements of Section 03300 Cast - In - Place Concrete and Section 03100 Concrete Formwork.

B. Pre - Cast concrete: Where applicable products shall conform to the requirements of Section 02521 Precast Concrete Units.

PART 3 EXECUTION

All work performed under this Section shall be of the highest quality, and performed by experienced craftsmen, and performed in a timely manner, coordinated with other trades and crafts.

END OF SECTION

SECTION 02483
LANDSCAPE PLANTING

PART 1 GENERAL

This section concerns the furnishing and installation of trees, shrubs, climbers and ground cover plants together with accessories and appurtenances:

1.01 Work Included

A. Preparation of Planting Soil Mix.

B. Excavation for Planting.

C. Planting Procedures.

D. Maintenance and Guarantee.

1.02 Related Work

A. Section 02480 Landscape Development.

1.03 Reference Standards

A. American National Standards Institute (ANSI) Publications:

- ANSI Z60.1 - 80 Nursery Stock.
  (Available from American Association of Nurserymen, Washington D.C.)

B. American Society for Testing and Materials (ASTM) Publications:

- C 136-81 Sieve Analysis of Fine and Coarse Aggregate
- F 405-77a Corrugated Polyethylene Tubing

C. US Department of Agriculture (USDA) Publications:

- Soil Survey Investigation Report No. 1,
- Soil Survey Laboratory Methods and
- Procedures for Collecting Soil Samples,

1.04 Quality Assurance:

A. All plants shall conform to classification No. 1 as described in ANSI Z60.1-80.

B. Soil tests shall be performed on site utilizing a complete combination soil testing kit containing reagents and apparatus for all tests required herein, provided by the Contractor.

1.05 Qualified Supervision

A. Supervision of Work covered in this section shall be performed by a graduate of a fully accredited four year course in Ornamental Horticulture Landscape Gardening.

B. Verify authenticity of supervisors credentials by corresponding with Registrar of Institution (grantor of diploma) and submit institution certified evidence of satisfactory course completion to Engineer.

C. Supervisor shall also exhibit evidence of at least 5 (five) years field experience. Verify and submit as in Para. B.

D. Duties of qualified supervisor may be shared between work of this and other sections requiring horticultural expertise. However, supervisor must execute his duties and responsibilities on a full-time on-site basis.

1.06 Delivery, Storage And Handling:

A. Notify Engineer of time and mode of shipping, date and time of arrival of all materials originating off-island. Furnish copies of all required customs documents to Engineer 14 days before scheduled delivery.

B. *Freight Containers:* Shall be carefully packed to provide protection from environmental and physical injury and adequately ventilated. All plant material shipments shall be promptly delivered to site in enclosed refrigerated trucks and inspection and transportation certificates must accompany each consignment.

C. *Storage on Site:* Plants delivered to site more than 24 hours before planting shall be stored in a temporary wind shelter/shade house constructed by the Contractor in an approved location and removed (or retained) at completion of Plant Establishment Period, as directed by Engineer. Roots, root balls or containers shall be protected by planting mix and watered daily until planted.

D. *Handling*: No plant shall be handled or lifted by the stem or foliage. Roots of plants shall be protected from drying at all times. Containers shall be removed before planting.

E. *Anti-desiccant* shall be applied to all trees and shrubs, according to manufacturers directions before transporting to the site. Provide adequate film coverage on trunks, branches, stems, twigs and leaves.

1.06 Delivery, Storage And Handling: (cont'd)

F. *Packaged organic and inorganic soil additive* shall be delivered in original. Waterproof containers showing composition, weight, chemical analysis and name and address of manufacturer/supplier.

G. *Materials furnished in bulk* shall be delivered in covered vehicles or freight containers, accompanied by invoices stating composition, age of material and suppliers name and address.

H. Submit copies of all invoices to Engineer.

1.07 Planting Season:

A. The planting season shall be as defined by the manufacturer's written recommendations. No planting operations will be allowed before or after the approved defined season.

1.08 Existing Conditions:

A. Verify finished grade, elevations, underground utilities and conditions under which work of this section will be performed.

A. Verify irrigation system before beginning planting operations perform complete and thorough inspection and testing of the irrigation system to ensure that adequate quality and quantity of water is available for establishment and maintenance.

B. Report any defects or deficiencies to Engineer before beginning planting operations execution.

1.09 Submittals:

A. Submit plans for plant shelter shade house and adjacent soil mixing and storage area for Engineer.

B. Top-soil proposed for use in planting soil mixture shall be inspected by Engineer before stripping. Contractor shall furnish transportation.

C. Organic Amendment, Fertilizers and other Soil Mix Additives shall be inspected by the Engineer at the Contractors storage area on project site.

D. *Submit certified reports or soil tests* performed by Contractor. Where necessary, Contractor shall provide custom designed soil mix for specific plant varieties and submit soil reports for same.

E. *Each species and variety of plant materials* shall be inspected by Engineer within five days after they are received at the Contractors storage area on the site. Transportation for said inspections to be furnished by Contractor.

F. *Planting Accessories*: Submit one sample of each product for Engineer approval. Samples shall be retained until project completion.

PART 2 PRODUCTS

2.01 Planting Soil Mix Materials:

A. Top soil shall be natural domestic dune sweet sand suitable for the production of agricultural crops, shall have a maximum 0.02% total dissolved salts and shall conform to the following mechanical requirements:

Sieve Size	Percent Passing	
No. 4 Mesh	4.7 mm	100
No. 50 Mesh	20-80	
No. 200 Mesh	0-5	

Top soil shall be free of spilled fuels, chemical contaminants, stones, weeds, roots, debris and other deleterious substances, but may contain up to 25% marl (maximum particle size: 100mm) if thoroughly dispersed.

B. Organic Amendments - Plant Sources:

1. Ground Tree Bark shall be from pine, fir or other coniferous trees removed during normal lumbering operations, and mechanically ground or pulverized to pass a 6mm (1/4 inch) screen. Tree bark shall be clean and free from insect infestation or eggs and shall not contain more than five percent wood fibre. Tree bark shall not contain harmful bacteria or other plant pathogens, or weed seeds, may be supplied in bulk.

2. Shredded Coconut Husks shall be provided from normal copra harvesting operations, shall be mechanically chopped or shredded to pass a 25mm (one inch) screen. Shredded husks shall be free of insect infestation or eggs bacteria or other plant pathogens or weed seeds, and may be supplied in bulk.

C. Organic Soil Amendments - Animal Sources:

1. Racing Stable Waste - equine source, shall be well rotted and dry at least one year and forced to pass a 25mm (one inch) screen. Equine waste shall be provided from domestic sources and may be delivered in bulk.

2. Dairy or Feedlot Waste - Bovine source, shall be well rotted and dry, at least one year old and forced to pass a 25mm (one inch) screen. Bovine waste shall be provided from domestic sources and may be delivered in bulk.

C. Organic Soil Amendments - Animal Sources:

3. Fish, blood and bone meal shall contain minimum 6.5% Nitrogen (N), 6.0% Phosphorous (P) and 5.0% Potassium (K). Meal shall not contain porcine by-products and shall be delivered in original bags. (See para. 1.06-F).

D. Compound Fertilizers and Trade Elements:

1. General purpose fertilizer shall have minimum chemical composition of: 7% Nitrogen, 7% Phosphorous, 7% Potassium (K), shall be dry and free flowing, furnished in original containers. Fertilizer shall contain no porcine by-products. (See para. 1.06-F).

2. Sequestered trade elements shall consist of Boron, Copper, Iron, Manganese, Molybdenum and Zinc. Trace elements shall be soluble in water, furnished in original containers. (See para. 1.06-F).

2.02 Plant Materials:

A. Each plant or group of planting shall have a "key" symbol indicated on the plans and on the Plant Materials Schedule. Furnish plants grown under climatic conditions similar to those in the locality of project, if possible. Spray plants with an anti-desiccant before digging. All plant of the same specified size shall be of uniform size and character of growth.

B. Trees and shrubs: Symmetrically developed and of uniform habit of growth, with straight boles or stems, and free from objectionable disfigurement. Well branch, well formed, sound, vigorous, healthy planting stock free from disease, sun scald, windburn, abrasion and harmful insects or insect eggs and having healthy, normal and unbroken root systems.

C. Ground Covers: Number and length of runners and clump sizes indicated, and of the proper age for the grade of plants indicated, furnished in removable containers, integral containers, or formed homogeneous soil section.

D. Size: Minimum sizes measured after pruning and with branches in normal position, shall conform to the measurements indicated. Plants larger in size than specified may be used with the approval of the Engineer. If larger plants are used, increase the ball of earth or spread of roots in accordance with ANSI Z60.1.

E. Balled and Burlapped (B&B) and Balled and Potted (B&P) Plants: Ball size and ratios conforming to ANSI Z60.1. Ball plants with firm, natural balls of soil. Wrap B&B plants firmly with burlap (hessian) or strong cloth. and tie securely.

F. Balled and Platformed (BP) Plants: Wrap and ball in the same manner as B&B plants and fasten securely to strong platforms as approved.

G. Bare-root Plant: (Not allowed except in shelter belt and windbreaks). Wrap Roots in hessian (burlap) and keep moist.

2.03 Accessories

A. Granular Fill for Planter and Plant Bed Drainage: Uniformly graded stone, gravel, or stone screenings free from an excess of soft or unsound particles or other objectionable material. When tested in accordance with ASTM C136, material shall conform to the following gradation limits:

Sieve Size	Percent Passing
3/8 inch	100
No. 4	85-100
No. 16	45-80
No. 50	0-30

B. Roll Type Fiberglass Mats: 100 percent lime borosilicate glass fibers with an average fiber diameter of 8 to 12 microns and 2 to 4 inch strands of fiber bonded with phenol formaldehyde resin, water permeable, having a minimum of 1/4 inch and a maximum of 1/2 inch thickness with a density of not less than 3/4 pound per cubic foot.

C. Drainage Pipe for Plant Pits and Beds: Plastic polyvinyl chloride pipe, 75mm (3 inches) in diameter, perforated, conforming to ASTM D 2729, and corrugated plastic drainage tubing, 75mm (3 inches) in diameter, perforated, conforming to ASTM F 405.

D. Trunk Wrapping Material: Two thickness crinkled paper cemented together with bituminous material, minimum 4 inch width, with stretch factor o4 33-1/3 percent.

E. Tying Material: 3 ply, lightly tarred medium or coarse sisal yarn twine.

2.04 Stacking And Guying Materials

A. Support Stakes for trees Planted in Concrete Tree Rings shall be 50mm (2 inches) diameter steel pipe 1.5m(5feet) long. Provide one stake per tree (except palms) regardless of size of tree at time of planting. Drilled holes shall be provided as detailed. Pipe tree stakes shall be painted dark brown.

B. Support stakes for trees not planted in concrete tree rings (except Shelter Belt and Windbreak trees) shall be rough sawn hardwood, free of knots, rot, cross grain, bark, long silvers or other defects that impair strength. Stakes shall be 50mm (2 inches) square or 64mm (2-1/2 inches) diameter by 1.5m(5feet) long, painted at one end. Drilled holes shall be provided as detailed. Paint or stain wood stakes dark brown.

C. Anchoring Stakes for wood support stakes shall be same material, 50mm (2 inches) square by 610mm (24 inches) long, pointed at one end.

D. Guying Wire: 12 gauges annealed galvanized steel.

E. Hose Chafing Guards: New or used, 2 ply, 3/4 inch diameter, reinforced rubber or plastic hose, black or dark green, all of the same color.

F. Flags: White surveyor's plastic tape, 6 inch long, fastened to guying wires.

G. Turnbuckles: Galvanized or cadmium plated steel with minimum 100mm (4 inches) long openings fitted with screw eyes.

H. Eye Bolts: Galvanized or cadmium plated steel with 25mm (1 inch) diameter eyes and of adequate length to pass thru tree rings, provided with flat washers and nut fasteners of same material.

2.05 Antidesiccant:

Sprayable, water insoluble vinyl- vinledine complex which produces moisture retarding barrier not removable by rain. Film shall form at temperature commonly encountered out of doors during planting season and have a moisture vapor transmission (MVT) rate of the resultant film of maximum 10 grams per 24 hours at 70 percent humidity.

2.06 Tree Wound Dressing:

Black asphalt base antiseptic paint or black paint consisting of zinc oxide, raw linseed oil, and lamp black.

2.07 Water:

Suitable quality for irrigation of ornamental horticulture.

2.08 Climbers Support Wires:

3mm (1/8 inch) diameter annealed bare copper - (for climbers supports at walls and for trellis tops).

PART 3 EXECUTION:

3.01 Priorities And Scheduling

A. Primary Shelter Belt is excluded from the planting season requirements, and shall be the Contractors first priority. Coordinate with other trades and crafts to ensure earliest possible establishment of these structural landscape elements to minimize blown sand and dust during construction process and to optimize growing conditions for ornamentals.

3.01 Priorities And Scheduling (Contd.)

B. Soil Stabilization: All areas where soil has been disturbed during project grading operations shall receive soil stabilization treatment consisting of either Aggregate Surface Course or Sand/Soil Liquid Stabilizer. Treat graded areas as early as possible after inspection by Engineer.

C. Submit a schedule of planting operations to the Engineer illustrating how and when each priority will be achieved.

3.02 Preparing Soil Mixture

A. Location: Excepting only grass lawns and seeded perennials, soil mix shall be prepared at the Contractor's lay down area which shall include a suitable well drained paved area of sufficient size to accommodate stockpiles of soil mix ingredients, bins for storage of the prepared soil mix and space for mixing and loading operations. This facility is to be adjacent to the shelter/shade house (para. 1.06-C).

B. Composition: Planting Soil Mixture shall consist of the following materials and ratios:

Top soil (Sweet Sand)	5 parts
Organic Amendment (Plant Source)	12 parts
Organic Amendment (Animal Source)	1 part
General purpose compound fertilizer	100 grams per cubic meter.

And

Sequestered Trace Elements: As determined by soil test of the above mixed ingredients.

C. Method: Submit written description of proposed mechanical method of preparing, mixing, storing and transporting planting soil mix for approval by Engineer.

D. Application: Material excavated from tree pits, and from shrub, ground cover, vine and bulb beds shall be disposed of as directed by the Engineer. Tree pits, planting beds and concrete planters shall be backfilled with prepared planting soil mix before and/or during planting operations. Planting soil mix shall be transported to areas of planting operations daily.

3.03 Preparation For Ornamentals

A. Layout: Stake out approved plant material locations and bed outlines on the project site before digging plant pits or beds. Adjustment of plant material locations to meet filed conditions, or for any other reason, will only be permitted if a written description of the proposed changes, (accompanied by marked up prints and proposed irrigation revisions) is approved in writing by the Engineer.

3.03 Preparation For Ornamentals (Contd.)

B. Excavation for Planting: Verify the location of underground utilities. Protect existing adjacent plantings before excavation are made. (Concrete bed edging shall have been poured and cured before excavating plant beds).

C. Plant Beds: Excavate existing soil in plant beds to a minimum depth of 500mm (20 inches) and replace with 400mm planting soil mixture over 100mm granular fill and one layer of roll type fiberglass mat. Bring plant beds to smooth and even surfaces conforming to established grades.

D. Subsoil Drainage for Plant Pits and Beds: Provide in all concrete planters, and beds adjacent to walls. Lay perforated drain pipe with perforations down.

3.04 Planting Ornamentals

A. Handling: Handle plants only by supporting the ball container, or root mass. Set plants on hand compacted layer of planting soil and hold in position until soil is 50mm below surrounding grade and so that they are at the depth at which they were grown.

B. Balled and Burlapped Stock: Backfill with (planting soil mixture) to approximately half the depth of ball and then tamp and water. Carefully remove or fold back excess burlap and tying materials. Tamp and complete backfill and water.

C. Ground Covers and Vines: Do not remove from flats or containers until immediately before planting. Space at the intervals indicated, and plant sufficiently deep to cover all roots. Immediately sprinkle with water until entire areas is soaked. Smooth planting areas after planting to provide even smooth finish.

3.05 Finishing

A. Wrapping: Tie trunk wrapping material to trunks of all trees except conifers and palms, with specified material the same working day of planting. Engineer will inspect the trunks of deciduous trees for physical damage, insect infestation or disease, determine required treatment or rejection prior to wrapping operation. Being wrapping at base and extend to first branches. Overlap the wrapping half the width of underlying wrap and securely tie at top, bottom and 450mm (18 inches) maximum intervals with twine.

B. Staking and Guying:

1. Stake, guy and place tree rings for planting as indicated.

2. Hold trees firmly vertical with double-strand of 12 gauge guying wire. Use hose shafting guards, as specified, where wire will contact the plant. Provide and tighten turnbuckles, as indicated.

3. Provide wires and hose shafting guards at 50cm intervals for the entire height of the support stake for future use.

B. Staking and Guying:

1. Drive support stakes vertically into ground as indicated. Do not injure ball or roots.

2. Drive ground stakes into firm ground outside of tree pit with top of the stake flush with ground.

3. Securely fasten flags on each guy wire approximately two thirds of the distance up from ground level.

C. Hedge Protection: Provide stake and wire hedge protection as detailed in the drawings.

D. Tuning: Remove dead and broken branches. Prune deciduous trees and shrubs to reduce total amount of branching structure by maximum one third. Retain typical growth habit of individual plants with as much height and spread as in practicable. Make cuts with sharp instruments flush with trunk or adjacent branch to ensure elimination of stubs. Take care not to damage central-leaders of columnar trees (Lombardy Poplars).

E. Apply tree wound dressing to cuts 13mm (1/2 inch) in diameter and larger immediately after pruning.

3.06 Maintenance

A. Commencement: Begin maintenance immediately after each plant is planted and continue until end of plant Establishment Period.

B. Inspection: Inspect plants at least once a week during installation period and perform needed maintenance promptly.

C. Application of Pesticides:

1. Equip hydraulic equipment for liquid application of chemicals with leakproof tanks and positive agitation method. Calibrate and meter equipment so that application of chemicals in specified amounts can be determined. Equip equipment with gauges and valves capable of maintaining constant application pressure.

2. Apply so damage will not result to personnel or property from either direct spray or drifting of chemicals both on and off project site.

3.07 Plant Establishment Period

A. Commencement: Will begin on the date that inspection by the Engineer shows that all new plants furnished under this contract have been satisfactorily installed, and continue for one Julian Calendar year.

B. Maintenance During Plant Establishment Period:

1. Water, prune, mulch, re-guy, rewrap, spray, remove weeds and perform other operations necessary to promote healthy growth. Take necessary action to prevent infestation by insects or rodents, and for the prevention of plant diseases.

2. Fertilize plants at least once during the plant establishment period between 90 to 120 days after planting. Fertilize by top dressing at 1 kilo per 10 square meters of plant pit or bed area or by tablet or packet form with controlled release fertilizer.

3. Plants not in healthy growing condition, as determined by the Engineer will be noted and as soon as seasonal conditions permit shall be removed and replaced with plants of the same species and sizes to match plants in the same group. Make replacements in same manner as specified for original planting.

3.08 Restoration

Restore pavement, concrete other planted areas and structures damaged or soiled during execution of work in this section.

3.09 Maintenance Schedule

Provide a maintenance schedule of day by day maintenance activities covering one Julian Calendar year. Schedule shall include mowing, spraying, pruning, etc. Provide three copies each in Arabic and English.

3.10 Final Inspection And Acceptance

A. Final Inspection: At completion of the plant establishment period, final inspection will be made upon written request at least 10 days prior to the anticipated date. Prior to final inspection, fertilize all plants by top dressing at 1 kilo per 10 square meters of plant pit or bed by area or by tablet or packet form with controlled release fertilizer.

B. Final Acceptance: Based on compliance with the following:

1. Plants have been accepted and required number of replacements are in place.
2. Plants beds, and tree rings, are free of weeds and are properly mulched.
3. Stakes and guys are in good condition.
4. Remedial measures directed by Engineer to ensure plant survival have been carried out.
5. Plant materials have been fertilized as required.

END OF SECTION

SECTION 02513
ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.01 Work Included

A. Prepare sub-grade to receive base course.

B. Place stabilizing base course, work and compact.

C. Prime base course, place asphalt pavement.

1.02 Related Work

A. Section 01410: Testing Laboratory Services.

B. Section 02210: Site Grading.

C. Section 02577: Pavement Markings.

1.03 Reference Standards

A. ATSM D1557 - Tests for Moisture - Density Relationship of Soils using 10 lb. (4.5 kg) Rammer in 18 inch (457 mm) Drop.

B. Asphalt Institute Manuals.

1.04 Testing And Inspection

A. Testing and inspection of asphalt pavement mix(es) and testing of placed stabilizing base course and asphalt pavement will be performed by independent testing laboratory appointed and paid for by Contractor in accordance with Section 01410. Testing and inspection will be performed so as to minimize disruption to Work.

B. Allow testing laboratory access to the mixing plant for verification of weights or proportions, character of materials used and determination of temperatures used in the preparation of asphalt concrete mix.

C. When and if required, the testing laboratory will perform laboratory tests on proposed asphalt pavement mix to determine conformity with requirements.

D. The testing laboratory will perform two (2) series of compaction tests for stabilizing base course and for each asphalt pavement. Pay for costs of additional

testing as required due to improper performance of work.

1.04 Testing And Inspection

A. When stabilizing base course or portion thereof has been placed and compacted in accordance with requirements, notify the testing laboratory to perform density tests. Do not place asphalt pavement until results have been verified and base course installation approved.

B. If compaction tests indicate that stabilizing base course or asphalt paving do not meet specified requirements, remove defective work, replace and retest at own expense.

PART 2 PRODUCTS

2.01 Stabilizing Base Course Materials

A. Granular Base: Angular crushed natural stone; free from shale, organic matter and debris; graded within following limits:

Sieve Size	Percent Passing
22 mm	100
19 mm	80 to 100
16 mm	75 to 100
13 mm	70 to 90
No. 4 (5 mm)	40 to 70
No. 10 (2 mm)	25 to 50
No. 14 (1.40 mm)	15 to 35
No. 40 (425 micrometers)	15 to 30
No. 200(75 micrometers)	3 to 8

B. Primer: Homogeneous medium curing liquid asphalt; of type recommended for asphaltic paving; of grade to suit job conditions (according to Asphalt Institute recommendations).

2.02 Asphalt Pavement Materials

A. Coarse Aggregate(s): Crushed rock, slag or gravel, or a combination thereof; free of clay, silt or other deleterious materials; graded within the following limits.

Sieve Size (Surface Course)	Percent Passing
1/2 inch (13 mm)	100
3/8 inch (10 mm)	50 to 73
No. 4 (4.75 mm)	0 to 10

2.02 Asphalt Pavement Materials (cont'd)

B. Fine Aggregate(s):Clean, hard, durable natural sand, manufactured sand or screenings resulting from the crushing of rock, stone or gravel; free of clay, silt or other objectionable material; graded within the following limits:

Sieve Size (Surface Course)	Percent Passing
No. 4 (5 mm)	100
No. 8 (2 mm)	80 to 100
NO. 16 (1 mm)	55 to 90
No. 30 (600 micrometers)	35 to 70
No. 50 (300 micrometers)	15 to 40
No. 100(150 micrometers)	5 to 18
No. 200(75 micrometers	0 to 8

C. Asphalt Cement: Homogeneous; free of water; will not foam when heated to 177 degrees C; 60/70, 85/100 or 150/200 penetration grade.

D. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust acceptable to Engineer; free of clay, silt or other deleterious matter; graded within following limits:

Sieve Size	Percent Passing
No. 30 (600 micrometers)	100
No.200 (75 micrometers)	80

2.03 Asphalt Pavement Mix

A. Combine mineral constituents in proportions to produce a mixture conforming to following gradation requirements:

Sieve Size	Percent Passing
13 mm	100
10 mm	72 to 88
No. 4 (4.75 mm)	45 to 65
No. 8 (2 mm)	36 to 65
No. 30 (600 micrometers)	16 to 45
No. 50 (300 micrometers)	7 to 26
No. 100(150 micrometers)	2 to 10
No. 200(75 micrometers	0 to 5

B. Percentage by weight of asphalt cement in mixture; 5.0% to 7.0% for surface course.

C. Maintain thorough and uniform mixture.

D. Bring asphalt cement and mineral constituents to required temperatures before mixing. Ensure aggregates are sufficiently dry so as to cause foaming in mixture.

E. Job mix formula: The Contractor shall prepare all asphaltic concrete for use on the project in accordance with the following criteria (unless an alternative specification is agreed with Engineer).

Stability 820 kg (min.)
Flow, units
2 mm min. 4 mm max.
% Air Voids 3 min., 5 max.
Density
(in situ) 98% - 100% laboratory density.

PART 3 EXECUTION

3.01 Preparation

A. Ensure grading of sub-grade to required elevation.

B. Scarify sub-grade, where asphalt pavement is to be placed, to a depth of minimum 300 mm. Window loosened soil to one side. Recompact in two layers to 100% density as measured by ASTM 1557 150 mm. Rework the wind rowed soil to as finely a divided condition as possible, spreading over compacted surfaces and compact to densities mentioned above.

C. Where existing gravel has been wind rowed and retained for sub-grade, incorporate such into the top 150 mm by mixing and blading. Compact as specified in the proceeding paragraph.

D. Water and thoroughly mix sub-grade until optimum moisture content is obtained when deficiency of moisture content exists. When excess of moisture exists, rework and aerate sub-grade until optimum moisture content is obtained.

E. Before final rolling, shape entire section, add additional sub-soil as required and compact sub-grade to provide grades, elevation and cross-section indicated. Points of finished sub-grade surface shall be within 12.5 mm of elevations indicated.

3.02 Placement Of Stabilizing Base Course

A. Add water during compaction to bring granular material to optimum moisture content.

B. Spread base course materials over prepared granular sub-base to a compacted depth as shown on the drawings. Compact to 100% density. Ensure top surface of base course is true to lines and grades indicated, with all points within 12.5 mm of elevations indicated.

C. Add water during compaction to bring stabilizing base course materials to optimum moisture content. When an excess moisture exists, rework stabilizing base course materials until optimum moisture content is obtained.

3.03 Priming Prepared Stabilized Base Course

A. Ensure stabilized base course is dry and free of loose or foreign material before priming.

B. Apply primer over prepared stabilizing base course at a uniform rate as recommended by Manufacturer and approved by Engineer, 2.25 liters per square meter. Ensure primer is at recommended temperature. Use clean natural sand to blot excess primer.

C. Similarly prime surfaces of curbs and catchpits which will be in contact with asphalt pavement.

D. Coat surfaces of manholes, catch basins which are to remain free of asphalt with oil to prevent asphalt adhesion.

3.04 Placement Of Asphalt Pavement

A. Place asphalt pavement within 24 hours of priming stabilizing base course.

B. Place asphalt pavement to compacted depth indicated.

C. Do not place asphalt pavement when surface temperature is 4 degrees C or lower. Ensure asphalt pavement is minimum 118 degrees C immediately after placing and prior to initial rolling.

D. Compact asphalt paving to required density, with approved rolling equipment. Start compaction as soon as pavement will bear equipment without checking or undue displacement.

E. Carry out compaction in three operations in pass sequence. Ensure each pass of roller overlaps previous passes to ensure smooth surface free of roller marks. Keep roller wheels sufficiently moist so as not to pick up material.

F. Perform hand tamping in areas not accessible to rolling equipment.

G. Ensure joints made during paving operations are straight, clean, vertical and free of broken or loose material. Prime vertical surfaces of joints to ensure tight bond.

H. Ensure surface of completed asphalt pavement is true to lines, profiles and elevations indicated, and is free from depressions exceeding 3 mm when measured with a 3 meter straight-edge.

I. Do not allow vehicular traffic on newly paved areas until surface has cooled to atmospheric temperature.

J. In areas where pavements are to be used for playing courts, apply a seal coat in accordance with Asphalt Institute Manual No. 13 (MS-13).

END OF SECTION

SECTION 02517
INTERLOCKING CONCRETE PAVERS

PART 1 GENERAL

1.01 Work Included

A. Manufactured concrete paving units.

B. Sand bed and joint fill.

1.02 Related Work

A. Section 02521 Precast Concrete Units.

B. Section 03300 Cast-in-Site Concrete.

1.03 Samples

A. Submit two samples in accordance with Section 01340.

B. Samples shall represent style, size and color of units being provided.

PART 2 PRODUCTS

2.01 Materials

A. Paving Units: precast, 28-day strength, 5 to 7 percent air entrained, style, shape and color shall be selected by the Engineer from manufacturer's standard range.

B. Sand Base: Clean river or bank sand containing no more than 30 percent of #10 (2 mm) sieve size granule.

PART 3 EXECUTION

3.01 Installation

A. Spread sand evenly on base surface to approved depth. Screed and level to uniform surface.

B. Place paving stone in indicated pattern beginning from straight reference edge.

C. Cut units as necessary to make straight even joints with other hard surface interruptions. Maintain tight joints.

3.01 Installation (cont'd)

D. Level units again until units are uniformly level and true to grade.

E. Replace cracked, defaced, or deformed units.

F. Sprinkle fine sand over surface and sweep into joints. Moisten joints and recover with additional sand until firm joints are achieved.

G. Remove excess sand from paving surface.

END OF SECTION

SECTION 02521

PRECAST CONCRETE UNITS

PART 1 GENERAL

1.01 Work Included

A. Precast concrete curb stones and laying.

B. Precast concrete tiles with plain surface finish and laying.

1.02 Related Work

A. Section 02210: Site Grading.

B. All sections relevant to concreting operations, contained within these specifications.

1.03 References

A. BS 340 - Concrete Curbs

B. BS 1197 - Concrete Tiles

C. BS 8110 - C-BS 8110 - Concrete Work Generally.

1.04 Storage

A. All precast units shall be stored on site away from traffic areas; avoid excessive handling and protect from accidental damage.

1.05 Submittals

A. Sample tiles and curbs shall be submitted together with details of design for approval by the Engineer; the approved samples shall be used as the standard for the works.

PART 2 PRODUCTS

2.01 Materials

A. Precast concrete curbs shall be as shown on the Drawings or of such size and shape as approved by the Engineer on site.

B. Precast concrete tiles; shall have a surface finish with an approved colour of a single source.

2.02 Mixes

A. All Mixes are to be approved by the Engineer on site.

B. The crushing strength of the precast concrete units shall be 35 MPa at 28 days.

C. The concrete slump in the slump test shall not exceed 75mm.

D. The colour of the top surface of all the units shall be uniform throughout. The use of colour additive is not permitted without the approval of the Engineer.

E. The requirements of other sections relating to concrete in this specification shall also apply.

2.03 Fabrication.

A. Concrete shall be mixed and handled as specified in other sections in this specification.

B. Moulds shall be metal high density plywood or plastic; they shall be watertight and of sufficient rigidity to produce the required shape, size and surface texture.

C. The required surface finish shall be determined by the Engineer.

D. The edges of all tiles and curbs shall be uniformly chamfered or straight as required and perfectly at right angles, the surfaces shall be free from weariness, chipped arises and other defects.

E. Patching up and making good of any defective units is not permitted.

F. All units shall be cured by totally immersing them in water for at least 24 hours after the initial set has taken place, and allowed to mature for a period of 28 days before transport and laying.

PART 3 EXECUTION

3.01 Inspection and Preparation

A. Ensure that all surfaces to receive the precast concrete units are free from any loose material, dry, and uniformly graded and compacted as required and approved by the Engineer.

B. Ensure that the surface to receive the precast concrete curbs is of sufficient width and depth to have concrete bedding placed as required therein to receive the curb.

C. Do not commence work until unsatisfactory conditions are corrected.

D. Paving tiles and curbs shall not be laid until the major work in the vicinity of the area has been completed. When laid, they shall be protected and kept free of any oils, paints, etc. liable to cause damage or stains.

E. Verify that substrate is level and to the correct gradient; smooth, capable of supporting pavers and imposed loads and ready to receive work of this section.

3.02 Installation Of Curbs and Paving Tiles

A. The plan layout, showing lines and levels of the curbs shall be adhered to.

B. The curbs shall be set as shown on the drawings. The mix of the concrete shall be approved by the Engineer.

C. All joints between the curb and the paving tiles, and between the curb sections themselves shall be filled with a sand cement mortar, as for the paving tiles.

D. Paving tiles shall be laid on an approved sand bed underlay of an appropriate thickness, and a mortar bed.

E. Coordinate installation of pre-cast concrete units.

F. Spread sand evenly over prepared substrate surface to the required thickness.

G. Dampen and compact sand to a level and even surface.

H. Screed and scarify top 12mm of sand-bed underlay.

I. Lay mortar bed to the required thickness.

J. Lay paver units from straight reference edge.

K. Place special shaped units at edge and interruptions.

L. Maintain evenly spaced joints.

M. Grout with an approved cementetious grout.

3.03 Protection and Cleaning

A. Surfaces of all precast units shall be carefully cleaned on completion, taking care to avoid any damage.

B. Adequate protection shall be given to all the completed work, to avoid damage from any subsequent activities.

C. Any damage caused to completed work shall be made good by the Contractor at his own expense.

END OF SECTION

SECTION 02577
PAVEMENT MARKING

PART 1 GENERAL

1.01 Work Included

1st. Pavement marking.
2nd. Arrows.

1.02 Reference Standards

A. Federal Specification TT-P-115E Paint Traffic, Highway, White, Yellow.

1.03 Submittals

A. The Manufacturer's specifications and application recommendations shall be submitted to the Engineer.

B. Samples and details of the paint shall be submitted (about 60 days before application), for approval.

1.04 Storage

A. The paint shall be stored in sealed containers which clearly show the designated name, formula or specification number, batch number, colour, date of manufacture, manufacturers name and directions for use.

1.05 Job Conditions

A. Air and pavement temperatures shall be above 4 degrees C during application of the paint.

B. All markings shall be adequately protected to prevent damage.

PART 2 PRODUCTS

2.01 Materials

A. The paint shall be homogenous, and shall show no objectionable characteristics during the storage period prior to usage.

B. The paint shall conform to Federal Specification TT-P-115E, colour as selected.

PART 3 EXECUTION

3.01 Preparation And Inspection

A. New pavement surfaces shall be allowed to cure for a period of time of not less than 30 days before application of marking materials.

B. All surfaces to be marked shall be thoroughly cleaned before application of the paint.

C. All pavement cleaning operations shall be performed only after approval by the Engineer.

D. Mechanical preparation and/or priming as may be required shall be in accordance with the material Manufacturer's Instructions and as applicable to the types of pavement and material involved.

3.02 Layouts And Tolerance

A. The Contractor shall provide the work necessary to layout the marking work in conformance with the requirements of the MOC standards for Road Safety Features and with the typical details shown on the Contract Drawings and within the specified tolerances. Layout marks shall be removed following completion of marking materials application.

B. Any variation in the alignment of stripes or broken lines shall not exceed 25 mm in 25 meters, and the width or stripes or broken lines shall not vary more than plus or minus 10 mm from the width shown.

C. Any line required to be curved shall have uniform curvature throughout the arc length, and shall be accurately aligned and free from offsets at tangent point intersections with lines at straight roadway sections.

D. All markings shall be in positions as shown on the Contract Drawings and with an accuracy of 50 mm transversely with respect to the roadway centerline, and longitudinally within 100 mm with respect to survey stations.

E. Broken lines shall be uniform in length and spacing and shall not vary from the dimensions indicated more than plus or minus 50 mm.

F. Parallel strips and/or broken lines shall be uniformly spaced apart as shown and any variation in spacing between them shall not exceed plus or minus 10 mm.

3.03 Application

A. Marking material shall be applied at a rate of 4 litres per sq. metre or in accordance with the Manufacturer's Instructions as approved.

B. Paint shall be applied pneumatically.

3.03 Application (Cont'd)

C. Application shall not be made in conditions of blowing sand and dust, nor when the pavement surface is wet or damp, nor when the ambient and/or surface temperatures exceed the extremes permitted by the Manufacturer nor otherwise when weather conditions would adversely affect the finished work.

D. Adjacent surfaces shall be maintained or otherwise cleaned free from marking materials not required to be applied.

E. When complete, the installed marking material shall be uniform in colour, level and smooth, and free from inclusions of sand or other deleterious substances, stains, discolouration or other irregularities. Edges of the work shall be neat, straight and free from raggedness or other unevenness; and corners shall be neatly cut off square or true and sharp to the angle required. Any markings applied outside the tolerances specified in Article 3.02 shall be completely removed and re-applied correctly.

F. Each colour required shall be uniform in hue and reflectance throughout the work.

3.04 Safety And Protection Of Work

A. The Contractor shall provide and use sufficient safety devices and methods to protect all personnel on site.

B. Markings shall be protected until they are sufficiently cured to be driven across without damage. The Contractor shall plan his operations for working only in hours of daylight.

END OF SECTION