

## **VOLUME 3 - Section 11: Roads, Landscaping and Fences**

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## **11 Roads, Landscaping and Fences**

### **11.1 Road Works**

#### **11.1.1 General**

The road works in this Contract comprise construction of the following:

- Service roads
- Parking areas
- Walkways
- Surface drainage for roads.

The word "roads" in these requirements includes parking areas.

Roads shall consist of the following layers:

- A layer of wearing course
- A layer of bituminous asphalt course
- A bottom layer of sub-grade material, only where necessary
- A sub-base of granular material or broken stones to a suitable grade.

Walkways shall consist of the following compacted components:

- Tiled pavements
- A bottom layer of sub-grade material, only where necessary
- A sub-base of granular material.

Walkways shall be constructed at the following locations:

- Around all buildings and structures
- Between plant roads and all plant structures
- In areas where frequent pedestrian walking is expected (for example, between the MBT and the administration building).

The sub-base and base in walkways shall have each a minimum thickness of 150 mm. Tiled pavements, consisting of approved concrete slabs, shall have a minimum thickness of 50 mm. The tiles shall be laid evenly according to the lines and levels of the adjacent pavements. All tiles shall be of an approved type, design and make and shall be firmly bedded on the underlying course and shall be laid against each other. Upon completion of the tiling, sand shall be spread and shall be compacted with a mechanical vibrating machine of sufficient weight.

Sub-grade means the soil immediately below the formation. The formation and sub-grade shall be graded and compacted to the levels, falls, cambers and densities as required by DIN standards or other equivalent standards and specifications. The sub-grade shall be so compacted that the dry density of the upper 150 mm of the ground or fill is not less than 95% of the maximum dry density determined by tests in accordance with the relevant Turkish Standards. Where existing ground conditions are such that direct compac-

tion of the sub-grade cannot be carried out as specified, unsuitable material shall be removed and replaced with granular sub-base.

The materials for the sub-base and road-base shall be laid in layers, each not exceeding 150 mm or being less than 75 mm. The total compacted thickness of the sub-base and road base shall not be less than the specified nominal thickness. The sub-base and base in roads shall have each a minimum thickness of 200 mm.

#### **11.1.2 Clearing and grubbing**

Clearing and grubbing for road works shall be executed according to Section 6 of these Employer's Requirements.

#### **11.1.3 Road formations**

The road formation shall be the surface obtained after completion of any earthworks.

Formations, immediately before being covered with sub-base or road base material, shall be clean, free from mud and slurry and properly shaped and compacted to an even and uniform surface.

The preparation and surface treatment of formations shall be carried out after the reinstatement of any excavations for services.

Where unsuitable material naturally occurs at formation level, it shall be excavated as directed by the Engineer and it shall be removed from the Site. The resulting void shall be filled with a compacted granular sub-base material, in layers not exceeding 250 mm uncompacted depth.

The sub-grade shall be compacted so that the dry density of the upper 150 mm of the ground or fill is not less than 95% of the maximum dry density. Where the sub-grade is in natural ground, the compaction shall be carried out at or near the natural moisture content of the ground. Any irregularities or depressions that develop in the formation during compaction of the sub-grade shall be corrected by loosening the surface of these places and adding, removing or replacing material and re-compacting so that the surface is smooth and uniform. Any area of sub-grade that shall become muddy, broken-up or loosened due to weather conditions or otherwise damaged shall be corrected or prepared again by the Contractor as specified above.

#### **11.1.4 Sub-base construction**

Within 48 hours of completion of a road formation, granular sub-base material shall be spread and compacted to the required thickness. The sub-base shall be protected from deterioration due to ingress of water, the adverse effects of weather and the use of Contractor's equipment. Compaction shall be carried out in accordance with the following table:

Type of compaction plant	Category	Number of passes for depth layers not greater than		
		110 mm	150 mm	225 mm
Smooth-wheeled roller	Mass per metre width of roll:			
	Over 2700 kg up to 5400 kg	16	Unsuitable	Unsuitable
	Over 5400 kg	8	16	Unsuitable
Pneumatic-tyred roller	Mass per wheel:			
	Over 4000 kg up to 6000 kg	12	Unsuitable	Unsuitable
	Over 6000 kg up to 8000 kg	12	Unsuitable	Unsuitable
	Over 8000 kg up to 12000 kg	10	16	Unsuitable
	Over 12000 kg	8	12	Unsuitable
Vibrating roller	Mass per metre width of vibrating roll:			
	Over 700 kg up to 1300 kg	16	Unsuitable	Unsuitable
	Over 1300 kg up to 1800 kg	6	16	Unsuitable
	Over 1800 kg up to 2300 kg	4	6	10
	Over 2300 kg up to 2900 kg	3	5	9
	Over 2900 kg up to 3600 kg	3	5	8
	Over 3600 kg up to 4300 kg	2	4	7
	Over 4300 kg up to 5000 kg	2	4	6
	Over 5000 kg	2	3	5
Vibrating-plate compactor	Mass per unit area of base plate:			
	Over 1400 kg/m <sup>2</sup> up to 1800 kg/m <sup>2</sup>	8	Unsuitable	Unsuitable
	Over 1800 kg/m <sup>2</sup> up to 2100 kg/m <sup>2</sup>	5	8	Unsuitable
	Over 2100 kg/m <sup>2</sup>	3	6	10
Vibro-tamper	Mass:			
	Over 50 kg up to 65 kg	4	8	Unsuitable
	Over 65 kg up to 75 kg	3	6	10
	Over 75 kg	2	4	8
Power rammer	Mass:			
	100 kg – 500 kg	5	8	Unsuitable
	over 500 kg	5	8	12

### 11.1.5 Road base material

Road base material shall consist of crushed rock or other material approved by the Engineer, and shall be suitably proportioned to conform to the following grading or such other grading, where appropriate, in accordance with the requirements of the Turkish Highway Authority:

Sieve size, mm	Percentage by weight passing square mesh
75	100
37.5	85-100
20	60-80
10	40-60
5	20-40
2.36	15-30
0.425	5-18
0.075	4-9

The fraction passing the 0.075 mm sieve shall not be greater than two-thirds of the fraction passing the 0.425 mm sieve.

Material constituents shall comply with the following maximum limits:

For material passing the 0.425 mm sieve:

- Liquid limit: 25
- Linear shrinkage: 3
- Plasticity index: 6

For coarse material:

- Stone size: 75 mm
- Aggregate crushing value: 35%
- Water absorption: 6%
- Flakiness index: 35
- Elongation index: 35

The aggregate crushing value shall be monitored by regular testing of the material prior to its inclusion in the construction.

Road base materials shall be crushed and mixed using approved mechanical equipment to produce a material complying with the specified grading.

Water required to adjust the moisture content shall be added at the mixer. If required, the moisture content shall be adjusted to allow for evaporation loss during transportation.

Material when mixed shall be removed at once from the mixer and transported directly to the point where it is to be laid.

Road base material shall be spread evenly in a layer not exceeding 150 mm compacted thickness for the roadway and a layer not exceeding 200 mm compacted thickness in the verges. Segregation shall be avoided during transport and placing and any segregation evident after compaction shall be made good by removing and replacing with properly graded material.

Where natural gravel is used, water necessary to adjust the moisture content shall be added during laying by use of equipment equipped with a sprinkler bar giving an even spread of water over the whole width of the pass. Uneven wetting of the road base shall be avoided by ensuring that the equipment moves at a constant speed, and in addition, the material shall be turned over to ensure even distribution of the water throughout the layer.

The road base shall be compacted by approved equipment to a dry density which shall be not less than 95% of the maximum laboratory dry density as measured by 4.5 kg rammer method. The CBR value shall not be less than 80% after four days immersion in water.

On completion of compaction and before commencing the next operation, the surface of the granular road base shall comply with a surface tolerance of  $\pm 1$  cm.

#### **11.1.6 Asphalt pavements**

The final re-surfacing of asphalt public roads and pavements shall be considered as included in the rates and prices.

The Contractor shall when laying the temporary reinstatement ensure that levels of manholes and surface boxes shall match the final road surface level.

Asphalt roads within the site(s) shall be surfaced in accordance with the following Employer's Requirements.

All the tests required by the requirements of Turkish Highway Authority shall be carried out.

#### **11.1.7 Bituminous course**

The bituminous mixture for the surface courses shall conform to the requirements of locally produced mixtures.

The composition of the mixtures is generally as follows:

- Stone dust filler
- 5 to 7 % bitumen
- 70 to 75 % grey or blue calcareous material
- 23 to 25 % sand.

Bituminous mixtures shall, as far as practicable, be obtained from a local mixing plant approved by the Engineer.

Names and addresses of local producers will be given by the Engineer. No bituminous mixture shall be manufactured until a job-mix formula has been submitted by the Contractor and approved by the Engineer in writing.

The formula shall indicate the exact percentage of each sieve fraction and the exact percentage of asphalt to be used in the mixtures, including the mix temperature. The job-mix formula shall be within the master range as specified and shall be in effect until modified in writing by the Engineer.

### **11.1.8 Bituminous works**

#### **Bituminous Sealing**

The surface of the road base shall be sprayed with suitable bitumen emulsion (M.C.70) at a rate of 1,5-2,0 kg/m<sup>2</sup> immediately after it has been completed and checked for compliance with the specified tolerances.

#### **Bituminous Wearing Course**

The laying of wearing course shall include the supply of bituminous material, the placing and compaction of the bituminous layer and the removal of surplus material.

The wearing course shall be coated macadam, in a quality corresponding to ZTV-Asphalt with graded, broken aggregates. The layer shall be compacted by rollers.

#### **Base Course**

The laying of base course shall include the supply of bituminous material, the placing and compaction of the bituminous layer and the removal of surplus material. The base course shall comply with ZTV-Asphalt with graded, broken aggregates. The layer shall be compacted by rollers.

#### **Asphalt Course**

The laying of the asphalt course includes the supply of material, the placing and compaction of the asphalt layer, the treatment of the completed surface and the removal of surplus material.

The asphalt course shall comply with ZTV-Asphalt with graded, broken aggregates. The layer shall be compacted by rollers to a minimum compacted thickness of not less than 4 cm. After completion fine sand shall be evenly sprayed over the surface and left for two days before final cleaning.

### **11.1.9 Weather limitations**

Bituminous courses shall be constructed only when the base is dry and when the weather is not rainy. Such courses shall not be constructed when the atmospheric temperature is below 10°C and falling, but may be constructed when the atmospheric temperature is at least 8°C and rising, unless otherwise directed by the Engineer.

### **11.1.10 Preparation**

Immediately before applying a bituminous pavement, the surface of the underlying course shall be thoroughly cleaned of all loose or foreign material. The underlying layer shall be coated with a tack-coat of the liquid asphalt rapid curing type (RC-250). The tack-coat to be used shall be to the Engineer's approval. The tack-coat shall be applied just sufficiently in advance of the placement of the asphalt concrete mixture so as to provide a thin adhesive film of bituminous cement to ensure a good bond. Tack-coat shall be asphalt emulsion (50 % water, 50% bitumen).

The tack-coat shall be uniformly applied by means of a pressure hand spray, in quantities of 0.3 litres per square meter of surface, unless otherwise directed by the Engineer. Stakes for alignment control shall be furnished, set and maintained by the Contractor, subject to checking and correction by the Engineer.

The stakes shall be set in lines parallel with the centre line of the area to be paved, offset and spaced, as directed by the Engineer.

Asphalt at the plant shall have minimum temperature of 150°C just before the delivery.

#### **11.1.11 Transportation**

All bituminous mixtures shall be transported from the mixing plant to the spreader in trucks having tight, clean, smooth beds which have been oiled with a minimum amount of approved thin oil to prevent adhesion of the mixtures to the trucks. Each load shall be covered with canvas, or other suitable material, to protect it from dust or rain, and to prevent the loss of heat. Deliveries shall be arranged so that spreading and rolling of all the mixtures prepared for a day's run can be completed during daylight, unless artificial light satisfactory to the Engineer is provided. Any excessively wet loads will be rejected. Hauling over freshly laid material will not be permitted.

#### **11.1.12 Placing**

The asphalt pavement shall be constructed in accordance with the thickness as present prior to removal and excavation work with a minimum thickness as specified. The temperature of each mixture when dumped into the spreader shall be as directed by the Engineer, plus or minus 10°C. Asphalt mixture shall have a minimum of 90°C.

The spreader shall be adjusted, and the speed regulated, so that the surface of the course will be smooth and of such depth that, when compacted, it will conform to the cross section shown on the Drawings. The length of any lane before placing the adjacent lane shall be as directed by the Engineer. Where two spreading machines are operating in staggered position, no single lane shall be laid in advance of the adjoining lane further than will permit a satisfactory hot longitudinal joint between the lanes.

Where forming a hot longitudinal joint, the 150 mm strip along the edge against which additional material is to be laid shall not be rolled until such additional material is placed, except when the work is to be discontinued. After the first lane has been placed and rolled, the adjacent lane shall be placed while the unrolled 150 mm strip is hot and in readily compatible condition. Rolling of the adjacent lane shall begin along the joint. Placing of the mixture shall be as continuous as possible.

Rolling shall be carried out using at least two machines, one three-wheel roller having a weight of 10 tons, and the other rubber wheel roller having a weight of 20 tonnes.

In areas where the use of machine spreading is impractical, the mixture may be spread by hand and dressed with rakes. The loads shall not be dumped any faster than can be properly handled by the shovellers and rakers.

Contact surfaces of previously constructed pavement kerbs, manholes and similar structures shall be painted with a thin tack-coat prior to placing the bituminous mixture.

#### **11.1.13 Compaction of mixtures**

Compaction shall be effected by three-wheel rollers and tandem rollers.

Rolling of the mixture shall begin as soon as after placing as the mixture will bear the roller without undue displacement. Delays in rolling freshly spread mixtures will not be permitted. Initial rolling shall be effected by tandem rollers, followed immediately by the three-wheel rollers. Rolling shall start at the ex-

treme sides of the lanes and proceed toward the centre of the pavement, overlapping on successive strips by at least one-half the width of the rear wheel of the three-wheel roller. On the super elevated curves, rolling shall begin at the low side and progress toward the high side. Alternative trips of the roller shall be slightly different lengths. Tests for conformity with the smoothness will be made immediately after initial compaction, any deviations in excess of the specified tolerances shall be corrected by loosening the hot surface with rakes and removing or adding material as directed before continuing the rolling.

Generally, rolling shall be executed in such a manner as to produce a smooth surface and shall be continued until a density of at least 100% has been obtained.

During rolling, the wheels of the rollers shall be moistened to prevent adhesion of the mixture to the wheels, but an excess of water will not be permitted. The Contractor shall furnish additional and sufficient rollers if it is found that the pavement density specified is not obtained. In all spaces not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers weighing not less than 10 kg, with a tamping face of not more than 300 cm<sup>2</sup>. Skin patching of an area that has been rolled will not be permitted.

Any mixture that becomes mixed with foreign material, or is in any way defective, shall be removed, replaced with fresh mixture and re-compacted. The rollers shall not be permitted to stand on pavement which has not been fully compacted. Necessary matter on the pavement, either when the rollers are in operation or standing. The Contractor shall provide competent workmen who are capable of performing all work incidentals to the correction of all pavement irregularities.

The finished surface shall not vary more than 3 mm when tested with a 3.00 m straight edge applied parallel with the centre line of the pavement. After completion of the final rolling, the smoothness of the course will be checked, and any irregularities that exceed the tolerance or that retain water on the surface, shall be corrected by removing the defective area and replacing with new pavement. The completed bituminous pavement will be tested for thickness at such intervals as directed by the Engineer. Where the thickness proves to be more than 5mm smaller than the specified pavement thickness, the deficient pavement shall be removed and replaced with satisfactory pavement with no additional payment.

All joints shall present the same texture, density and smoothness as other areas of the course. The joints between old and new lanes or sections shall be carefully made in such manner as to ensure a continuous bond between the old and new pavement. All trimmed contact surfaces of previously constructed pavement shall be painted with a thin, uniform tack coat before the fresh mixture is placed. When the edges of joints are irregular, honeycombed, or poorly compacted, all unsatisfactory sections of joint shall be trimmed to expose an even, vertical, or sharply sloping surface for the full thickness of the course. Fresh mixture shall be raked uniformly against the joint, followed by rolling, no vehicular traffic of any kind shall be permitted on the pavement for at least 24 hours.

#### **11.1.14 Drainage**

Surface water drainage to site roads, hard standings and access roads consists of a cross fall on the surface of the roads or paved areas draining to the adjoining ground.

Where surface water drainage is provided for roads it shall consist of piped drainage. Where practicable drainage work shall be completed before road works is commenced.

Trenches for piped drainage shall be excavated to the minimum dimensions necessary for the proper construction of the Works, and after pipes have been laid, tested and, where specified, surrounded with gravel or concrete, the trenches shall be backfilled with excavated material and compacted to a dry density equal to that of the adjacent ground. Surplus excavated material shall be disposed of off site.

Porous pipes shall be laid dry-jointed and shall be surrounded with gravel.

Soak ways and in-situ concrete catch pits with kerb weirs shall be constructed

Brickwork manholes and gullies shall be constructed complete with cast iron covers or gully gratings.

Open drainage channels for roads shall be constructed as concrete channels with a width up to 1 m and a depth up to 0.5 m. The bottom of the trench and the lower part of the slopes (1/3 of the total depth) shall receive stone pitching as described in the Employer's Requirements. The works to be carried out shall include the required excavation, the trimming, compaction and pitching of surfaces and site clearance after completion of the works.

#### **11.1.15 Laying kerbs and channels**

Kerbs, edgings, channels and quadrants shall be laid and bedded on a layer of mortar, either on the concrete carriageway or on a Grade C20/25 concrete foundation. They shall be butt-jointed except where otherwise described in the Contract, save that where laid on concrete carriageways they shall be provided with joints coincident with the carriageway movement joints, of width and with filler identical to that used in the carriageway joints. All kerbs shall be backed with Grade C20/25 concrete.

Alignment of kerbs and channels shall not deviate from that described in the Contract by more than 10 mm, with no lipping of visible faces.

#### **11.1.16 Foundations for walkways**

Foundations for footways shall consist of granular sub-base material spread evenly and compacted in layers of not more than 100 mm thickness.

Compaction to the correct levels shall be carried out using a vibratory roller have a static load of at least 1000 kg/m width of roll.

#### **11.1.17 Laying concrete paving flags**

Pre-cast concrete flags shall be laid to falls on sub-base material, bonded with joints at right angles to the kerb, and spot bedded with mortar with no lipping of top surfaces.

Flags shall be cut to fit around surface boxes and other furniture and, on circular work where the radius is 12m or less, shall be radially cut on both edges to the required lines.

#### **11.1.18 Laying paving blocks**

Pre-cast concrete block paving shall be used.

### **11.1.19 Tolerances for finished carriageway surfaces**

Finished surfaces at each stage of road construction shall not vary from the levels described in the Contract by more than the following permissible deviations:

Surface	Permissible deviation, mm
Formation and sub-base	+10, -30
Base	±15
Wearing surface or slab surface	±6

The combination of permitted tolerances in the levels of different pavement courses shall not result in a reduction in thickness of the pavement, excluding the sub-base, by more than 15 mm from that specified, and the maximum allowable irregularity of the wearing surface below a 3 m straight edge shall be 3 mm.

### **11.1.20 Tiled pavements**

Tiled pavements for walkways consisting of approved concrete slabs with a minimum thickness of 50 mm shall be laid on 20 mm of sand for final levelling. All slabs shall be of approved type and design and shall be firmly bedded on the underlying course and shall be laid against each other. Upon completion of the slabs sand shall be strewed, and be compacted with a mechanical vibrating machine of sufficient weight. The application projects shall be prepared by the Contractor and shall be subject to approval of the Engineer.

### **11.1.21 Pre-cast units for kerbs and surface drainage**

Kerbs and drains units shall be supplied and laid along the roads and parking areas to be constructed on site.

Curves shall be provided with specially made bends as follows:

Curbs shall not be laid until the 28 day strength of the pre-cast unit is attained. Kerb sections shall be set on compacted sub-grade. Any section deviating in line or level by more than 1 mm in 1 m shall be lifted and re-laid. Joints shall be grouted up with mortar. The application projects shall be prepared by the Contractor and shall be approved by the Engineer.

### **11.1.22 Concrete**

The quality of the concrete surface course, tiled pavement, kerbs and units for surface drainage shall be according to Section 6 of these Specifications.

## **11.2 Fences and Gates**

### **11.2.1 General**

The fence shall surround the whole MBT plant site.

### **11.2.2 Fences**

The MBT plant site shall be surrounded with fences on concrete (or galvanized steel) parapet. The panel fence shall be used with 50 x 15 mm openings, minimum 4.5 mm thickness and 50 x 50 mm box section with minimum 1.5 mm thickness. Electrostatic painting shall be applied for corrosion protection.

Height of panel fence shall be 2.00 m and total height of the fence including concrete parapet will be 2.40 m.

### **11.2.3 Gates**

A sliding gate shall be installed at the entrance to the MBT plant site.

The gate shall be operated both mechanically and manually. The gate shall be operated by a control panel button in the guard house / weighbridge container. The height of the gate shall be 2.50 m.

The gate shall be complete with all fittings such as rails, wheels, appropriate electrical motor, drop bolts; back catches, locking bars, lock plates and lock including three keys. The gates shall be provided with locks of the cylinder type.

## **11.3 Landscaping**

### **11.3.1 General**

Prior to commencement of any landscaping work, the Contractor shall submit to the Engineer for approval his detailed proposals for landscaping including the proposed species of grass, trees and shrubs.

### **11.3.2 Material**

#### **Top Soil**

Existing top soil stripped from the site and stored in heaps adjacent to the works may be reused provided it has not become contaminated and is free of rubble and debris. Where insufficient site top soil is available additional humus shall be imported from an approved source. Where the upper layer of natural soil is poor in organic matter, it shall be improved to a minimum depth of 250 mm by adding either clay or sand or silt to create a loamy soil texture consisting of 40% sand (size > 0.05 mm), 30% silt (size 0.05 - 0.002 mm) and 30% clay (size < 0.002 mm).

#### **River Sand**

River sand for use on the site shall be obtained from an approved source.

#### **Grasses**

Type of grasses shall be proposed by the Contractor and approved by the Engineer.

Where the topsoil shall be sown with grass seed, the top 75 mm of the topsoil shall be brought to a fine tilt suitable for seeding, and sowing shall be carried out as soon as practicable after completion of top soiling having due regard to the season and the weather conditions. After the seed has been sown uniformly, they shall be raked and lightly rolled into the surface. The young grass shall be kept free from weeds and any bare patches shall be re-seeded until an even close turf is established. The grass shall be watered and rolled as required and maintained in good condition.

### **Trees and Shrubs**

Trees and shrubs shall be of the species proposed by the Contractor and approved by the Engineer and shall be of the best quality and free from disease. They shall be young stock or in the case of shrubs may be established seedlings or cuttings. All must be sufficiently mature to survive transplanting from the supply nursery. The root systems of all plants shall be maintained intact in the soil in which they have been grown and may be supplied in containers.

### **Gravel**

Gravel for use on the site for landscaping shall comply with TSE and be of 28 mm nominal size.

## **11.3.3 Existing trees**

### **Inspection of Retained Trees**

All trees and shrubs to be retained shall be inspected jointly by the Engineer and the Contractor at the commencement of the Contract and a list of trees to be retained shall be agreed. Any tree found to be diseased, dead, dying or unsafe shall be felled and uprooted subject to the prior approval of the Engineer.

### **Tree Felling**

Existing trees and shrubs where directed by the Engineer shall be cut down and all stumps and main roots shall be grubbed up. All planting thus dealt with shall be either burnt in situ or removed from the Site. The removed trees place should be transported to the place by the Employer.

### **Protection of Retained Trees**

During execution of works existing trees and shrubs that are to be retained shall be adequately protected from all operations and from animals. Small trees and shrubs generally shall be surrounded by adequate temporary fencing to safeguard trunks and foliage. Large trees shall have suitable screening round trunks, and low branches shall be protected by temporary fencing or barriers to prevent damage. Construction materials shall not be stored close to or within the branch spread of any tree or shrub. Existing ground levels shall be maintained.

### **Maintenance of Retained Trees**

Retained trees and shrubs shall be maintained during the Contract and pruned at completion having due regard to the appropriate time of year for such work to be carried out. Maintenance shall include removing snags, dead wood and fronds, sealing cavities and irrigating as required to ensure the continued health of existing planting.

### **Replacement of Damaged Trees**

Should any retained tree or shrub be damaged as a result of the building operations then it shall be replaced by the Contractor by an equivalent mature tree or shrub of the same variety.

## **11.3.4 Implementation of landscaping**

### **Preparation of Ground**

The areas to be landscaped shall be brought to final ground levels less the depth required for top soil or other surfacing and all surplus material shall be disposed of off site.

### **Cultivation of Ground**

The Contractor shall relay a 250 mm thick topsoil. Any deficiency in the topsoil shall be made up with imported top soil. Prior to replacing topsoil areas of the Site which are to be prepared for grass planting

shall be thoroughly broken up by deep raking and cross raking to a depth of 450 mm. Retained topsoil may be used as filled to final ground level subject to the approval of the Engineer being first obtained. Imported top soil shall be used if the existing top soil is insufficient or unsuitable. Where new and replacement trees or shrubs are to be planted in agreement with the Engineer, holes 1 m deep below final ground level shall be excavated in each case. These shall be filled with sweet and topped with 250 mm of top soil. Sand filling shall be thoroughly mixed with 10 kg manure before placing.

#### **Time for Planting**

In programming the planting work the Contractor shall take due regard of the accepted seasons for planting.

#### **Top Soil Dressing**

Top soil ready to receive planting shall be given a dressing of manure at a rate of 5 kg/m<sup>2</sup>.

#### **Supply of Plants**

All trees, shrubs, grasses and other plants shall be supplied by the Municipality based on the Landscape design to be prepared by the Contractor and approved by Engineer.

#### **Planting of Trees and Shrubs**

Prior to planting holes for trees and shrubs shall be prepared and filled twice with water. Plants shall be watered in their containers so that the soil and the roots are kept in a moist condition. Plants shall then be removed from their containers and their root ball complete with soil set in place and the holes backfilled and the plants firmly trodden in. Soil shall not be allowed to rise above the original container level and the ground level around the trunk or stem shall be set below adjacent ground to retain irrigation water. All species of tree and shrubs where required shall be provided with supports during planting. These shall take the form of timber stakes of adequate strength driven into the ground adjacent to the trunk or stem without damage to roots. Wide hessian strips shall be used to tie the plant securely but not tightly to the support. Where shrubs are to be planted in groups to provide ground cover, individual plants shall be spaced as follows:

Size	Height when grown	Spacing
Small	Less than 1 m	500 - 600 mm
Medium	1 - 2 m	900 - 1200 mm
Large	Over 2 m	1800 mm

#### **Irrigation**

After planting of native tree and shrub species they shall only be irrigated twice and thereafter only as required. Non-indigenous species shall be irrigated regularly until handover to the Employer. Grassed areas shall be irrigated immediately after planting and regularly thereafter until handover. Watering of grass shall be by night-time sprinkler system.

#### **Maintenance**

All new plants and grassing shall be maintained after planting. This shall take the form of irrigation, re-stacking, pruning, weeding, tilling, etc. to ensure sufficient growth is achieved by all. Once grassed areas are sufficiently established, they shall be kept cut or mown to provide a uniform depth of growth. Edges of grassed areas shall be trimmed as necessary. All new plants and grassed areas shall be protected to pre-

vent damage from workmen, builder's plant, equipment and animals, by the use of temporary fencing or other suitable means.

**Replacement**

Any trees, shrubs or areas of grass which fail to satisfactory growth or wither and die shall be replaced. The responsibility for the irrigation and maintenance of these replacement plants shall remain with the Contractor until such time as they exhibit satisfactory growth.