



KENYA RURAL ROADS AUTHORITY

EMBU REGION

SPECIFICATION AND DRAWINGS

FOR

ROUTINE MAINTENANCE & SPOT IMPROVEMENT OF EMBU COUNTY ROAD

DECEMBER, 2025

**REGIONAL DIRECTOR EMBU REGION
KENYA RURAL ROADS AUTHORITY
P.O. BOX 2718-60100,
EMBU.**

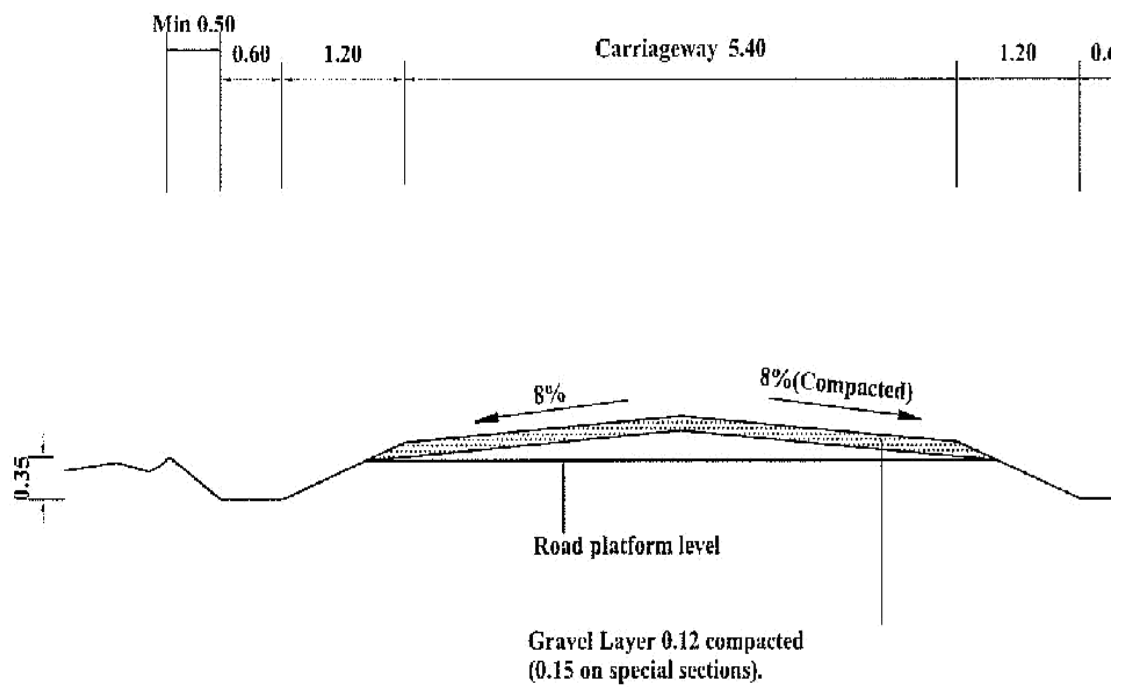
**DIRECTOR GENERAL,
KENYA RURAL ROADS AUTHORITY
P.O. BOX 48151 – 00100,
NAIROBI.**

PART II - WORK REQUIREMENTS

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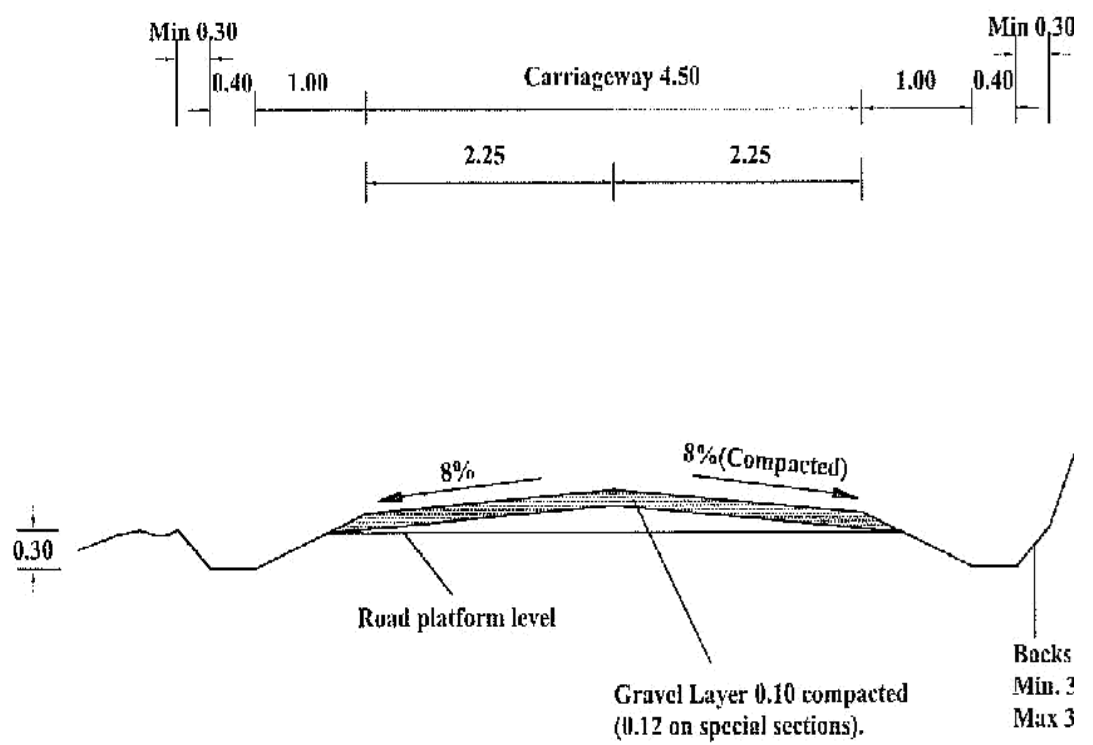
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SECTION I – DRAWINGS



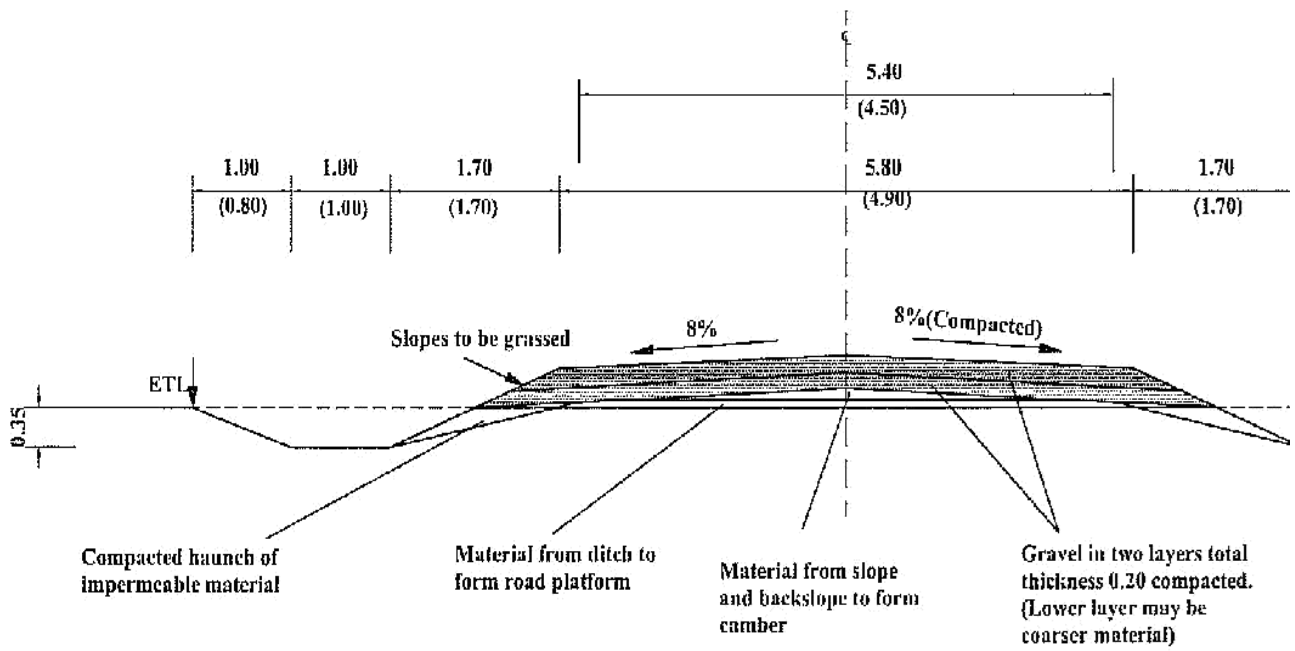
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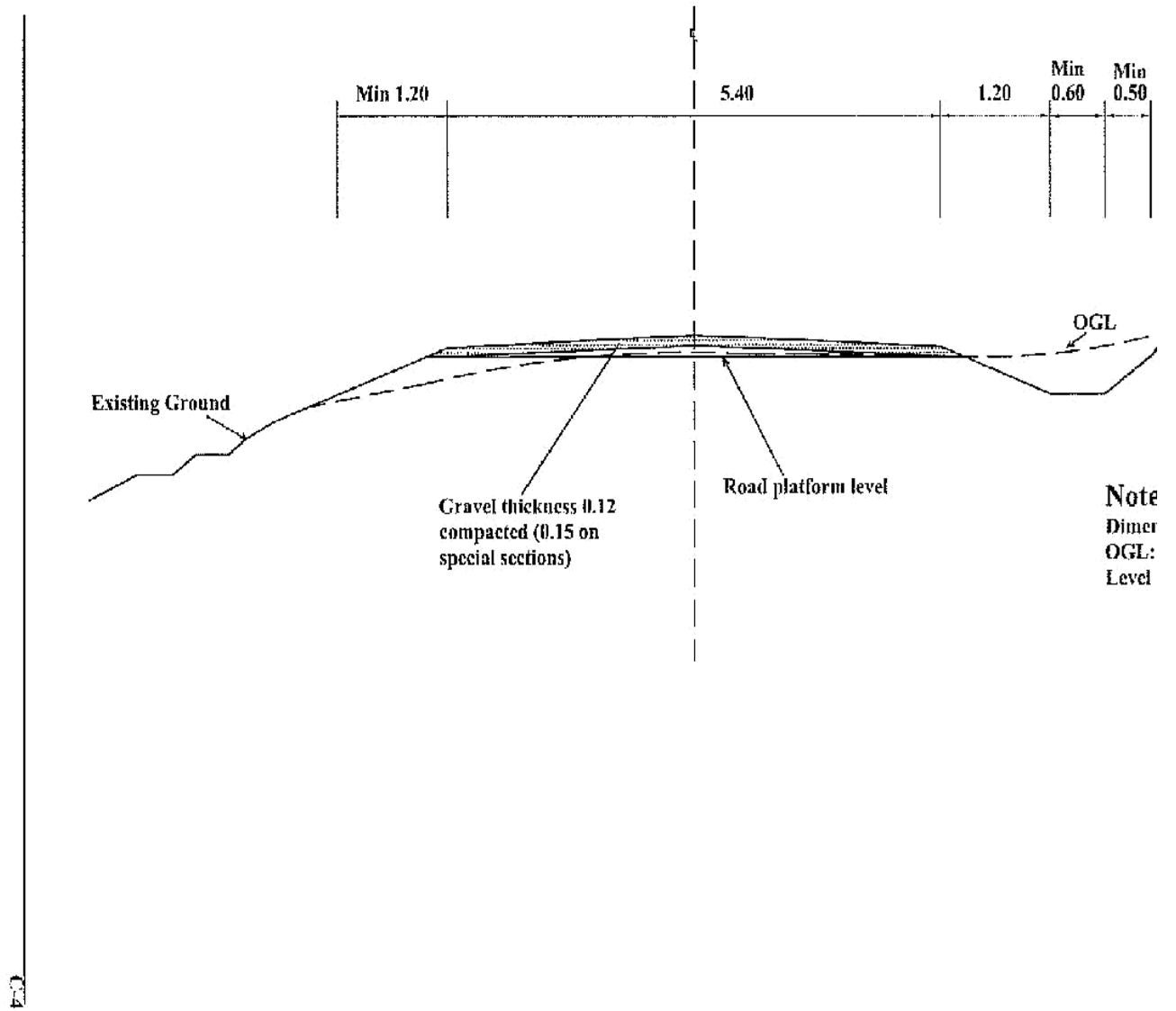
1. All dimensions in metres
2. Traffic levels of > 200vpd may justify a carriageway width of 6.0m
3. Gravel thickness may be increased as directed by the Engineer

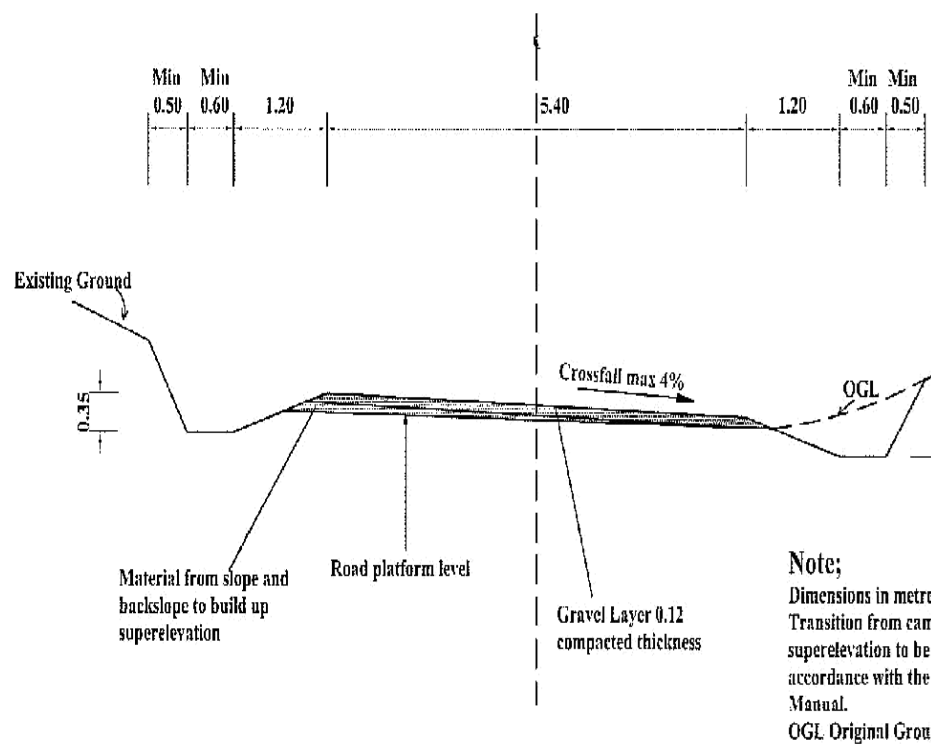


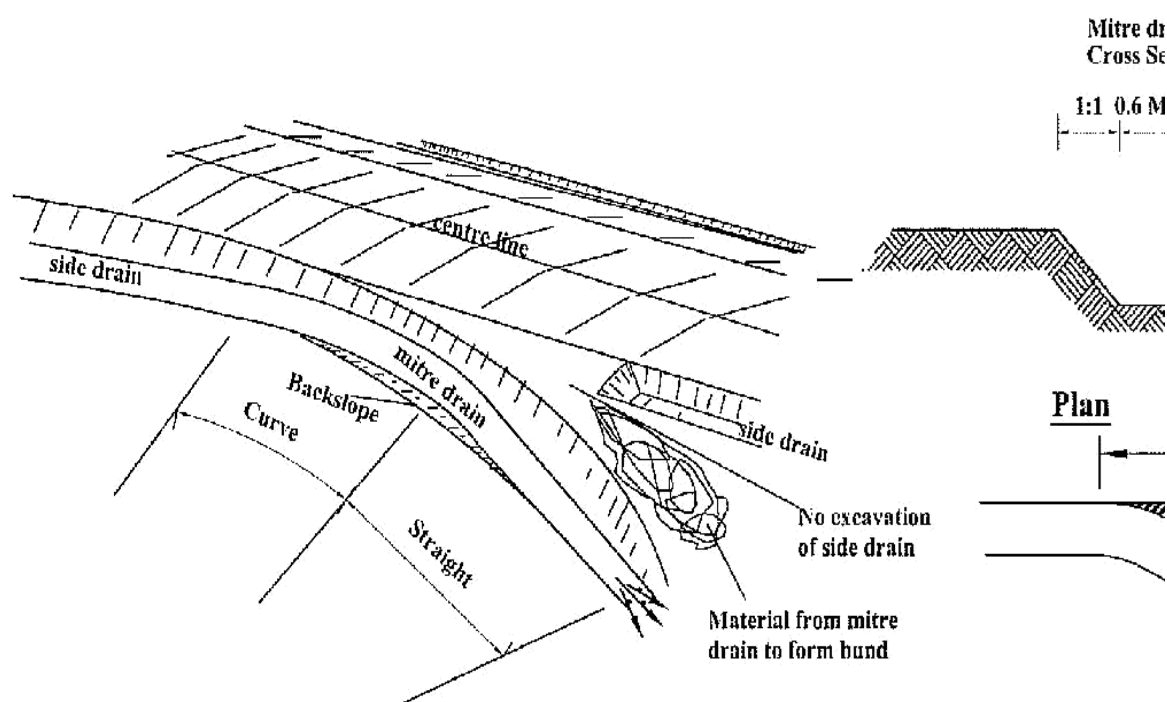
Notes:

1. All dimensions in metres
2. Gravel thickness may be increased as directed by the Engineer





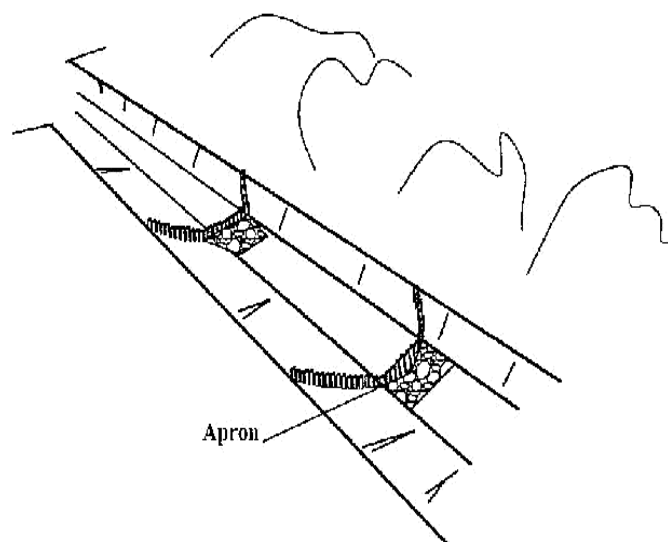




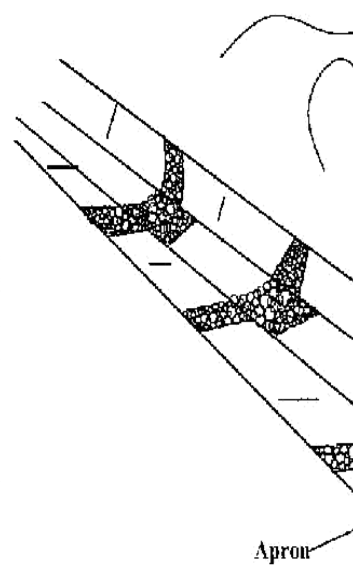
Notes

Location, direction and length of th
by the Engineer

Scour checks made of wooden stakes

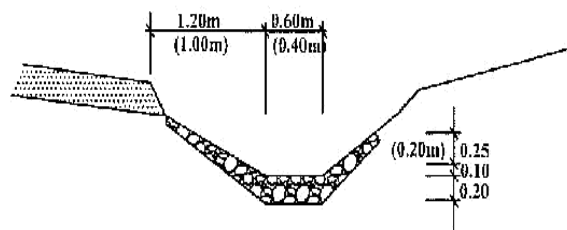


Scour checks made of stones

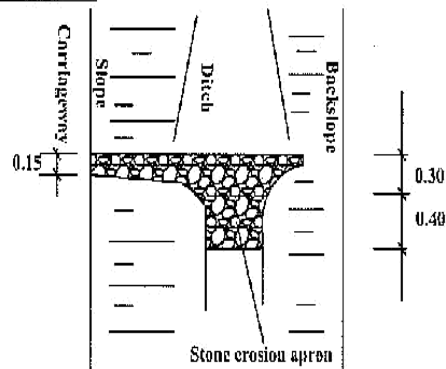


Scour checks made of stones

Cross section



Ground plan

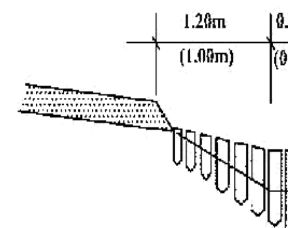


NOTE

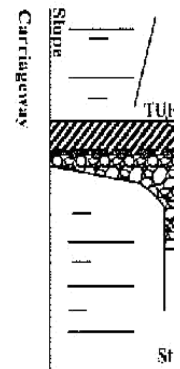
1. Dimensions in metres

Scour checks made of stakes

Cross section



Ground plan

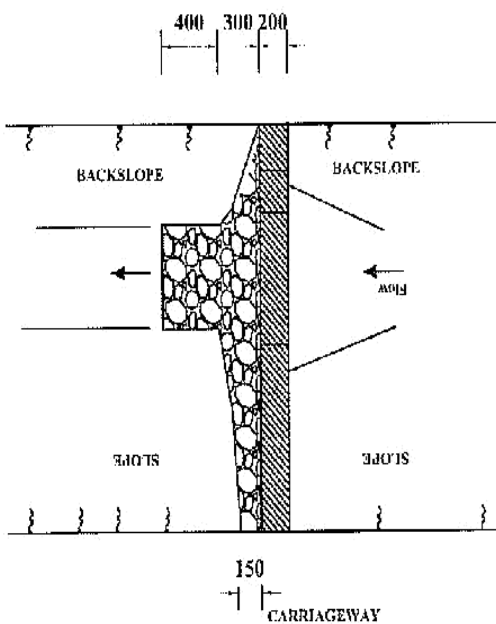


STONE WEIGHT: MIN 10KG
STAKE DIAMETER: MIN. 0.10



SECTION OF MASONRY SCOUR CHECK

Note
[Dimensions in mm]



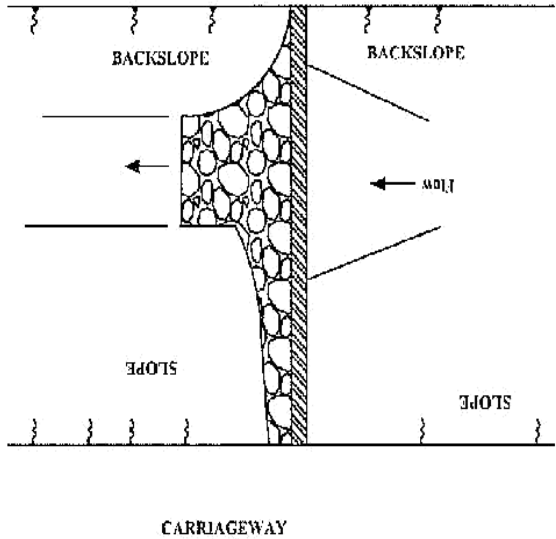
PLAN OF DRAIN WITH SCOUR CHECK

Cross-Section	Sizes In mm			Excav (cu3)	Concr of (cu3)	Apron stone pitching (cu3)
	Length	Width	Depth			
A	2400	300	550	0.22	0.25	0.18
R	2000	200	500	0.18	0.2	0.14

7

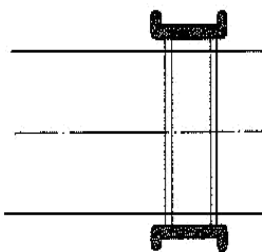
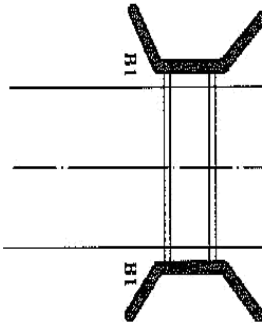
SECTION OF CONCRETE SCOUR CHECK

NOTE
1. Dimensions in mm



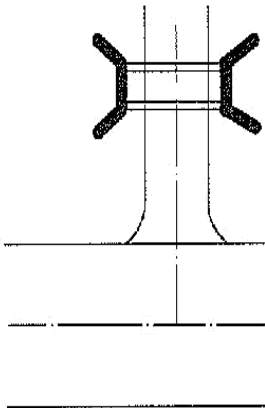
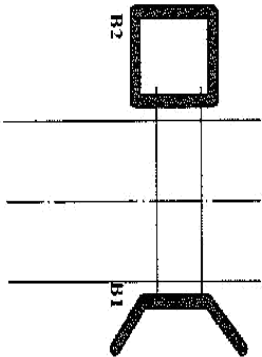
PLAN OF DRAIN WITH SCOUR CHECK

Cross-Section	Sizes in mm			Excav (m ³)	Concrete (m ³)	Apron stone pitching (m ³)
	Length	Width	Depth			
A	2400	100	550	0.13	0.15	0.18
B	2000	100	500	0.10	0.09	0.14



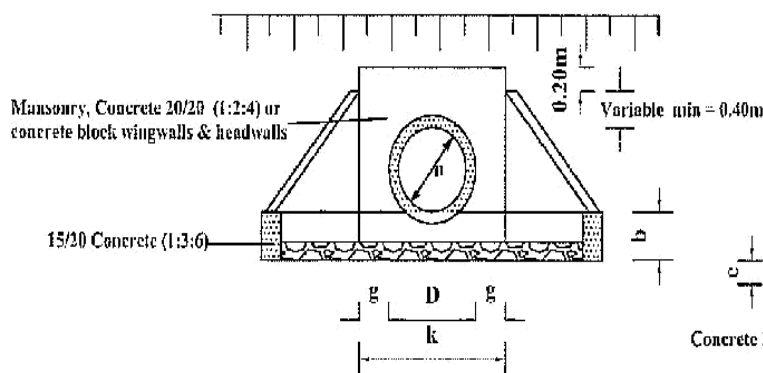
TYPE 2(ENTRY ONLY)

TYPE 4(ENTRY AND EXIT ON ACCESS)

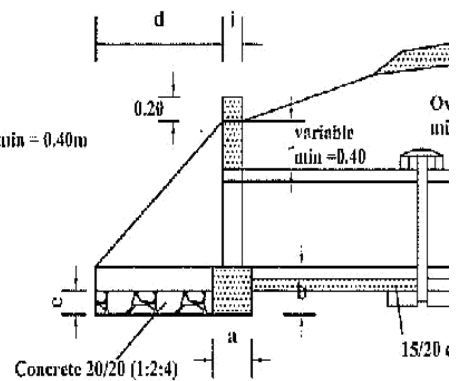


NOTE
 1. The code numbers specify the shape and function and the code letter denotes the material:
 A =Concrete block
 B =Stone masonry
 C =Concrete

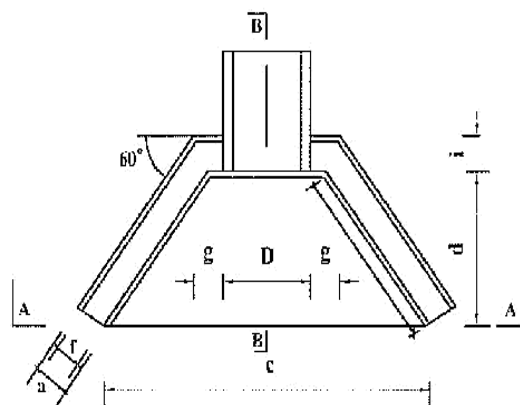
SECTION A-A



SECTION B-B



PLAN



CULVERT TYPES	
X-SECTION WIDTH m	No. of pipes
4.50	6
5.50	7
6.50	8

PIPE DIAMETER IN M	UNIT	TYPE A and C CONCRETE BLA	
		450	600
a	FOUNDATION	m	0.30 0.30
b	FOUNDATION	m	0.30 0.30
c	FOUNDATION	m	2.20 2.35
d	APRON	m	1.00 1.00
e	APRON	m	0.20 0.20
f	WALL	m	0.20 0.20
g	WALL	m	0.30 0.30
h	WALL	m	1.15 1.15
i	WALL	m	0.20 0.20
k	APRON	m	1.05 1.20
MATERIAL REQUIREMENT			
FOUNDATION (concrete)		m ³	0.30 0.32
HEAD/WINGWALLS (Concrete/Masonry)		m ³	0.42 0.49
APRON (concrete)		m ³	0.33 0.36

[illegible]

Technical drawing of a drainage channel cross-section and plan view. The cross-section shows a trapezoidal channel with a bottom width b , top width f , and height h . The side slopes are indicated by a ratio of 0.20m vertical to 1.00m horizontal. The plan view shows the channel layout with dimensions a and c .

PLAN

i k i

B

A

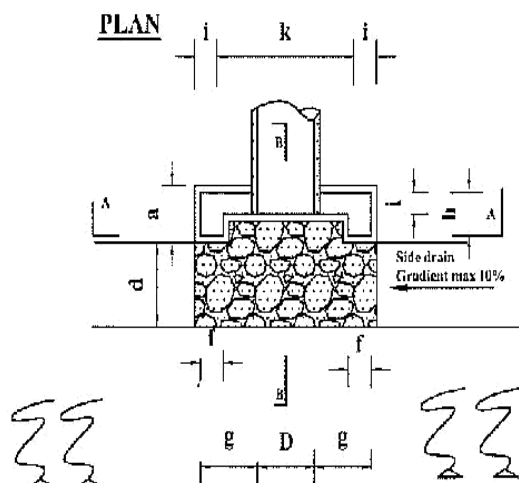
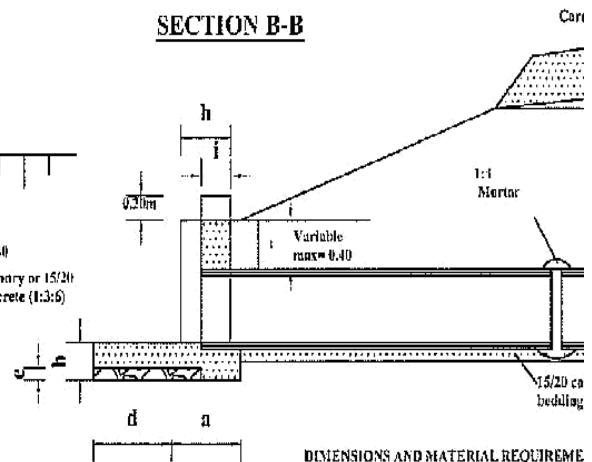
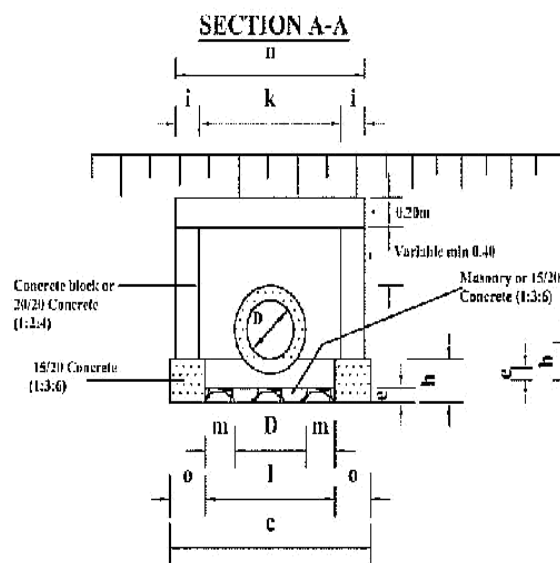
side drain

Stone Pitching to slopes

B

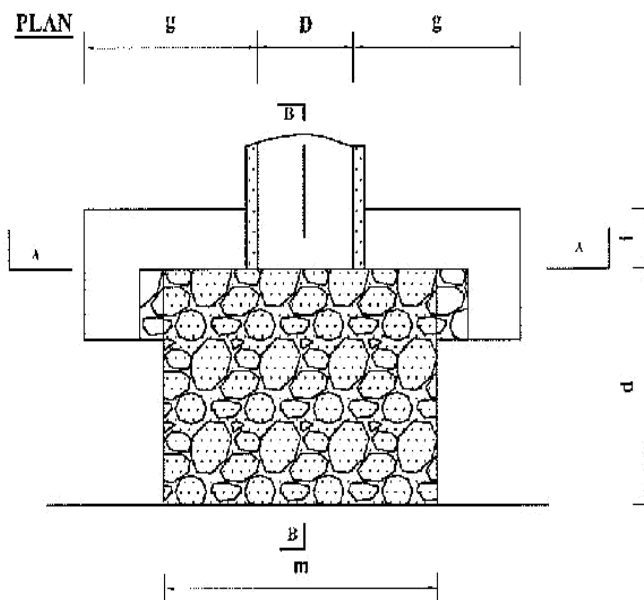
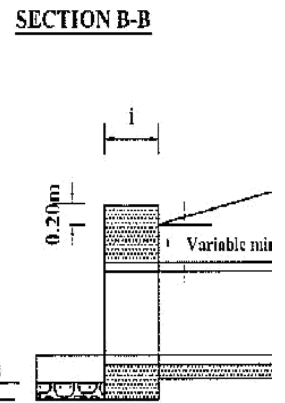
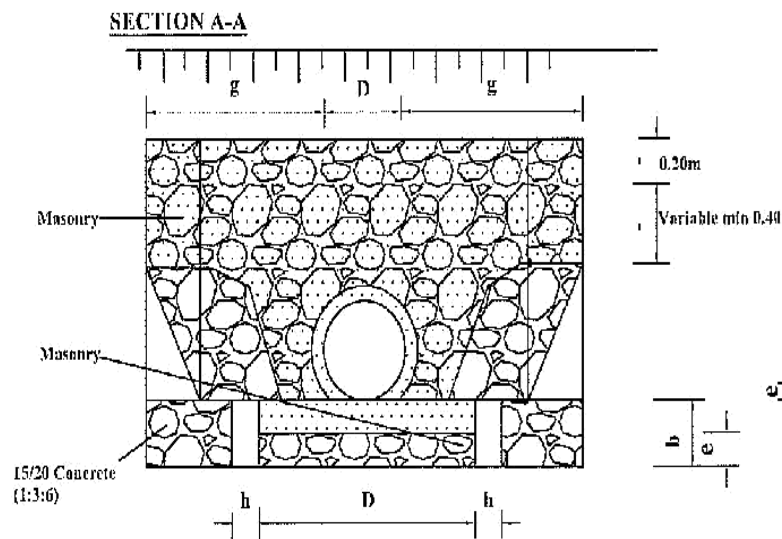
DIMENSIONS AND MATERIAL REQUIREMENTS

DIMENSIONS AND MATERIAL REQUIREMENTS					
PIPE DIAMETER IN (M)		TYPE A CONCRETE BLOCKS			TY M ³
		450	600	900	450
DIMENSION		UNIT			
a	FOUNDATION	m	0.30	0.30	0.30
b	FOUNDATION	m	0.30	0.30	0.30
c	FOUNDATION	m	1.10	1.10	1.40
d	APRON	m	0.90	0.90	0.90
e	APRON	m	0.20	0.20	0.20
f	DROP INLET	m	0.60	0.60	0.60
g	DROP INLET	m	0.30	0.40	0.60
h	DROP INLET	m	0.60	0.80	1.20
i	DROP INLET	m	0.20	0.20	0.20
k	DROP INLET	m	1.20	1.20	1.50
l	DROP INLET	m	1.80	1.90	1.90
m	DROP INLET	m	0.38	0.30	0.30
MATERIAL REQUIREMENT					
FOUNDATION (concrete)		m ³	0.47	0.47	0.52
HEAD/WINGWALLS (Concrete/Masonry)		m ³	0.56	0.72	1.15
APRON (concrete)		m ³	0.24	0.24	0.30



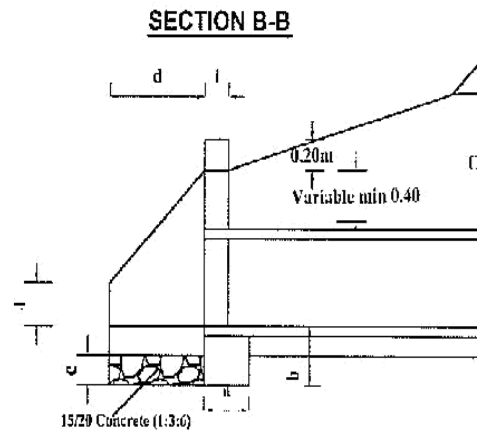
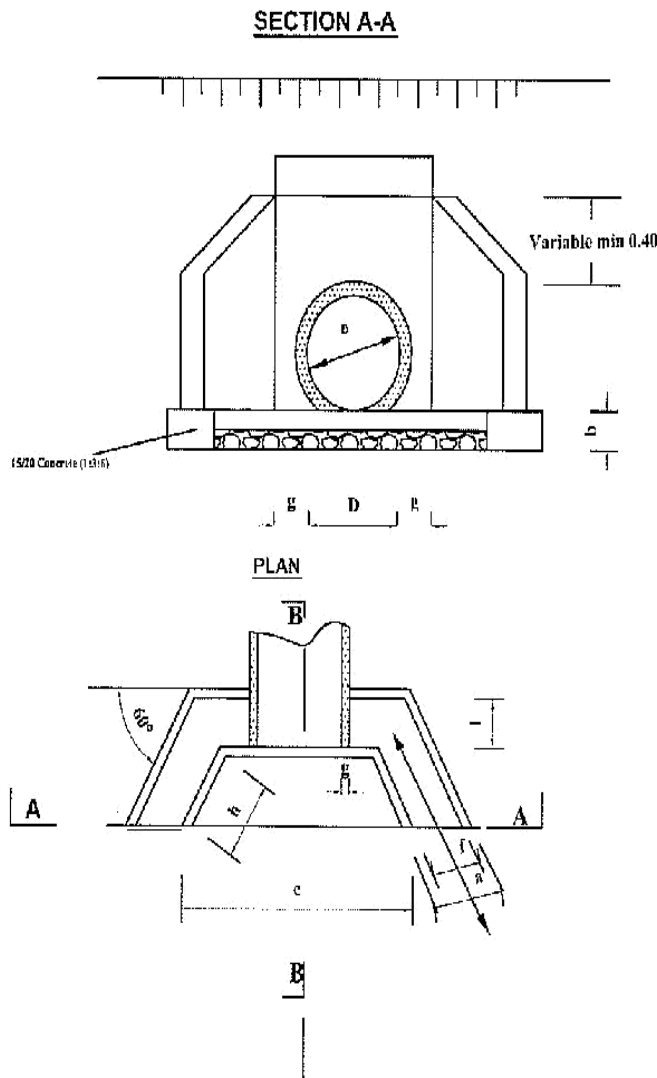
DIMENSIONS AND MATERIAL REQUIREMENT

PIPE DIAMETER IN (M)		TYPE A and C/C BLOCKS	
		450	600
DIMENSION	UNIT		
a FOUNDATION	m	0.50	0.50
b FOUNDATION	m	0.30	0.30
c FOUNDATION	m	1.55	1.70
d APRON	m	0.60	0.60
e APRON	m	0.20	0.20
f HEADWALL	m	0.20	0.20
g HEADWALL	m	0.50	0.50
h HEADWALL	m	0.50	0.50
i HEADWALL	m	0.50	0.50
k HEADWALL	m	0.50	0.50
l FOUNDATION	m	0.50	0.50
m FOUNDATION	m	0.50	0.50
n HEADWALL	m	0.50	0.50
o FOUNDATION	m	0.50	0.50
MATERIAL REQUIREMENT			
FOUNDATION (concrete)		0.23	0.19
HEAD/WING WALLS (Concrete/Masonry)		0.34	0.37
APRON (concrete)		0.95	0.99



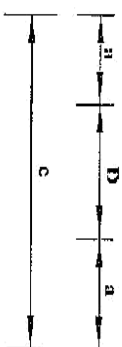
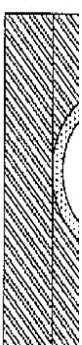
DIMENSIONS AND

PIPE DIAMETER (M)	
DIMENSION	
a	FOUNDATION
b	FOUNDATION
c	FOUNDATION
d	APRON
e	APRON
f	HEADWALL
g	HEADWALL
h	HEADWALL
i	HEADWALL
m	FOUNDATION
MATERIAL REQ'D	
FOUNDATION (concrete)	
HEAD/WING (Concrete/Masonry)	
APRON (concrete)	



DIMENSIONS AND MATERIAL REQUIREMENTS

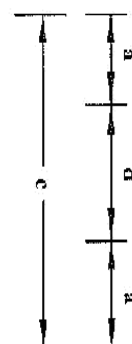
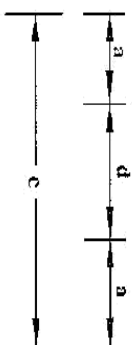
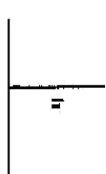
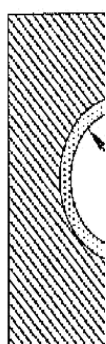
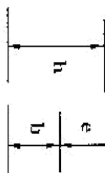
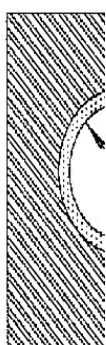
PIPE DIAMETER IN (M)	TYPE A (CONCRETE BLOCKS)			
		450	600	900
DIMENSION	UNIT			
a FOUNDATION	m	0.30	0.30	
b FOUNDATION	m	0.30	0.30	
c APRON	m	1.34	1.49	
d APRON	m	0.60	0.60	
e APRON	m	0.20	0.20	
f WINGWALLS	m	0.20	0.20	
g WINGWALLS	m	0.10	0.10	
h HEADWALLS	m	0.69	0.69	
i HEADWALLS	m	0.20	0.30	
k HEADWALLS	m	0.65	0.80	
l HEADWALLS	m	0.30	0.40	
MATERIAL REQUIREMENT				
FOUNDATION (concrete (1:3:6))		0.18	0.20	
HEAD/WINGWALLS (Concrete/Masonry)		0.28	0.32	
APRON (concrete)		0.12	0.14	



Diameter (D)	450 (mm)	600 (mm)	900 (mm)
a	0.15	0.20	0.20
b	0.10	0.15	0.15
c	0.86	1.12	1.48
d	0.56	0.72	1.08
e	0.14	0.18	0.27
f (mm)	0.34	0.45	0.68
g	-	-	-
h	0.24	0.33	0.42
i	-	-	-
Concrete Class 15/20	Volume in (m ³ /m)		
	0.24	0.24	0.24
Application	-Fair subgrade condition -Overfill > 75% of the pipe diameter -Seasonal water flow only		
Remarks	Material for back/overfill shall be approved by the Engineer		

450 (mm)	600 (mm)	900 (mm)
0.15	0.20	0.20
0.10	0.15	0.15
0.86	1.12	1.48
0.56	0.72	1.08
0.28	0.36	0.54
0.34	0.45	0.68
-	-	-
0.38	0.51	0.69
Volume in (m ³ /m)		
0.20	0.37	0.56
-Fair to poor subgrade condition -Overfill > 75% of the pipe diameter -Seasonal water flow only		
Material for back/overfill shall be approved by the Engineer		

e
b

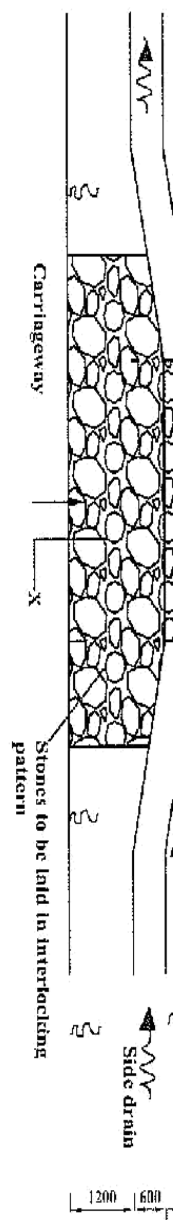


Diameter (D)	450 (mm)	600 (mm)	900 (mm)
a	0.15	0.20	0.20
b	0.10	0.15	0.15
c	0.86	1.12	1.48
d	0.56	0.72	1.08
e	0.42	0.54	0.81
f (min)	0.23	0.3	0.45
g	-	-	-
h	0.52	0.69	0.96
i	-	-	-

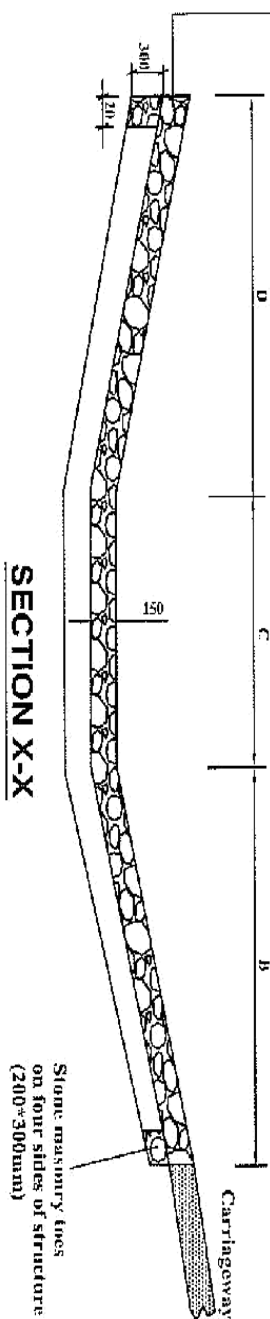
450 (mm)	600 (mm)	900 (mm)
0.15	0.20	0.20
0.10	0.15	0.15
0.86	1.12	1.48
0.56	0.72	1.08
0.46	0.52	0.78
0.15	0.15	0.15
0.15	0.15	0.15
0.81	1.02	1.38
0.28	0.35	0.45

Concrete Class 15/20	Volume in (m ³ /m)	0.26	0.47	0.71
Application	-Fair subgrade condition -Overfill > 75% of the pipe diameter -Seasonal water flow only			
Remarks	Material for back/overfill shall be approved by the Engineer			

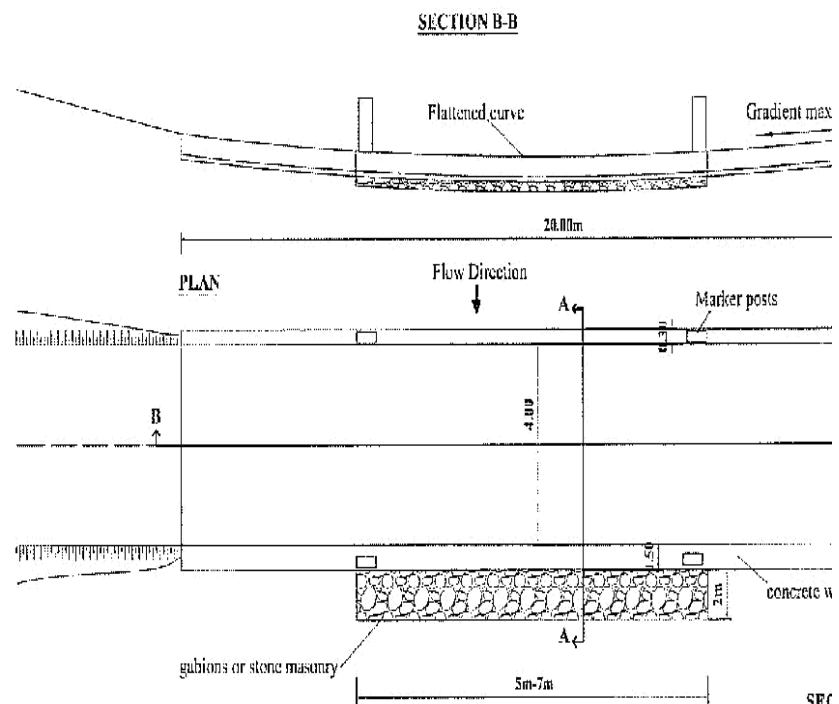
Volume in (m ³ /m)	0.37	0.61	0.92
Application	-Fair to poor subgrade condition -Overfill > 75% of the pipe diameter -Seasonal water flow only		
Remarks	Material for back/overfill shall be approved by the Engineer		



150mm Grouted Stone Pitching
(Cement mortar 1:4)

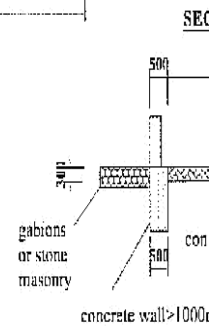


QUANTITIES TABLE						
Cross section	DIMENSIONS					Excavation(m ³)
	A	B	C	D	E	
A	4000	1800	600	1800	4200	7.5
	6000	1800	600	1800	4200	10.00
B	4000	1400	400	1800	3600	7.00
	6000	1400	400	1800	3600	9.00
						1.50
						25.50

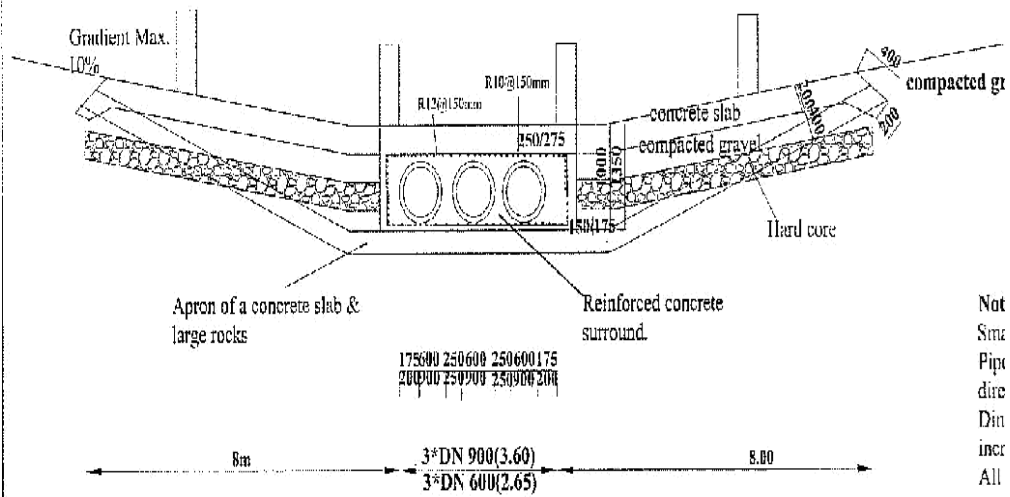


Material : All concrete Class 20/20 (1:2:4)

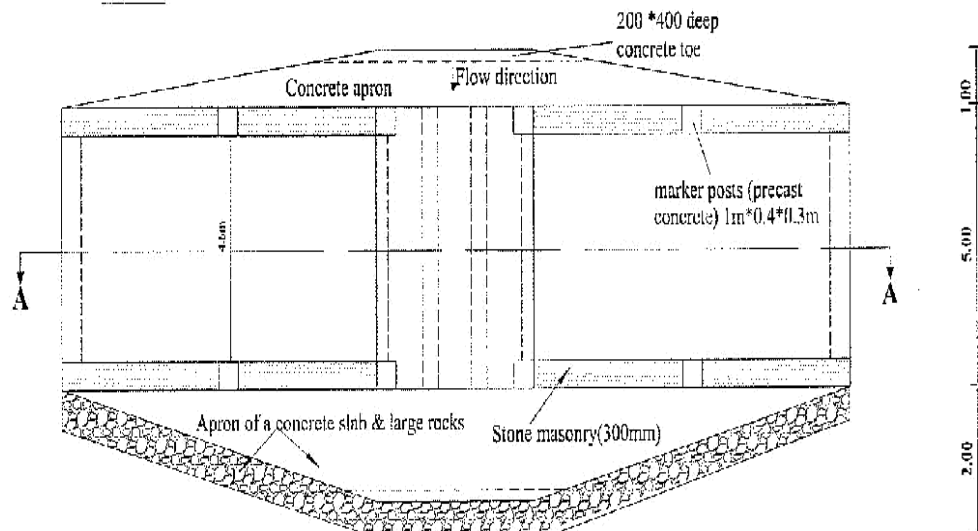
- 1 Concrete wall : 16m³
- 2 Concrete slab: 24m³ or stone masonry
- 3 Concrete toe : 8m³ or stone masonry
- 4 Gabions / mattress rock fill: 4.3m³ or stone masonry
- 5 Gabions / mattress: 36m³
- 6 Marker posts - precast concrete: 4 no.
- 7 Excavation (slab + toes + gabions) 54.2m³



SECTION A-A



PLAN

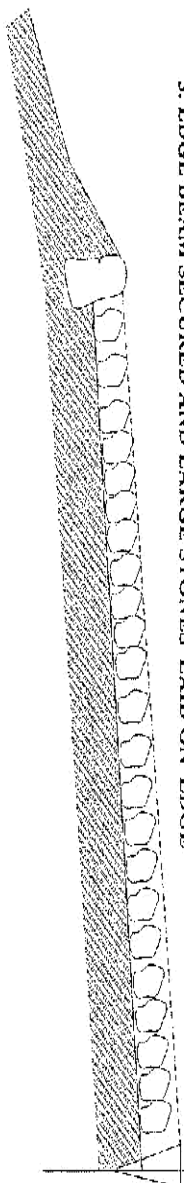




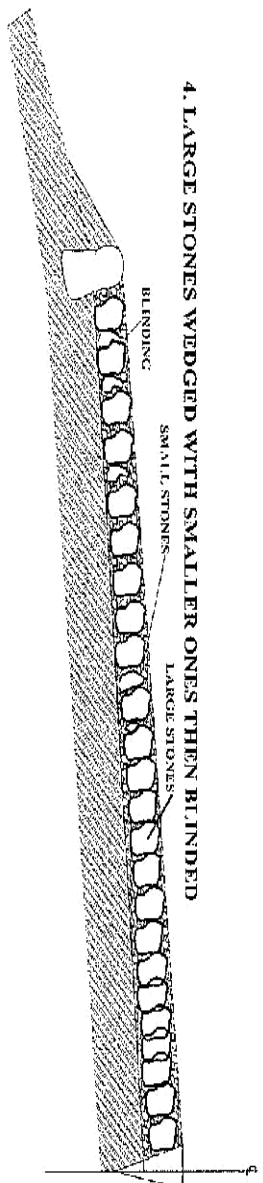
2. EDGE BEAM OF LARGE STONES



3. EDGE BEAM SECURED AND LARGE STONES LAID ON EDGE

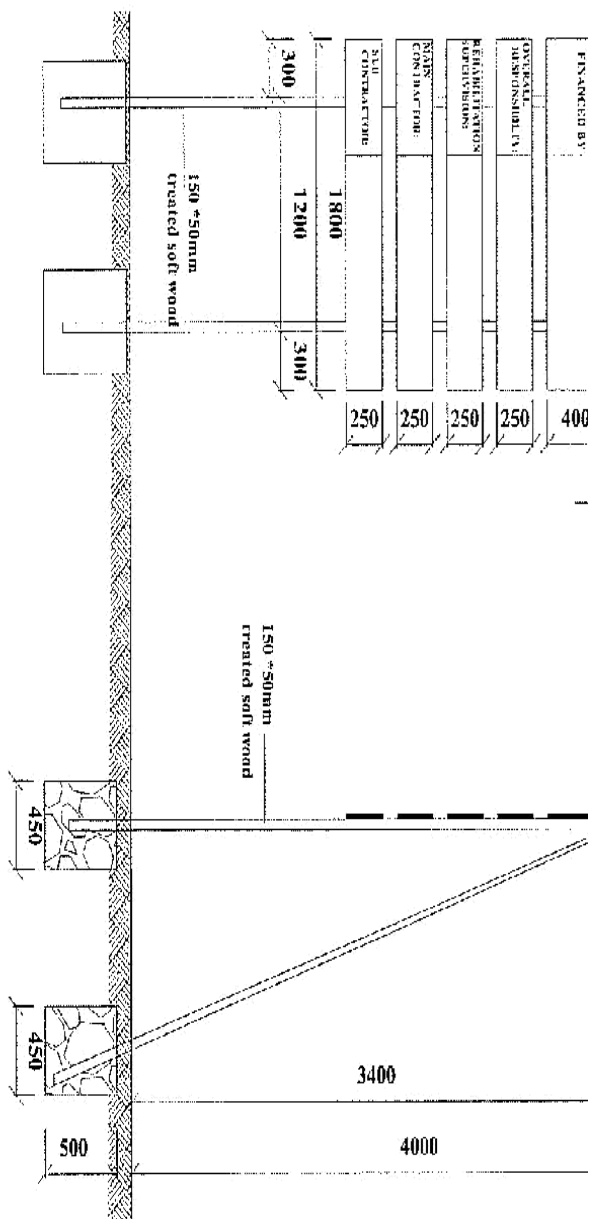


4. LARGE STONES WEDGED WITH SMALLER ONES THEN BLINDED










- C-22



WHITE
BLACK

NOTES

1. The wording of the project sign board and the location to be as directed by the Engineer.
2. Materials to be used for fabrication of signboard shall be pressure impregnated treated softwood timber
3. Wording board posts to be attached to the posts with galvanised nails
4. Project board posts and struts to be embedded in concrete class 20/20(1:2:4)

	GOVERNMENT OF KENYA MINISTRY OF ROADS AND TRANSPORT STATE DEPARTMENT OF ROADS FINANCED BY – FUEL LEVY FUNDS			
	KENYA RURAL ROADS AUTHORITY ROUTINE MAINTENANCE& SPOT IMPROVEMENT OF EMBU HOSPITAL - NJUKIRI – KIBUGU (C403) ROAD KERRA/EBU/MAN/08/39/6/2025-2026			
	EMPLOYER DIRECTOR GENERAL KENYA RURAL ROADS AUTHORITY			
	OVERALL RESPONSIBILITY DIRECTOR – ROAD ASSET MANAGEMENT			
LOGO	CONTRACTOR			
	GET TESTED FOR HIV/AIDS PLAN YOUR FUTURE			
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NOTES

1. Footing to be Class 15 Concrete
2. Height of letters 70mm and 35mm
3. Space between poles 1550mm
4. Board panels 250mm x 2150mm
5. Clearance from ground 1450mm

SECTION II - SPECIFICATIONS

BILL 01: PRELIMINARY AND GENERAL ITEMS

Scope:

This bill comprises those items that are required at the Commencement and Completion of the Works or that are Provisional Items applicable for the duration of the Works.

01-50- 001 Mobilization and Establishment of the Site

The Contractor shall provide all equipment, tools, materials, temporary offices, stores and housing required to carry out the Works.

The Contractor shall ensure that all possible means of protection are given to the labour force at all times. Such protection shall include provision of high visibility clothing or vests, goggles and masks for workers in potentially dangerous locations or dealing with potentially harmful materials. The Contractor shall also maintain first aid kits with a minimum of the following items:-

- Non-Stick wound dressing
- Selection of plaster/band aids
- Crepe bandages
- Gauze and cotton wool
- Antiseptic solution (washing wounds)
- Antiseptic cream – Betadine, Burnol
- Pain killers Panadol, Disprin
- Anti diarrhoea – Immodium, Diadis, Charcoal
- Anti histamine – Piriton, Triludan
- Anti nausea – Stemetil
- Eye ointment
- Oral re-hydration sachets
- Surgical gloves

Measurement and Payment: NA

01-60- 001 Contract Supervision

Provisional sum available for the Engineer for expenses incurred for supervising the contract such as allowances, casual wages and transportation within the project area.

Measurement and Payment:

Provisional Sum: Payable by the Contractor to the Engineer through certification as directed by the Engineer. No mark up is included in this item.

Work Method: NA

01-60- 002 Clearance on Completion

On Completion of the Works, all temporary housing, equipment, signs and tools shall be removed from the site, and the site left in good order to the satisfaction of the Engineer.

Measurement and Payment

The Lump Sum payment will be made upon approval by the Engineer that the Clearance has been

satisfactorily carried out.

Work Method: NA

01-60-003 Insurance

The Contractor shall provide Insurance in accordance with the Conditions of Contract as indicated in the Appendix to form of tender for Rehabilitation and Improvement Contracts and Clause 14.1 for small works conditions of contract.

Measurement and Payment

Lump Sum payment for this item will be made upon the production of satisfactory evidence by the Contractor that Insurances have been affected.

Work Method: NA

01-60-004 Quality Control Tests

The Engineer may instruct the Contractor during the progress of the Works to carry out quality control tests to check materials and standards of workmanship, against the Specifications.

Where such tests indicate defective standards, the Engineer shall instruct the Contractor to rectify the defects to the Engineer's satisfaction and at the Contractor's expense.

The Engineer shall include a Provisional Sum for this item to be expended only as and when the Contractor is instructed to carry out tests at approved material testing laboratories.

Measurement and Payment

Reimbursable item based on actual costs incurred by the contractor including sampling, transportation and testing.

Work Method: NA

01-60-005 Publicity Sign Boards

The Contractor shall provide Sign Boards as specified on the Drawings or as directed by the Engineer. The Sign Boards shall be placed at the beginning and end of the road or road bill covered by this Contract.

Sign Boards shall be maintained for the duration of the Works, and removed on completion.

Quality Control

The Engineer shall check that Sign Boards have been erected in accordance with Drawings and Specifications.

Measurement: Number

The unit of measurement shall be number of Sign Boards erected

Payment

The unit rate shall be the full compensation for labour, tools, materials and incidental costs required for carrying out the work.

Work Method: NA

01-60- 006 Drinking Water

The Contractor shall provide safe drinking water on site for workers at a reasonable distance from all work locations, for the duration of the Works.

Quality Control

The Engineer shall check regularly that adequate supplies of water are available throughout the Site.

Measurement and Payment

A Lump Sum shall be paid on a Monthly basis upon the approval of the Engineer that adequate supplies have been provided.

Work Method: LB

01-60-007 Provision of site sanitation facilities

The Contractor shall provide sanitation facilities on site for workers at a reasonable distance from all work locations, for the duration of the Works. This can be in the form of shallow pit latrines that are appropriately covered. All shallow pit latrines shall be filled in after the end of use.

Quality Control

The Engineer shall check regularly that adequate sanitation facilities are available throughout the Site.

Measurement and Payment

A Lump Sum shall be paid on a Monthly basis upon the approval of the Engineer that adequate sanitation facilities have been provided.

Work Method: LB

BILL 03: SETTING OUT

Scope

This bill covers the activities required in the re-establishment of the horizontal alignment of the road including setting out the centre line, cross section widths, drains and structures.

03-50-001: Setting Out the Horizontal Alignment

The Contractor shall set out the centreline to follow the existing road alignment unless instructed otherwise by the Engineer.

The minimum standards as shown in Table 2.1 shall apply.

Table 2.1 Alignment Standards

Standard	Flat and Rolling Terrain	Hilly Terrain
<i>Horizontal Curves</i>		
Desirable Minimum radius	100m	50m

The cross-section details of the road shall be as shown on the Drawing or as directed by the Engineer. Horizontal setting out shall be done for the approved work sections at a time but not for the entire road.

Work Method: **LB**

Quality Control

Centreline pegs shall be set at 10m intervals on straight sections and 5m on curves

Chainage or reference pegs shall be set out and marked at 20m intervals and located at one metre outside the cleared width and on both sides of the road.

Cross section widths shall be checked at 10m intervals and shall have maximum tolerances of + 25mm

Measurement Unit: m

The measurement shall be the linear metres of the road set out.

Payment:

The unit rate shall be the full compensation for labour, tools, materials and incidental costs required for carrying out the work.

BILL 04: SITE CLEARANCE

Scope

This bill covers the clearance of bushes, shrubs, grasses, trees, stumps, boulders, stripping and grubbing of the topsoil, removal of anthills and other unsuitable materials for the specified widths of the road, quarry and borrow areas. The distinction between light and heavy bush shall be decided by the Engineer.

The minimum site clearing widths for each of the activities shall be as shown in Table 4.1

Table 4.1: Site Clearing Widths

<i>Road Category</i>	<i>Running Surface</i>	<i>Stripping and Grubbing</i>	<i>Trees, Stumps, Boulders</i>	<i>Bush Clearing</i>
A/B/C + Secondary Roads	6.0 m	10.6 m	10.6 m	14.0 m
D/E + Minor Roads	5.4 m	10.0 m	10.0 m	13.0 m

RAR Roads	4.5 m	7.9 m	8.0 m	11.0 m
Minor / RAR roads with insufficient widths or Temporary sections	3.5 m	6.9 m	7.0 m	9.0 m

04-50-002 Grass Cutting

Grass shall be defined as any form of plant growth including small shrubs having a girth of not more than 100mm measured at height of 200mm above ground level.

The grass shall be cut to height of not more than 50 mm above the ground. The width limits shall be as instructed by the Engineer. All cut grass shall be removed from the carriageway, side drains, mitre drains and inlets and outlet drains of structures/culverts and deposited in approved spoil dumps

Burning of the grass shall not be allowed and care shall be taken not to damage roadside fixtures such as signs and marker posts.

This activity shall be carried out as either Machine Based (Mechanical Mowing) or as Labour Based as defined in the Bills of Quantity or as instructed by the Engineer.

Grass cutting shall be done off-carriageway and shall not include areas designated for grubbing.

Work Method: **LB or MB**

Quality Control

The road width for grass cutting shall be measured at 50-m intervals and shall be free of grass after the operation.

Measurement: m²

The measurement shall be area of grass cut, based on the standard width and measured length of clearing.

Payment

The unit rate shall be full compensation, for equipment, labour, materials, tools, and incidental costs required to carry out the work.

04-50-003 Bush Clearing (Heavy)

Where the Engineer designates an area as Heavy Bush (based on the undergrowth density) the Contractor shall clear all vegetation including small trees, shrubs and undergrowth, and their root systems, and shall salvage any re-useable timber or other material by cutting into logs and stacking. Other cleared material shall be collected and disposed of off-site as directed by the Engineer.

This activity shall be carried out as either Machine Based or as Labour Based as defined in the Bills of Quantity or as instructed by the Engineer.

Work Method: **LB or MB**

Quality Control

The Engineer shall check the cleared widths at 50 metre intervals

Measurement Unit: m²

The measurement shall be the area cleared to the specified width over the length as instructed by the Engineer.

Payment:

The unit rate shall be the full compensation for all labour, tools, equipment and incidental costs required to complete the work.

04-50-004 Bush Clearing (Light)

The Contractor shall clear all vegetation including small trees, and shrubs with their root systems. Grasses and any undergrowth shall be cut to a height of not more than 100mm. The cleared material shall be collected and disposed of away from the side drains and in a manner that causes no visibility obstruction to traffic.

This activity shall be carried out as either Machine Based or as Labour Based as defined in the Bills of Quantity or as instructed by the Engineer.

Work Method: **LB or MB**

Quality Control

The Engineer shall check the cleared widths at 50 metre intervals.

Measurement Unit: m²

The measurement shall be the area cleared to the specified width over the length as instructed by the Engineer.

Payment:

The unit rate shall be the full compensation for all labour, tools and incidental costs required to complete the work.

04-50-005 Pruning Tree Branches

Where instructed by the Engineer, the Contractor shall trim tree branches to improve visibility. Cut material shall be collected and disposed of as directed by the Engineer and burning of waste material shall not be permitted.

Work Method: **LB**

Quality Control

The Engineer shall check for visibility improvement.

Measurement and Payment

A Provisional Sum shall be allowed for this item, which shall be paid under Day works.

04-50-006 Trees and Stumps Removal (200-450mm girth)

Trees and Stumps outside the construction width but within the road reserve having a trunk girth of between 200-450mm at a point 600mm above the ground shall only be removed on the instruction of the Engineer.

The Contractor shall excavate around any trees to be removed to a depth not less than 0.5 m before cutting the roots. Existing stumps shall be uprooted in the same manner. All holes left by the removal of trees and stumps shall be back-filled with approved material and compacted to existing ground level. Cut material and stumps shall be collected and disposed of as directed by the Engineer. Burning of waste material shall not be permitted.

Work Method: **LB**

Quality Control

The Engineer shall approve the removal, backfilling and satisfactory disposal of all waste material.

Measurement Unit: No

The measurement shall be the number of trees and stumps removed.

Payment

The unit rate shall be the full compensation for all labour, tools and incidental costs required to complete this item.

04-50-007 Trees and Stump Removal (>450mm girth)

All the requirements of item 04-50-003 shall apply for trees and stumps greater than 450mm girth. In addition any re-useable timber from trees removed shall be cut into logs not more than 1.5 metres long and stacked as directed by the Engineer.

Work Method: **LB**

Quality Control

The Engineer shall approve the removal, backfilling and satisfactory disposal of all waste material.

Measurement Unit: No

Measurement shall be the number of trees and stumps removed

Payment:

The unit rate shall be the full compensation for all labour, tools, equipment and incidental costs required to complete this item.

04-50-008 Clearing Obstructions – Boulders and debris removal

The Contractor shall remove in a manner agreed by the Engineer, rocks and boulders greater than 1.5 m girth using labour, appropriate equipment and blasting as necessary. Boulders shall be disposed off outside the road area.

Blasting should only be done on instruction by the Engineer and only carried out by licensed individuals/firms.

Debris removal shall include:

Inspection of the road section(s) regularly

Removal of all obstructions such as fallen trees/ branches, rock fall, landslides and broken signs away from the road, side drains, mitre drains and other drains, inlets and outlets of drifts, culverts and other structures and the safe disposal thereof outside the road formation width.

Removal of dead animals' carcasses away for the carriageway and disposing of them as directed by the Engineer. Liaison with the Police may be necessary.

This activity shall be carried out as Machine Based, Labour Based or a mixture of the two as defined in the Bills of Quantity or as instructed by the Engineer.

Work Method: **LB, MB, LB-MB**

Quality Control

The Engineer shall approve the removal and satisfactory disposal of the boulders / debris.
The road section shall be free of any obstruction.

Measurement Unit: Provisional Sum

A Provisional Sum shall be included for this item

Payment:

Payment shall be made on a Day works basis.

04-50-009 Stripping and Grubbing

The Contractor shall remove, over the widths shown in Table 4.1, topsoil including grass, anthills, loose boulders up to 1.5m girth and other unsuitable material and deposit the debris outside the cleared area as directed by the Engineer.

Work Method: **LB**

Quality Control

The Engineer shall approve the stripped and grubbed area and the satisfactory disposal of waste material.

Measurement Unit m²

The measurement shall be the area grubbed as directed by the Engineer

Payment

The unit rate shall be the full compensation for all labour, tools and incidental expenses required to complete this item.

04-50-010 Excavate, remove and disposal of concrete structures

The Contractor shall excavate, remove and dispose of concrete structures as directed by the Engineer.

This activity shall be carried out either as Machine Based, Labour Based or a mixture of the two as defined in the Bills of Quantity or as instructed by the Engineer.

Work Method: **LB, MB, LB-MB**

Quality Control

The Engineer shall approve the area where the structure was removed from and the satisfactory disposal of the concrete structures.

A Provisional Sum shall be included for this item

Payment: Provisional Sum

Payment shall be made on a Day works basis.

Measurement Unit: Provisional Sum

BILL 05: EARTHWORKS

This bill covers the excavation of soil and the placing, watering and compaction of hard and soft material to form the road formation.

05-50-001: Establishment of the Vertical Alignment - Slotting

The Contractor shall re-establish the vertical alignment of the road section which includes the setting out and excavation of horizontal slots marking the level road platform.

The width of the slots shall be 0.5 m and they shall be set out at 10m intervals along the straight section and 5m on the curve sections of the road. Each slot shall be compacted using hand rammers until no more imprints of the rammer on the surface of the slot can be seen. The length of each slot shall be equal to the formation width of the road.

Vertical alignment standards shall be those set out in Table 5.1

Table 5.1 Vertical Alignment Standards

Standard	Flat & Rolling Terrain	Hilly Terrain
Gradients		
Desirable Minimum	2%	2%

Desirable Maximum	8%	10%
Absolute Maximum	10%	12%

The Contractor shall use Labour to carry out this item of work.

Work method: **LB**

Quality Control:

The hand rammer shall be not less than 5kg

The level of the slot shall have a tolerance of + 50 mm

The longitudinal profile of the road shall be checked at every third slot and shall have a maximum tolerance of + 50mm

Measurement Unit: m

The measurement shall be linear metres of road alignment set out

Payment:

The unit rate shall be the full compensation for labour, tools, materials and incidental costs required for carrying out the work.

05-50-002: Excavation, spread and compact in soft material (side drains)

The Contractor shall excavate side drains to the profiles shown on the Drawings or as directed by the Engineer.

Soft material in this case is defined as any material which is not hard or rock in which the average output is more than 1.5 m³ per PD.

The material from the excavations shall be placed on the carriageway, spread and compacted. Where additional material is required to achieve the required camber, the widths of the side drains may be increased, with the approval of the Engineer.

The fill layers to be compacted shall not exceed 150mm loose depth.

Compaction of the fill material shall be carried out from the edges to the centre by overlapping passes of the compaction equipment. The number of passes shall be as directed by the Engineer dependent upon the equipment used and the material being compacted. Unless otherwise instructed the moisture content of the material shall be within + 2% of optimum. Where additional moisture is required, water shall be applied in an even manner such that no longitudinal or transverse flow occurs.

Locations of the side drains shall be as shown on the Drawings or as directed by the Engineer, and the Contractor shall use the appropriate ditch template to control the excavations

The Contractor shall use Labour and appropriate compaction Equipment to carry out this item of work

Work method: **LB - MB**

Quality Control

- The dimensions of the side drains shall be checked at 50m intervals and shall have a tolerance of + 50mm
- The longitudinal profile of the side drains shall be checked at 30m intervals and shall have a tolerance of +50mm.
- *Compaction shall show no movement of material under the roller – minimum of 6 passes.*
- *Compaction test standard shall be 95% MDD (AASHTO T99)*

Measurement Unit m³

Measurement shall be the volume of material excavated to form the side drains, and deposited for camber formation.

Payment

The unit rate shall be the full compensation for labour, tools and incidental costs required for carrying out the work.

05-50-003 Excavation, spread and compact in hard material (side drains)

Where, in the opinion of the Engineer, the material to be excavated to form the side drains may be classified as hard (not rock) the Contractor shall carry out the excavation in accordance with 04-50-003 and shall be compensated under this item.

Hard material in this case is defined as hard gravel, dry black cotton soil, soil with high percentage of stones or other material in which the output is less than 1.5 m³ per PD.

This activity shall be carried out either as Machine Based, Labour Based or a mixture of the two as defined in the Bills of Quantity or as instructed by the Engineer.

Work Method: **LB, MB, LB-MB**

Quality Control:

The Engineer shall measure the volume of the excavation classified as Hard material

Measurement Unit: m³

The measurement shall be the volume of material excavated and deposited to form the camber

Payment:

The unit rate shall be the full compensation for all labour, tools, equipment and incidental costs required to complete the work.

05-50-004 Excavation to Level and Compaction

The Contractor shall cut material to form the level road platform and place the excavated material as fill or in spoil areas approved by the Engineer. Where material needs to be borrowed excavation shall only be from borrow areas approved by the Engineer.

The fill layers to be compacted shall not exceed 150mm loose depth.

Compaction of the fill material shall be carried out from the edges to the centre by overlapping passes of the compaction equipment. The number of passes shall be as directed by the Engineer dependent upon the equipment used and the material being compacted. Unless otherwise instructed the moisture content of the material shall be within + 2% of optimum. Where additional moisture is required water shall be applied in an even manner such that no longitudinal or transverse flow occurs.

The Engineer may instruct the Contractor to carry out density tests on the compacted material to ensure that an acceptable standard has been achieved.

The Contractor shall use Labour and appropriate compaction Equipment to carry out this item of work.

Work Method: **LB - MB**

Quality Control

- The width of the platform shall be checked at intervals of 50 m and shall have a tolerance of +50mm.
- *The level platform shall be horizontal in the transverse direction and shall have a tolerance of +15 mm under a 2 metre straight edge.*
- *The longitudinal profile shall have a maximum tolerance of +50 mm over a 30m length of gradient.*
- *Compaction shall show no movement of material under the roller – minimum of 6 passes.*
- *Compaction test standard shall be 95% MDD (AASHTO T99)*

Measurement Unit: m³

The measurement shall be the volume of compacted fill material forming the level platform.

Payment

The unit rate shall be the full compensation for labour, tools, equipment, water and incidental costs required for carrying out the work.

05-50-005 Spreading and Compaction for Camber Formation

The Contractor shall spread and compact the material deposited from the side drains to form the camber on the road, in accordance with the Drawings or as directed by the Engineer, and shall check the profile with the appropriate camber board.

Compaction shall be carried out from the edges to the centre line by overlapping passes of the compaction equipment. The number of passes shall be as directed by the Engineer dependent upon the equipment used and the material being compacted. Unless otherwise instructed the moisture content of the material shall be within + 2% of optimum. Where additional moisture is required water shall be applied in an even manner such that no longitudinal or transverse flow occurs.

The Engineer may instruct the Contractor to carry out density tests on the compacted material to ensure that an acceptable standard has been achieved.

The Contractor shall use Labour and appropriate compaction Equipment to carry out this item.

Work method: **LB-MB**

Quality Control

- The width of the carriageway including the shoulders shall be checked at 50m intervals and shall have a tolerance of +50/-20 mm.
- The camber shall be checked 50m intervals and shall have a tolerance of + 1%.
- Longitudinal levels shall be checked with a straight edge of minimum 2.7 m length. Maximum tolerance of +10 mm.
- Compaction shall show no movement of material under the roller, minimum of 6 passes.
- Compaction test standard shall be 95% MDD (AASHTO T99)

Measurement Unit **m²**

The measurement shall be the area of camber formed, according to the specified carriageway width and measured length of road.

Payment

The unit rate shall be the full compensation for all labour, tools, equipment, water and incidental costs required for carrying out the work.

05-50-006	Fill in soft material and compact.
05-50-007	Fill in hard material and compact.
05-50-008	Cut to spoil in soft material.
05-50-009	Cut to spoil in hard material.
05-50-010	Cut to fill in soft material.
05-50-011	Cut to fill in hard material.
05-50-012	Rock to fill to swamp
05-50-013	Filter to swamp under, over and around rock fill

These activities should be done in accordance with Bill 5, sub clauses 5.01 to 5.17 in the Standard Specifications for Roads and Bridges 1986.

05-50-014 Grassing

The Contractor shall plant sprigs of approved indigenous 'runner' type grass. The Contractor shall care for and water the grass until it is firmly established.

The Contractor shall use Labour to carry out this item of work.

Work Method: **LB**

Quality Control

The quality of grass and spacing of the sprigs shall be as directed by the Engineer

Measurement Unit **m²**

The unit of measurement shall be area calculated as the net area, measured on the slope.

Payment

The unit rate shall be full compensation, for labour, materials, tools, water and incidental costs required to carry out the work.

05-50-015 Back slope / Slope maintenance

This activity involves the protection / repair of erosion on embankment slopes, cut faces, shoulders, and side slopes by filling with suitable soils and compacting using appropriate tamping tools as instructed by the Engineer.

The Contractor shall use Labour to carry out this item of work.

Work Method: **LB**

Quality Control

The width of the slope shall be measured at 50m intervals and shall have maximum tolerances of +100mm.

Measurement Unit **m²**

The unit of measurement shall be area calculated as the net area, measured on the slope.

Payment

The unit rate shall be full compensation, for labour, materials, tools and incidental costs required to carry out the work.

BILL 07: EXCAVATION AND FILLING FOR STRUCTURES

This bill covers all Works in connection with the excavation for concrete pipe culverts; inlet and outlet structures; drifts and drainage protection Works;

07-50-001 Excavation for Drainage Structures – Soft Material

The Contractor shall excavate trenches for culverts; foundations for head walls, wing walls; inlet and outlet aprons and other drainage structures to the dimensions and levels shown on the Drawings or as directed by the Engineer. The excavations shall be kept free of water and shall be compacted with hand rammers of not less than 5kg.

The Engineer shall approve all excavations before the Contractor shall be permitted to proceed with the construction.

The Contractor shall take all necessary precautions to safeguard the stability and safety of the excavations.

The Contractor shall apply Labour methods to carry out this item

Work Method **LB**

Quality Control

- The dimensions of the excavations shall have a tolerance of +50mm
- The invert levels shall have a tolerance of +50mm
- The trench bottom gradients shall have a tolerance of +20mm over the length of the trench

Measurement Unit m³

The measurement shall be volume of material excavated measured net according to the Drawings.

Payment

The unit rate shall be the full compensation for labour, tools, and any incidental costs required for carrying out the work.

07-50-002 Excavation for Drainage Structures – Hard Material

Where, in the opinion of the Engineer, the material to be excavated to form the side drains and other drainage structures may be classified as hard (not rock) the Contractor shall carry out the excavation in accordance with 07-50-001 and shall be compensated under this item.

Hard material in this case is defined as hard gravel, dry black cotton soil, soil with high percentage of stones or other material in which the output is less than 1.5 m³ per PD.

This activity shall be carried out either as Machine Based, Labour Based or a mixture of the two as defined in the Bills of Quantity or as instructed by the Engineer.

Work Method: **LB, MB, LB-MB**

Quality Control:

The Engineer shall measure the volume of the excavation classified as hard material

Measurement Unit: m³

The measurement shall be the volume of material excavated and deposited.

Payment:

The unit rate shall be the full compensation for all labour, tools, equipment and incidental costs required to complete the work.

07-50-003	River training in soft material
07-50-004	River diversion
07-50-005	Porous filter material
07-50-006	Selected granular fill material
07-50-007	Cut to fill in soft material

These activities should be done in accordance with Bill 7, sub clauses 7.01 to 7.13 in the Standard Specifications for Roads and Bridges 1986.

BILL 08: CULVERT AND DRAINAGE WORKS

This bill covers all Works in connection with the installation of concrete pipe culverts; inlet and outlet structures; drifts and drainage protection Works; and the construction of Scour Checks

08-50-002: Ditch Cleaning

i. Partially silted

Partially silted drains are those that are less than half silted and require only cleaning.

All deposited material, debris, and vegetation shall be removed and the drain shaped to the original cross section and left in a free-draining condition. Suitable material may be used to fill depressions and potholes on the carriageway. All debris and other unsuitable material removed from the side drains shall be disposed of well clear of the drainage system in approved spoil dumps where it will not cause any obstruction or be washed back.

The side drains, mitre drains and catch water drains shall be cleaned before the onset of the rains or as directed by the Engineer.

This activity shall be carried out either as Machine Based, Labour Based or a mixture of the two as defined in the Bills of Quantity or as instructed by the Engineer.

Work Method: **LB, MB, LB-MB**

Quality Control

- Appropriate drain templates shall be used to check and control the dimensions of the drains.
- The longitudinal profile of the drains shall be checked using boning rods, to ensure free flow.

Measurement Unit: m

The measurement shall be the length of drain desilted or cleaned to the specified cross section.

Payment

The unit rate shall be full compensation, for labour, tools, and incidental costs required to carry out the work.

ii. Fully silted

Fully silted drains shall be those that are greater than half-silted and require re-excavation or reshaping.

All deposited material, debris, and vegetation shall be removed and the drain shaped to the original cross section and left in a free-draining condition. Suitable material may be used to fill depressions and potholes on the carriageway. All debris and other unsuitable material removed from the side drains shall be disposed of well clear of the drainage system in approved spoil dumps where it will not cause any obstruction or be washed back.

The side drains shall be desilted or re-excavated before the onset of the rains, or as directed by the

Engineer.

This activity shall be carried out either as Machine Based, Labour Based or a mixture of the two as defined in the Bills of Quantity or as instructed by the Engineer.

Work Method: **LB, MB, LB-MB**

Quality Control

- Appropriate drain templates shall be used to check and control the dimensions of the drains.
- The longitudinal profile of the drains shall be checked using boning rods, to ensure free flow.

Measurement Unit: m

The measurement shall be the length of drain re-excavated or re-shaped to the specified cross-section.

Payment

The unit rate shall be full compensation for equipment, labour, tools, and any incidental costs required to carry out the work.

08-50-003: Ditch Works earth fills.

This activity involves the reinstatement/protection works of culvert outlets by filling the resultant eroded ditch gullies with specified suitable soft material to ensure free passage of water at all times without causing further damage. The ditch shall be excavated to firm ground and shaped to the required suitable shape (depth, width, levelled and smoothed) to the satisfaction of the engineer prior to filling. The fill material shall be deposited in layers as directed by the Engineer.

The filling shall be carried with approved soft material and compacted in layers not exceeding 150 mm loose depth or in thickness that shall not exceed the maximum that the equipment and method of operation can process to meet the required compaction as directed by the Engineer.

The Contractor shall first reshape the eroded ditch gullies to suitable shapes for working, remove any unsuitable materials, supply, dump, spread and process and compact in accordance with Section 508 of the Standard Specifications or as instructed by the engineer.

Work Method: **LB-MB**

Quality Control:

The Engineer shall approve the borrow materials, measure the volume of the borrow fill materials, the compaction achieved of each layer and the gradient of the out fall to avoid further erosion.

Measurement Unit: m³

The measurement shall be the volume of the fill material excavated, transported and deposited to fill the ditch gullies.

Payment:

The unit rate shall be the full compensation for all labour, materials, tools, equipment and incidental costs required to complete the work.

08-50-004: Ditch Works rock fills. Supply and fill

This activity involves the reinstatement/protection works of culvert outlets by filling the resultant eroded ditch gullies with specified suitable hard material to ensure free passage of water at all times without causing further damage. The ditch shall be excavated to firm ground and shaped to the required suitable shape (depth, width, levelled and smoothened) to the satisfaction of the engineer prior to filling. The fill material shall be deposited in layers as directed by the Engineer.

The filling shall be carried with approved hard material and compacted in layers not exceeding 150 mm loose depth and systematically compacted by at least 8 passes of a towed vibrating roller weighing not less than 5 tonnes dead weight or in thickness that shall not exceed the maximum that the equipment and method of operation can process to meet the required compaction as directed by the Engineer. During compaction the surface of the layer shall be watered as necessary to facilitate the filling of the voids with the blinding material.

The Contractor shall first reshape the eroded ditch gullies to suitable shapes for working, remove any unsuitable materials, supply, dump, spread and process and compact in accordance with Section 508 of the Standard Specifications or as instructed by the engineer.

Work Method: **LB-MB**

Quality Control:

The Engineer shall approve and measure the volume of the hard materials, the compaction achieved of each layer and the gradient of the out fall to avoid further erosion.

Measurement Unit: m³

The measurement shall be the volume of the hard material excavated, transported and deposited to fill the ditch gullies to the desired level.

Payment:

The unit rate shall be the full compensation for all labour, materials, tools, equipment and incidental costs required to complete the work.

08-50-005: Ditch/Mitre Drains/Catch water Drains

The Contractor shall excavate side drains, mitre drains and catch water drains to the dimensions shown on the Drawings and at locations as directed by the Engineer. They shall be excavated in a manner to minimise erosion at the discharge point. The material excavated from the drains shall be used to form the side drain bund directing water to the mitre-drain, and a bund on the lower side of the cut-off drain, or used for forming camber or disposed of as directed by the Engineer.

This activity shall be carried out either as Machine Based, Labour Based or a mixture of the two as defined in the Bills of Quantity or as instructed by the Engineer.

Work Method: LB, MB, LB-MB

Quality Control

The longitudinal profile shall have a gradient of maximum 4%.

The dimensions of the drains shall have maximum tolerances of +20mm

The location of the drains shall be approved by the Engineer.

Measurement Unit: m³

The measurement shall be the volume of material excavated as measured on site in approved drains.

Payment

The unit rate shall be full compensation for labour, tools, equipment and incidental costs required for carrying out the work.

08-60-003/004: Culvert Cleaning (partially blocked)

08-60-003 600mm dia

08-60-004 900mm dia

This activity involves the cleaning of culverts of specified sizes including pipe barrels, the outlet/inlet structures, and the outlet drains, keeping them free of all debris, weed, silt and any obstruction to ensure free passage of water at all times. The debris shall be deposited in approved spoil dumps as directed by the Engineer

Partially blocked culverts shall be those with less than half of the barrel blocked.

Correct widths and slopes of the outlet drains shall be maintained. The gradient of the outlet drain shall be not less than 2 %.

All broken culvert barrels discovered in the course carrying out this activity shall be reported to the Engineer.

This activity shall be carried out before the rains, or as directed by the Engineer.

The Contractor shall use Labour to carry out this item of work

Work Method: **LB**

Quality Control

The culverts shall be checked as free of debris to the satisfaction of the Engineer.

Measurement Unit: m

The measurement shall be the length of culvert, including the outlet drain, cleaned

Payment

The unit rate shall be full compensation for labour, tools and incidental costs required to carry out the work.

08-60-008/9: Culvert Cleaning (Fully blocked):

08 - 60 - 008 600mm dia;

08 - 60 - 009 900mm dia;

This activity involves the cleaning of culverts of specified sizes including pipe barrels, the outlet/inlet structures, and the outlet drains, keeping them free of all debris, weed, silt and any obstruction to ensure free passage of water at all times. The debris shall be deposited in approved spoil dumps as directed by the Engineer

Fully blocked culvert shall be those with greater than half of the barrel blocked.

Correct widths and slopes of the outlet drains shall be maintained. The gradient of the outlet drain shall be not less than 2 %.

All broken culvert barrels discovered in the course of carrying out this activity shall be reported to the Engineer.

This activity should be carried out before the onset of the rains, or as directed by the Engineer.

The Contractor shall use Labour to carry out this item of work.

Work Method: LB

Quality Control

The culverts shall be checked as free from debris, to the satisfaction of the Engineer.

Measurement Unit: m

The measurement shall be the length of culvert, including the outlet drain cleaned.

Payment

The unit rate shall be full compensation for labour, tools and incidental costs required to carry out the work.

08-60-013/014 Concrete Culvert Repair / Replacement – Rings

08-60-13 600 mm

08-60-14 900 mm

The Contractor shall supply, lay and join concrete pipes to replace damaged culvert rings, including the concrete bedding and backfilling as instructed by the engineer.

The pipes shall be of Class 20/20 concrete, at least 28 days cured, and manufactured on site or procured from a supplier approved by the Engineer. The pipes shall be laid on a bedding of Class 15/20 concrete.

The culvert ring shall follow the existing gradient and shall be free flowing – minimum 2%.

Backfilling shall be carried with approved material and compacted in layers not exceeding 150 mm

loose depth and placed evenly on each side of the pipe. Ramps shall be shaped to achieve a minimum overfill of 75% of the pipe diameter, and shall be tapered back on the carriageway to provide a gradual approach, as directed by the Engineer.

On completion the inside of the culvert shall be smooth, without displaced joints or other obstructions and true to line and level.

The Contractor shall use Labour and appropriate compaction Equipment to carry out this item work

Work Method: LB-MB

Quality Control

- Concrete quality shall be checked for cracks, honey combing, and other defects.
- Before the pipes are laid, the gradient of the concrete bedding shall be checked and shall not be less than 2%
- The joints shall be checked to see that they have been properly made.

Measurement Unit: m

The measurement shall be in linear metres of the installed Type and size of culvert specified, measured net according to the Drawings.

Payment

The unit rate shall be the full compensation for labour, tools, materials, equipment and any other incidentals that may be required in carrying out the work.

08-60-024/029 Supply and Installation of Concrete Pipe Culverts

08-60-024	600	mm	unhaunched
08-60-025	600	mm	surrounds
08-60-026	900	mm	unhaunched
08-60-027	900	mm	surrounds

The Contractor shall supply, lay and join concrete pipes to form culverts, including the concrete bedding; haunching or surrounds; and backfilling, in accordance with the Drawings for the Type and diameter specified in the Contract or directed by the Engineer.

The pipes shall be of Class 20/20 concrete, at least 28 days cured, and manufactured on site or procured from a supplier approved by the Engineer and preferably ogee jointed. The pipes shall be laid on a bedding of Class 15/20 concrete of dimensions as shown on the Drawings and jointed with cement mortar 1:4.

The culvert gradient including the outlet shall be a minimum 2%.

The pipes shall be surrounded with Class 15/20 concrete to the dimensions shown on the Drawings or as directed by the Engineer.

Backfilling shall be carried with approved material and compacted in layers not exceeding 150 mm loose depth and placed evenly on each side of the pipe. Ramps shall be shaped to achieve a minimum

overfill of 75% of the pipe diameter, and shall be tapered back on the carriageway to provide a gradual approach, as directed by the Engineer.

If the Contractor wishes to construct culverts on site, using inflatable or collapsible forms the Engineer's approval shall first be sought for the proposed working method.

On completion the inside of the culvert shall be smooth, without displaced joints or other obstructions and true to line and level.

The Contractor shall use Labour and appropriate compaction Equipment to carry out this item work

Work Method: LM-MB

Quality Control

- Concrete quality shall be checked for cracks, honey combing, and other defects.
- Before the pipes are laid, the gradient of the concrete bedding shall be checked and shall not be less than 2%
- The joints shall be checked to see that they have been properly made.

Measurement Unit: m

The measurement shall be in linear metres of the installed Type and size of culvert specified, measured net according to the Drawings.

Payment

The unit rate shall be the full compensation for labour, tools, materials, equipment and any other incidentals that may be required in carrying out the work.

08- 60-017 Head Wall Repair - Masonry

This activity involves the repairs to damaged head walls and wing walls built in masonry.

Where directed by the Engineer, the masonry walls shall be inspected and loose or missing stone re-secured or replaced. Damaged pointing shall be repaired with cement mortar 1:4 and finished flush with the stonework.

The Contractor shall use Labour to carry out this item of work

Work Method: LB

Quality Control

- The stability of the walls and the pointing shall be to the satisfaction of the Engineer.

Measurement Unit: No

The measurement shall be the number of walls repaired as directed by the Engineer.

Payment

The unit rate shall be full compensation for labour, materials, tools, and incidental costs required to carry out the work.

08-60-018 Headwall Repair - Concrete

The activity involves the repairs to damaged concrete headwalls and wing walls, and to inlet/outlet concrete aprons. Concrete walls shall be inspected and repair works carried out as instructed by the Engineer to include breaking out and replacement of damaged concrete with similar material, and the rendering of open texture areas with cement mortar 1:4. Broken wall sections shall be re-built in 20/20 (1:2:4) concrete within formwork erected on the correct lines and levels in accordance with the Standard Drawings. Areas of new concrete and mortar shall be protected from direct sunlight and kept moist for 3 days.

The Contractor shall use Labour to carry out this item of work

Work Method: **LB**

Quality Control

The work shall be carried out to the satisfaction of the Engineer.

Measurement Unit: No

The measurement shall be the number of walls/aprons repaired.

Payment

The unit shall be full compensation for labour, materials, tools, and incidental costs required to carry out the work.

08-60-019 Headwall Construction - Masonry

The Contractor shall construct inlet and outlet structures for culverts including headwalls, wingwalls in stone masonry or concrete block, and aprons in concrete to the dimensions and levels shown on the Drawings (Types 1 to 4) as directed by the Engineer. The walls shall be built on foundations of class 15/20 concrete and jointed with cement mortar 1:4. The aprons shall be in Class 20/20 concrete and after laying the surface shall be kept moist for 3 days.

The Contractor shall use Labour to carry out this item.

Work Method: **LB-MB**

Quality Control

- The dimensions of the structures shall have a tolerance of +10mm
- The levels shall have a tolerance of +10mm
- The mortar joints shall be finished flush with the face of the walls.

Measurement Unit: m³

The measurement shall be the volume of the structures constructed, in whichever material, measured net according to the Drawings.

Payment

The unit rate shall be the full compensation for labour, tools, materials and any other incidentals that may be required in carrying out the work.

08-60-020 Headwall Construction – Concrete

The Contractor shall construct inlet and outlet structures for culverts in concrete to the dimensions and levels shown on the Drawings (Type 1 to 4) as directed by the Engineer.

Concrete shall be Class 20/20 unless otherwise specified. The formwork for the walls shall be erected on the concrete foundations, to the correct dimensions, and shall be approved by the Engineer before concrete is poured. Concrete shall be poured in a single lift and the top surface shall be kept moist for 3 days. Formwork may be struck after 2 days or as directed by the Engineer.

The Contractor shall use a concrete vibrator or other means approved by the Engineer to ensure full compaction of the concrete.

The Contractor shall use both Labour and appropriate Equipment to carry out this item.

Work Method: LM-MB

Quality Control

- The dimensions of the structures shall have a maximum tolerance of + 20mm / - 10mm
- The workability and mix of concrete shall be checked using the slump test and shall have a slump limit as directed by the Engineer. The frequency of testing shall be determined by the Engineer
- The concrete shall be checked for cracks, honey combing and other defects at the time of striking the formwork.

Measurement Unit: m³

The measurement shall be the volume of concrete in the completed structure, measured net in accordance with the Drawings.

Payment

The unit rate shall be the full compensation for labour, tools, materials, formwork, equipment and other incidentals that may be required in carrying out the work.

08-60-030	Excavate in soft material for culverts
08-60-031	Excavate in hard, material for culverts
08-60-032	Provide, lay and join 450mm inner dia. Concrete pipes
08-60-033	Provide, lay and join 600mm inner dia. Concrete pipes
08-60-034	Provide, lay and join 900mm inner dia. Concrete pipes
08-60-035	Provide, compact class 15/20 concrete
08-60-036	Provide, compact class 20/25 concrete
08-60-037	Provide and place A142 fabric mesh reinforcement
08-60-038	Selected backfill materials

These activities should be done in accordance with Bill 8, sub clauses 8.01 to 8.20 in the Standard Specifications for Roads and Bridges 1986.

The Contractor shall use both Labour and appropriate Equipment to carry out this item.

Work Method: LM-MB

Quality Control

- The workability and mix of concrete for the classes 15/20 and 20/25 shall be checked using the slump test and shall have a slump limit as directed by the Engineer.
- The laying and joining of the culverts shall be subject to the approval of the engineer.

Measurement Unit: m

The measurement shall be the length of culvert laid.

Payment

The unit rate shall be the full compensation for labour, tools, materials, formwork, equipment and other incidentals that may be required in carrying out the work.

08-70-001: Stone Pitching

The Contractor shall lay stone pitching at locations shown on the Drawings or as directed by the Engineer, which shall include levelling the area to be covered with stone pitching, collecting stones, laying stones, applying mortar to the joints and constructing weep holes, if required.

The area to be covered with stone pitching shall be trimmed to the level and slope shown on the Drawings or as directed by the Engineer. The prepared surface shall be firm and well compacted, with hand rammers.

The stones shall have minimum dimensions of 150mm and maximum 300mm and shall be set on the flat side and securely bedded, with the largest dimensions at right angles to the flow of water, in an interlocking pattern so as to leave only a minimum of voids between the stones which shall be filled with suitably shaped and tightly wedged spalls. The top of the pitching shall be finished flush with the adjacent material.

The stones shall be placed in full contact with the surface and bedded into cement mortar 1:4 with a minimum thickness of 100 mm. The mortar shall be worked into the pitching so that the voids between the stones are filled to the full depth of the pitching. The mortar shall be finished flush with the surface of the stones.

Weep holes shall be provided to stone pitching on slopes as directed by the Engineer.

The surface of the stone pitching shall be protected from direct sunshine and kept moist for 2 days.

The Contractor shall use Labour to carry out this item.

Work Method: LB

Quality Control

- The quality of pitching shall be checked for gaps and voids.
- The dimensions of the area of stone pitching shall have a tolerance of +100mm

Measurement Unit: m2

The measurement shall be the total area of pitching calculated as the net area, measured on the slope.

Payment

The unit rate shall be full compensation, for labour, tools, materials, and incidental costs required for carrying out the work.

08-70-002: Stone Pitching Repair

This activity involves the repair of stone pitching on slopes, in inlet/outlet aprons and access drifts. The stone pitching shall be inspected and repairs carried out as directed by the Engineer, including the replacement and re-bedding of missing or loose stones; the repair of mortar jointing; and the cleaning out of weep holes, as required. All work shall be to the lines and levels of the original construction with new stonework and mortar being flush with the adjacent materials.

The Contractor shall use Labour to carry out this work

Work Method: LB

Quality Control

The work shall be carried out to the satisfaction of the Engineer.

Measurement Unit: m2

The measurement shall be the net surface area of the repairs.

Payment

The unit rate shall be full compensation, for labour, tools, materials, and incidental costs required to carry out the work.

08-70-003: Gabion Repair

The Contractor shall repair installed Gabions using 3 mm galvanized binding wire to its original dimensions as directed by the Engineer.

The Contractor shall use Labour to carry out this item.

Work Method: LB

Quality Control

The repair of the Gabions shall be approved by the Engineer.

Measurement Unit: No

The measurement shall be the number of Gabion boxes repaired/installed.

Payment

The unit rate shall be the full compensation for labour, materials, and any incidental item costs necessary to carry out the work.

08-70-004: Gabion Installation

The Contractor shall provide and install Gabions as retaining walls and anti-erosion structures at locations shown on the Drawings or as directed by the Engineer.

Gabions shall include mattresses and boxes and for purposes of construction, measurement and payment, no distinction shall be made between them.

Gabions shall be 'Maccaferi' boxes or 'Reno' mattresses or equivalent approved by the Engineer.

The surfaces on which the Gabions are to be laid prior to being filled with rock shall be levelled to the depths and dimensions shown on the Drawings or as directed by the Engineer.

Gabion boxes shall be tied together with 3 mm galvanised binding wire securing all edges at 150mm intervals.

The Contractor shall use Labour to carry out this item.

Work Method: LB

Quality Control

The placing and tying of the Gabions shall be approved by the Engineer before filling commences.

Measurement Unit: No

The measurement shall be the number of Gabion boxes installed.

Payment

The unit rate shall be the full compensation for labour, materials, and any incidental item costs necessary to carry out the work.

08-70-005: Rock fill to Gabions

The Contractor shall provide selected rock, crushed if necessary, and carry out the packing and compacting of the rock inside the Gabion boxes.

The boxes shall be filled in layers from the sides towards the middle in an interlocking stone matrix to prevent deformation and bulging. The interior and top layers of the boxes shall be hand packed with smaller stone to form a tightly compact structure and rammed in place. Care shall be taken to ensure that each layer of boxes is filled evenly and to a level surface before the next course of boxes is placed.

The Contractor shall use a combination of Labour and transport Equipment to carry out this activity.

Work method: LB-MB

Quality Control

The filling and compaction of the stones in the Gabion boxes shall be approved by the Engineer.

Measurement Unit m³

Rock fill to Gabions shall be the volume of Gabions filled.

Payment

The unit rate shall be the full compensation for labour, tools, materials and incidental costs required for carrying out the work.

- 08-70-006: Construction of Scour Checks (Concrete)**
- 08-70-007: Construction of Scour Checks (Masonry)**
- 08-70-008: Construction of Scour Checks (Wooden Stakes)**

The Contractor shall construct scour checks using either stones, wooden stakes, or concrete as instructed by the Engineer.

Construction of concrete scour checks shall be in class 20/20 concrete, unless otherwise specified, and to the details shown in the Drawings.

Spacing for scour checks shall be as shown in Table 8.1, or as directed by the Engineer.

Table 8.1: Scour checks spacing

Gradient of Drain	Scour Check Spacing	Gradient of Drain	Scour Check Spacing
4% or less	not required	8%	7.5m
5%	20m	9%	6m
6%	15m	10%	5m
7%	10m	>10%	4m

The Contractor shall use Labour to carry out this item.

Work method: LB

Quality Control

The spacing of the scour checks shall have a tolerance of + 0.5m

The sizes of the wooden stakes and stones used shall be in accordance with the Drawings

The shape of the scour check shall be checked using the scour check template.

Measurement Unit: No.

The measurement shall be the number of scour checks constructed.

Payment

The unit rate shall be full compensation, for labour, tools, materials and incidental costs required for carrying out the work.

08-70-009:	Scour Check Repair - masonry
08-70-010:	Scour Check Repair - wooden
08-70-011:	Scour Check Repair - concrete

This activity involves the repair of Scour Checks using stones or wooden stakes or concrete. The construction details shall be shown in the Drawings or as instructed by the Engineer.

Scour checks shall be inspected and the repairs carried out as directed by the Engineer, which shall include replacement of missing or broken stonework and stakes; and the repair of damaged concrete, to the original lines, levels, and Specifications.

The Contractor shall use Labour to carry out this item work.

Work Method: LB

Quality Control

The sizes of the wooden stakes and stones used shall be as the original construction.
The shape of the scour check shall be checked using the scour check template.

Measurement: No.

The unit rate of measurement shall be the number of scour checks repaired.

Payment

The unit rate shall be full compensation, for labour, tools, materials, and incidental costs required for carrying out the work.

08-70-012 At-level Scour Checks

The Contractor shall select and place flat stones of minimum dimensions 0.10-0.15m in gently sloping channels (parabolic waterway) at locations and intervals as shown in drawing C9c. The stones shall be placed in a manner to ensure minimum voids within the structure. A trench 0.2m deep by 0.2m wide shall be excavated in the invert of the channel and extended 0.2m into the slopes. Stones shall be laid up to the level of the invert with the middle section lower than the sides to form a spill way. The spacing of the checks shall be 1-4 metres, as directed by the Engineer.

The Contractor shall use Labour to carry out this item.

Work Method: LB

Quality Control

The construction and spacing of the scour checks shall be checked by the Engineer.

Measurement Unit: No

The measurement shall be the number of scour checks constructed.

Payment

The unit rate shall be full compensation for labour, tools, materials and incidental costs required to carry out the work.

The payment for the construction of the parabolic waterway is under item 08-50-005

08-80-013	Gully – head protection - Stone Chute Stabilisation
08-80-014	Gully – head protection - Stone and Post Chute Stabilisation

The Contractor shall construct gully-head protection works as directed by the Engineer to the dimensions and details shown on Drawings C9d.

The dimensions of the stones shall not be less than 200mm and the volume not less than 0.01m³ for the smaller stones and pebbles to be used as the transition layer between the stone structure and the ground. No rounded stones shall be used. Posts shall be durable hardwood minimum 900mm in length and 15mm diameter.

The gully head shall be excavated as shown on Drawings to form a firm base for the stone layers. The initial layer shall be the small stones and gravel to a depth of 150mm after which the larger stone shall be carefully placed to form a compact matrix. Posts shall be driven a minimum of 600mm into the ground at spacing as directed by the Engineer.

The Contractor shall use Labour to carry out this item

Work Method: LB

Quality Control

The stone dimensions and construction shall be checked by the Engineer.

Measurement Unit: No

The measurement shall be number of units constructed

Payment

The unit rate shall be full compensation for labour, tools, materials and incidental costs required to carry out the work.

08-80-015	Stone Check Dams
08-80-016	Stone and Post Check Dams

The Contractor shall construct check dams in erosion gullies to the dimensions and details shown on Drawing C9e and/or as directed by the Engineer.

The dimensions of the stones in the main structure shall not be less than 200mm and the volume not less than 0.01 m³ for the stones and pebbles for the transition layer between the stone structure and the

ground. No rounded stones shall be used.

Posts shall be durable treated hardwood of minimum diameter 0.10m, of minimum length 1.6m, driven at least 600mm into the ground. Stones shall be carefully hand-packed to provide a stable structure with a minimum of voids.

The dam checks shall be constructed such that the top of the dam is lower than the level of the adjacent land to leave sufficient channel for water flow, the crest of the check dam is parabolic in shape forming the spillway and it is keyed into the excavation of the gully floor and into the sides of the gully. The gully floor below the check dam must be protected from erosion by an apron with parabolic shape protecting the sides of the channel. The posts must be hammered into the ground to a depth equal to the post height above the ground or a minimum of 0.6 m.

The spacing of the check dams shall be as shown in the table below:

Check Dam Spacing					
Gradient	Height of dam spill way (m)				
%	0.15	0.25	0.50	0.75	1.00
5	15.0	25.0			
7	5.0	8.7	17.5	25	35
10	2.5	4.2	8.4	12.6	16.8
15	1.4	2.3	4.6	6.9	9.2
20	0.9	1.6	3.2	4.8	6.4
25		1.3	2.5	3.8	5.0
30		1.0	2.0	3.0	4.0
40			1.6	2.4	3.2
50			1.2	1.8	2.0

Work Method: **LB**

The Contractor shall use Labour to carry out this item

Quality Control

The Engineer shall check the workmanship and spacing of the check dams.

Measurement Unit: No

The measurement shall be the number of check dams constructed

Payment

The unit rate shall be full compensation for labour, tools, materials and incidental costs required to carry out the work.

08- 080-001 Access Drifts (Stone Pitching)

The Contractor shall construct Access drifts in grouted stone pitching to the dimensions as shown on drawing C18 or as directed by the Engineer. This shall include the provision of stone and the levelling of the areas to be covered.

The stone pitching for Access drifts shall comply with the requirement of 08-70-001 (stone pitching)

with the addition of masonry toes at each end of the drift as shown on the Drawings.

The area to be covered shall be trimmed to the line and slope shown on the Drawings or as directed by the Engineer, and the prepared surface compacted with hand rammers or appropriate equipment.

The grouted stone pitching shall be covered with wet sacking or other approved cover for not less than 4 days after laying and shall not be subject to loading until adequate strength has been developed as instructed by the Engineer.

The Contractor shall use Labour and appropriate Equipment to carry out this item.

Work Method: LB-MB

Quality Control

- i) Stone pitching quality shall be as for 08-70-001

Measurement Unit m²

The measurement shall be the area of stone pitching, measured net according to the Drawings.

Payment

The unit rate shall be full compensation for labour, tools, materials, equipment and incidental costs required for carrying out the work.

BILL 10: GRADING AND GRAVELLING

Scope:

Grading covers the work of reinstating the road carriageway to the correct camber by removing the high points and filling gullies, corrugations, and wheel ruts to restore a smooth running surface.

Grading can either be done by labour (Manual Reshaping) or by Machine (Motorized grading or towed grading).

Manual reshaping is preferable where there is sufficient labour. For existing roads with side drains light manual reshaping should be used as defined in 10-50-004. Heavy manual reshaping should be used for roads that have deteriorated to such an extent that the drains and carriageway need to be re-instated. Heavy Manual Reshaping is defined under Bill 5 – Earth Works.

Light grading is carried out on good and fair roads as a maintenance activity while heavy grading is for re-establishing a road in poor or very poor condition.

Gravelling consists of the excavation; loading, hauling, dumping, spreading and compacting using approved equipment of gravel wearing course material on the formation of the road carriageway. Gravel shall include lateritic gravel, quartzitic gravel, calcareous gravel, decomposed rock, soft stone coral rag, clayey sand and crushed rock.

The material may be obtained from quarries, borrow pits or excavation in cuttings as directed by the Engineer. Gravel material shall conform to the requirement given in

Table 10.1: Requirement for Gravel Wearing Course

GRADING REQUIREMENTS	
Sieve (mm)	% by Weight Passing
40	100
28	95 – 100
20	85 – 100
14	65 – 100
10	55 – 100
5	35 – 92
2	23 – 77
1	18 – 62
0.425	14 – 50
0.075	10 – 40

For “Quarry Waste” gravel stones of maximum dimension 80mm may be permitted

PLASTICITY INDEX REQUIREMENTS PI		
Zone	Min	Max
WET: Mean annual rainfall > 500mm	5	20
DRY: Mean annual Rainfall < 500mm	10	30

BEARING STRENGTH REQUIREMENTS		
Traffic Commercial VPD	CBR	DCP Equivalent mm/Blow
>15	20	11
<15	15	14
CBR at 95 % MDD, Modified AASHTO and 4 days soaking		
Lower quality material (CBR 15) may be accepted if no better material can be found		

The Engineer shall approve quarries and the extent of their exploitation. The possible quarries shall be shown to the Contractor prior to commencement of the Works. The Contractor shall be responsible for the acquisition of the quarry rights and shall conduct respective negotiations with landowners and affected communities.

Alternative sources of gravel material whose quality can be shown to be in compliance with the specification requirements may be used, with the approval of the Engineer. The Contractor is deemed to have included in his rates for the provision of the gravel material.

10-50-001: Heavy Grading without watering and compaction.

Heavy grading without watering and compaction shall only be done when there is sufficient moisture in the material and the material can be compacted by traffic.

The Contractor shall scarify the existing carriageway surface, cutting high spots and moving materials to fill potholes, corrugations and wheel ruts and reshape the surface to the specified camber, using a Motor grader unless otherwise directed by the Engineer. All loose rocks, roots and grasses shall be removed first and disposed of well clear of the drains.

Pegs 300 to 400mm long shall be placed at 20 m intervals to mark edge of the carriageway.

The material shall be graded toward the centre of the road starting from both edges until the specified camber is achieved. Suitable material from the side drains may be used as additional material. Any further material needed to achieve the correct camber shall be from an approved source.

No grading shall be carried out in dry conditions.

The Contractor shall use Equipment to carry out this item.

Work Method: MB

Quality Control

The width of the carriageway shall be checked at every 50m intervals and have a tolerance of + 50mm or -20mm.

The camber shall be checked with a camber board at 25m intervals and shall have a tolerance of + 1%

Measurement Unit: m²

The measurement shall be the area of carriageway graded, measured net according to the specified width and measured length graded.

Payment

The unit rate shall be the full compensation for labour, tools, equipment and incidental costs required for carrying out the work.

10-50-002: Heavy Grading with watering and compaction.

The Contractor shall scarify the existing carriageway surface, cutting high spots and moving materials to fill potholes, corrugations and wheel ruts and reshape the surface to the specified camber, using a Motor grader unless otherwise directed by the Engineer. All loose rocks, roots and grasses shall be removed first and disposed of well clear of the drains.

Pegs 300 to 400mm long shall be placed at 20 m intervals to mark edge of the carriageway.

The material shall be bladed toward the centre of the road starting from both edges until the specified camber is achieved. Suitable material from the side drains may be used as additional material. Any further material needed to achieve the correct camber shall be from an approved source. Compaction shall be carried out using appropriate equipment approved by the Engineer, from the carriageway edges to the centerline in overlapping passes.

In order to achieve the desired compaction water shall be added in an even manner without transverse or longitudinal flow.

The Contractor shall use Equipment to carry out this item.

Work Method: MB

Quality Control

- The width of the carriageway shall be checked at every 50m intervals and have a tolerance of + 50mm or -20mm.
- The camber shall be checked with a camber board at 25m intervals and shall have a tolerance of + 1%
- Longitudinal levels shall be checked with a straight edge of minimum 2.7 m length. Maximum tolerance of + 10 mm.
- Compaction shall show no movement of material under the roller, minimum of 6 passes.
- Compaction test standard shall be 95% MDD (AASHTO T99)

Measurement Unit: m²

The measurement shall be the area of carriageway graded, measured net according to the specified

width and measured length graded.

Payment

The unit rate shall be the full compensation for labour, tools, equipment and incidental costs required for carrying out the work.

10-50- 004: Carriageway Grading - Light Grading

Light grading shall only be done when there is sufficient moisture in the material. The Contractor shall grade the carriageway to control roughness and corrugations using either a Towed or a Motor grader. The width of the carriageway shall be as specified for the Road Class.

Pegs 200 to 300mm long shall be placed at 20 m intervals to mark edge of the carriageway

The material shall be bladed toward the centre of the road, starting from both edges, to the specified camber. Where instructed by the Engineer, suitable materials from the side drains may be used to fill potholes and gullies in the carriageway. Any further material needed to re-form the camber shall be from an approved source. Compaction shall be achieved using the wheels of the equipment, tracked evenly over the full surface, or by other approved means.

No grading shall be carried out in dry conditions.

The Contractor shall use **Equipment** to carry out this item.

Work Method: **MB**

Quality Control

- The width of the carriageway shall be checked at every 50m intervals and have a tolerance of +50mm or -20mm
- The camber shall be checked with a camber board at 25m intervals and shall have a tolerance of + 1%
- Longitudinal levels shall be checked with a straight edge of minimum 2.7 m length. Maximum tolerance of +10 mm.

Measurement Unit: m²

The measurement shall be the area of carriageway graded, measured net according to the specified width and measured length graded.

Payment

The unit rate shall be the full compensation for labour, tools, equipment and incidental costs required for carrying out the work.

10-50-004: Light Manual Reshaping (Grub edge, fill gullies and Reshape carriageway)

This activity involves trimming the edge of the carriageway, grubbing grass from the carriageway filling gullies and ruts on the carriageway and reshaping of the camber of the road to the original standard and shape. No grass shall be grubbed from the shoulders, but it shall be cut to a maximum height of 50mm.

For earth roads materials from the side drains may be used to reshape the carriageway and fill gullies. Where additional suitable material is required to reinstate the camber to the required shape, this material shall be obtained from approved sources nearest to the final deposition area.

For gravel roads the gravel shall be obtained from the stacks placed at intervals along the road for this purpose if applicable.

The fill material shall be watered, mixed and compacted using suitable tampers to a finished level 25mm above the surrounding road surface.

This activity shall be carried out before and after the rains, or as directed by the Engineer.

The Contractor shall apply Labour methods to carry out this item.

Work Method: LB

Quality Control

- The width of the carriageway including the shoulders shall be checked at 100m intervals with tolerance of +50mm or -20mm
- The camber shall be checked using camber board at 50m intervals and shall have a tolerance of + 1%
- The quality of fill material shall be approved by the Engineer
- The minimum compaction to be applied to fill areas shall be such that no rammer imprint on the surface shall be seen.

Measurement Unit: m²

The measurement shall be the area of carriageway shaped.

Payment

The unit rate shall be the full compensation for labour, tools and incidental costs required for carrying out the work.

10-60-001: Provide Gravel Wearing Course

Excavation of Gravel

Gravel shall be excavated from quarries approved by the Engineer, and the Contractor shall inform the Engineer if the quality/availability of the gravel changes during the course of excavation.

Stones and boulders with one dimension greater than 80mm shall be removed from the excavated gravel and deposited outside the quarry at locations approved by the Engineer. Such stones and boulders may be reused in other parts of Works with the approval of the Engineer.

Excavation and loading shall normally be by labour unless, at the request of the Contractor, the Engineer allows the use of equipment.

The Contractor shall use Labour and/or Equipment to carry out this work, as directed by the Engineer.

Work Method: LB or MB

Quality Control:

- Oversize stones and boulders shall not be loaded for haulage to the road.
- Areas containing deleterious material shall not be excavated.

Free haul, spreading and Compaction of Gravel

Free haul involves the transportation of gravel material for the first 1.5 km from the quarry. The Contractor shall spread and compact gravel material, in a manner to ensure a uniform thickness of the layer across the full width of the carriageway and shaped to the specified camber. Spreading also includes the removal of any oversized stones or boulders, which cannot be broken down to the required size, to spoil dumps. Gravel shall be spread within 24 hours of off-loading.

Compaction of the gravel material shall be carried out from the carriageway edges to the centerline by overlapping passes of the compaction equipment. The number of passes shall be as directed by the Engineer dependent upon the equipment used and the material being compacted. Unless otherwise instructed the moisture content of the material shall be within + 2% of optimum

Where additional moisture is required water shall be applied in an even manner and the rate of application shall be such that no transverse or longitudinal flows occur.

The Engineer may instruct the Contractor to carry out density tests on the compacted material to ensure that an acceptable standard has been achieved.

The Contractor shall use Equipment for haulage and Labour for spreading unless the Engineer instructs otherwise.

Work Method: LB-MB

Quality Control:

- The gravel surface width shall be checked at 100m intervals and shall have a tolerance of
- +50mm
- Trial holes shall be dug as directed by the Engineer to check the gravel thickness and shall have a tolerance of + 5mm / - 0mm
- The camber shall be checked at 50m intervals and the maximum tolerance shall be +1 %
- The longitudinal profile shall be checked after the compaction of each load to ensure a smooth surface with no corrugations or depressions, tolerance of + 10mm.
- Compaction shall show no movement of material under the roller, minimum of 6 passes.
- Compaction test standard shall be 95% MDD (AASHTO T180)

Measurement Unit: m³

The measurement shall be the volume of compacted gravel surfacing measured net according to the Drawings and shall include the excavation and the 1.5km 'free' haul distance

Payment

The unit rate shall be the full compensation for labour, tools, equipment and incidental costs required for carrying out the work.

10-60- 002: Haulage (Overhaul beyond 1.5km)

The Contractor shall haul by appropriate equipment and off-load on the road as directed by the Engineer. Where the quantity delivered in any load falls short of the equipment capacity, off-loading shall only be permitted after the agreed spacing is adjusted accordingly.

No vehicle with a capacity of greater than 10 tonnes shall be permitted to off-load gravel directly on the prepared formation unless approved by the Engineer. Any greater loads shall be dumped in stockpiles off-road and transported to the formation areas by appropriate means.

Where loads supplied are found to contain material other than from the approved quarry and are of unacceptable quality, the Contractor shall remove them from site at the Contractor's expense.

The Contractor shall use Equipment to carry out this Item.

Work Method: **MB**

Quality Control:

- No haulage equipment shall be used until its capacity has been ascertained by the Engineer
- The quality of gravel dumped on the road shall be according to the Specifications
- The quantity of material delivered in each load shall be checked before dumping is allowed
- The distance between the stacks shall be checked to ensure the required compacted thickness will be achieved.

Measurement Unit: m^3/km (Overhaul)

The Contractor shall allow in the rates for item 10-60-001 for a 'free' haul distance of 1.5km. The 'overhaul' shall be the distance, greater than 1.5km, to the centre point of the section where the gravel is being dumped and processed, measured along the shortest route as determined by the Engineer.

The measurement of overhaul shall be the product of the volume of the gravel hauled and the distance to the centre point as indicated above.

Payment

The unit rate shall include full compensation for labour, tools, equipment, and incidental costs necessary to carry out the work.

10-60-004 Gravel Patching

Excavation of Gravel

Gravel shall be excavated from quarries approved by the Engineer, and the Contractor shall inform the Engineer if the quality/availability of the gravel changes during the course of excavation.

Stones and boulders with one dimension greater than 80mm shall be removed from the excavated gravel and deposited outside the quarry at locations approved by the Engineer. Such stones and boulders may be reused in other parts of Works with the approval of the Engineer.

Excavation and loading shall normally be by labour unless, at the request of the Contractor, the Engineer allows the use of equipment.

The Contractor shall use Labour and/or Equipment to carry out this work, as directed by the Engineer.

Work Method: **LB or MB**

Quality Control:

- Oversize stones and boulders shall not be loaded for haulage to the road.
- Areas containing deleterious material shall not be excavated.

Free haul, preparation, spreading and Compaction of Gravel

Free haul involves the transportation of gravel material for the first 1.5 km from the quarry. The Contractor shall prepare the area to be patched by removing excessive water and loose material. The contractor shall then dump, spread and compact gravel material, in a manner to ensure a uniform thickness of the layer across the full width of the carriageway and shaped to the specified camber. Spreading also includes the removal of any oversized stones or boulders, which cannot be broken down to the required size, to spoil dumps. Gravel shall be spread within 24 hours of off-loading.

Compaction of the gravel material shall be carried by overlapping passes of the compaction equipment. The number of passes shall be as directed by the Engineer dependent upon the equipment used and the material being compacted. Unless otherwise instructed the moisture content of the material shall be within + 2% of optimum

Where additional moisture is required water shall be applied in an even manner and the rate of application shall be such that no transverse or longitudinal flows occur.

The Engineer may instruct the Contractor to carry out density tests on the compacted material to ensure that an acceptable standard has been achieved.

The Contractor shall use Equipment for haulage and Labour for spreading unless the Engineer instructs otherwise.

Work Method: **LB-MB**

Quality Control:

- The gravel surface width shall be checked at 100m intervals and shall have a tolerance of + 50mm
- Trial holes shall be dug as directed by the Engineer to check the gravel thickness and shall have a tolerance of + 5mm / - 20mm
- The camber shall be checked at 50m intervals and the maximum tolerance shall be +1 %
- The longitudinal profile shall be checked after the compaction of each load to ensure a smooth surface with no corrugations or depressions, tolerance of + 10mm.
- Compaction shall show no movement of material under the roller, minimum of 6 passes.
- Compaction test standard shall be 95% MDD (AASHTO T180)

Measurement Unit: m3

The measurement shall be the volume of compacted gravel surfacing measured net according to the Drawings and shall include the excavation and the 1.5km 'free' haul distance

Payment

The unit rate shall be the full compensation for labour, tools, equipment and incidental costs required for carrying out the work.

10-70-001: Site clearance of borrow area.

This activity should be done in accordance with Bill 4, sub clauses 4.01 to 4.05 in the Standard Specifications for Roads and Bridges 1986.

10-70-002: Removal of Overburden

The Contractor shall remove overburden from quarries and borrow pits, which includes excavation, loading, hauling and stockpiling at approved locations. The thickness of the overburden layer to be removed shall be determined from trial pits dug on a 30 metre grid within the quarry area.

The overburden shall be deposited neatly for re-use to reinstate the quarry on completion of the Works, as directed by the Engineer.

The Contractor shall use Labour to carry out this item unless the Engineer instructs otherwise.

Work Method: **LB or MB**

Quality Control

- The location and manner of stock piling of the overburden for the reinstatement of the quarry shall be to the approval of the Engineer.

Measurement Unit: m3

The measurement shall be the volume of overburden removed as calculated from the cleared area and the mean depth indicated from the trial pits.

Payment

The unit rate shall include full compensation for labour, tools materials and equipment, haulage, stockpiling and incidental costs required for carrying out the work.

10-70-003: Restoration of Quarries and Borrow Pits

The Contractor shall level the ground, return the topsoil from the stockpiles, and uniformly spread the material over the full excavation area.

Adequate drainage provisions shall be made to protect the excavation areas, and where necessary appropriate protection measures shall be taken to avoid erosion of the spread topsoil layer. Grass and trees shall be replanted as directed by the Engineer.

The Contractor shall use Labour and/or Equipment to carry out this item as agreed by the Engineer.

Work Method: **LB, LM-MB**

Quality Control

The Engineer shall check that the required measurements have been satisfactorily taken.

Measurement and Payment: **Provisional Sum**

Payment shall be made on a Dayworks basis for the labour and equipment as directed by the Engineer

BILL 17: Concrete Works

17-50-001: Bridge Deck Replacement - Concrete

17-50-002: Bridge Abutment Repair – Concrete

These activities involve the repair or replacement of concrete bridge deck and abutment, including the removal of loose or broken concrete, cutting back damaged areas to sound surfaces and repairing with concrete of similar Class to the original.

The bridge deck and abutment shall be inspected and necessary repairs shall be instructed by the Engineer. All Holes and voids shall be cleared of debris, loose material and dust, and shall be well watered before the new concrete is placed. The new concrete shall be firmly rammed against the existing surfaces and finished flush with the surrounding materials. The surface of the repair shall be protected from direct sunlight and kept moist for 3 days. Concrete shall be Class 20/20 unless otherwise directed by the Engineer.

In the event of complete replacement of the abutment and deck, the activity shall be carried in accordance with Section 17 Sub Clauses 1701 to 1741 of the Standard Specifications for Road and Bridge Construction.

The Contractor shall use Labour to carry out this item

Work Method **LB**

Quality Control

The work shall be carried out to the satisfaction of the Engineer.

Measurement Unit: **m3**

The measurement shall be the volume of concrete used for the repair.

Payment:

The unit rate shall be the full compensation for labour, tools, materials and incidental costs required to carry out the work.

17-50-003: Bridge Abutment Repair - Masonry

This activity involves the repair of masonry bridge abutment, including the removal of loose or broken stones and then repairing the damaged parts with similar size stones using mortar of 1:4(cement: sand by volume)..

The abutment shall be inspected and necessary repairs shall be instructed by the Engineer. All loose stones shall be removed and replaced afresh. The stones shall be laid with a bond allowing a minimum overlap of $\frac{1}{4}$ the length of the smallest stone. The joints shall be a minimum of 10mm and no stone shall touch another stone but shall be laid fully on a mortar bed. The mortar joints on the face of the abutment shall be painted and raked to produce a durable finish.

The Contractor shall use Labour to carry out this item

Work Method **LB**

Quality Control

The work shall be carried out to the satisfaction of the Engineer.

Measurement Unit: m³

The measurement shall be the abutment repaired.

Payment:

The unit rate shall be the full compensation for labour, tools, materials and incidental costs required to carry out the work.

17-50-004: Drift Repairs – Concrete

This activity involves the repair of concrete drifts, including the removal of loose or broken concrete, cutting back damaged areas to sound surfaces and repairing with concrete of similar Class to the original.

The drift shall be inspected and necessary repairs shall be instructed by the Engineer. Holes and voids shall be cleared of debris, loose material and dust, and shall be well watered before the new concrete is placed. The new concrete shall be firmly rammed against the existing surfaces and finished flush with the surrounding materials. The surface of the repair shall be protected from direct sunlight and kept moist for 3 days. Concrete shall be Class 20/20 unless otherwise directed by the Engineer.

The Contractor shall use Labour to carry out this item

Work Method **LB**

Quality Control

The work shall be carried out to the satisfaction of the Engineer.

Measurement Unit: m³

The measurement shall be the volume of concrete used for the repair.

Payment:

The unit rate shall be the full compensation for labour, tools, materials and incidental costs required to carry out the work.

- 17-60-001: Provide, place and compact class 15/20 concrete for blinding**
- 17-60-002: Provide, place and compact class 25/20 concrete**
- 17-60-003: Vertical formwork class F2 finish**
- 17-60-004: Horizontal formwork class F2 finish**
- 17-60-005: Provide, cut, bend and fix into position high yield reinforcement bar to BS 44461 as directed and as shown on the drawing**

These activities should be done in accordance with Bill 17 sub section 17.01 to 17.41 of the Standard Specifications for Roads and Bridges 1986.

- 17-70-001: Drift Construction by contract**
- 17-70-002: Bridge Construction by contract**

The activities for these items will be defined in a separate specific document and only summarised under these item numbers.

17-70-003: Concrete Road Section

The Contractor shall construct the concrete road carriageway on the prepared, shaped and compacted road formation as approved by the Engineer. Concrete shall be class 20/20 and may be batched by volume, but shall be mixed in a mechanical mixer. The mix shall be as shown below.

Concrete Class	Nominal Mix by Volume	Batch with 1 bag Cement		
		No. of boxes		
		Fine	Coarse	Yield (approx)
20/20	1:2:4 (20mm max aggregate)	2	4	0.16m ³

The water added shall be the minimum necessary to give sufficient workability for efficient consolidation of the concrete. For concrete placed by hand this shall be 23-27 litres per bag of cement. For mechanical mixing and compacting (poker vibrator) the water content shall be reduced to 20 litres per bag of cement.

The concrete shall be placed in formwork which is clean, smooth faced and secure from movement and leakage to the full depth of the carriageway (150mm) in clearly marked out bays. Steel reinforcing mesh mats (6mm) shall be laid at a depth 50mm below the finished surface as the concrete is being poured. Compaction of the concrete shall be by hand ramming or poker vibrator. The surface shall be tamped with a timber tamping bar to produce a uniform, transverse ridged surface.

Concrete pours shall normally be over half the carriageway width and in lengths between construction joints as directed by the Engineer, of 10-15 metres. Contraction joints if required shall correspond with the construction joints. Where directed by the Engineer expansion joints shall be formed in positions and in accordance with the details provided by the Engineer.

The surface of the concrete shall be covered and kept moist for at least 4 days to allow adequate curing. The Contractor shall make cubes for testing as directed by the Engineer.

All materials used for concrete production and the Contractor's working method shall be approved by the Engineer before concreting is permitted.

The Contractor shall use **Labour** and **Equipment** to carry out this item.

Work Method **LB - MB**

Quality Control

Slump test shall be to the standard specified by the Engineer in the range of 25-100mm. Cube strength shall be 27.5 N/mm² at 28 days on an average of 4 cubes

Measurement Unit: m³

The measurement shall be the volume of concrete measured net according to the Drawings

Payment

The unit rate shall include full compensation for labour, tools, equipment, materials and incidental costs necessary to carry out the work.

BILL 20: ROAD FURNITURE

Scope:

This bill comprises those items of Road Furniture to be erected and maintained as aids to road safety, including traffic signs and guardrails.

- 20-50-001: Road reserve boundary posts**
- 20-50-002: Installation of fencing and gates**
- 20-50-003: Repair/replace fence**

These activities should be done in accordance with Bill 20 sub section 20.01 to 20.11 of the Standard Specifications for Roads and Bridges 1986.

20-50-005: Permanent Road Signs

The Contractor shall erect road / traffic signs of the type and at locations as directed by the Engineer. The signs materials and quality are shown on the Drawings. The signs shall be bedded in concrete Class 15/20 and shall be supported vertically until the concrete is set.

The Contractor shall use Labour to carry out this item.

Work Method. **LB**

Quality Control

The Engineer shall check the sign position before concrete is backfilled.

Measurement Unit: No

The measurement shall be the number of signs erected.

Payment

The unit rate shall be the full compensation for labour, tools, materials and incidental costs required for carrying out the work.

20-50- 008: Guardrail Repair

This activity involves the repair of Guardrails (including rails, posts and fixings) to a properly aligned, vertical and secure condition. The repair shall include securing any loose posts by re-compaction or removal of any unsuitable material surrounding the post, importing and compaction of suitable materials to render the posts secure, and the re-fixing of the rails.

The Contractor shall use Labour to carry out this item.

Work Method **LB**

Quality Control

The guardrails shall be checked as being properly aligned secure and in a vertical position
The fixings shall be hand checked to be firmly fixed

Measurement Unit: m

The measurement shall be the length of Guardrail repaired

Payment

The unit rate shall be the full compensation for labour, material, tools, and incidental costs required to carry out the work.

20-50-009: Guard Rail Replacement

20-50-010: Guard Rail Installation

The Contractor shall erect guardrails at locations shown on the Drawings or as directed by the Engineer. The guardrails shall comply with the requirements of the Road Authority and shall be erected on hard wood or treated timber posts of top diameter not less than 150mm.

Posts shall be drilled and shaped as shown on the Drawings and provided with the necessary bolts, nuts, washers and spacer blocks.

Holes excavated for the timber posts shall be spaced to suit the standard length of guardrail supplied, and shall be of sufficient size to permit the proper setting of the posts and to allow room for backfilling and compacting. At least 1 metre of a post shall be embedded in the ground. The backfilling shall be with 12:1 soil cement mixture, or as otherwise directed by the Engineer, after the erected rails have been approved by the Engineer.

The Contractor shall use Labour to carry out this item.

Work Method **LB**

Quality Control

The Engineer shall check the post and rail erection before final backfilling.

Measurement Unit: m

The measurement shall be the length of Guardrail erected.

Payment

The unit rate shall be the full compensation for labour, tools, materials and incidental costs required for carrying out the work.

20-50-011: Handrail repair/installation

These activities should be done in accordance with Bill 20 sub section 20.01 to 20.11 of the Standard Specifications for Roads and Bridges 1986.

20-60-001: Traffic Sign Maintenance

This activity involves all the tasks required to ensure that the road signs and signposts are in a clean, properly aligned, vertical and secure condition; the replacement of missing or broken bolts, nuts or other fixings and the tightening of the same. The maintenance shall also extend to securing any loose posts by the re-compacting or removal of any unsuitable material surrounding the posts, importing and compacting of suitable material to render the post secure. Painting of the Traffic signs if required is also included in this item.

The Contractor shall use Labour to carry out this item.

Work Method **LB**

Quality Control

The signs shall be clean and in vertical position
The fixings shall be hand checked to be tight

Measurement Unit: No.

The measurement shall be number of signs maintained.

Payment

The unit rate shall be the full compensation for labour, tools, material and incidental costs required to carry out the work.

BILL 22: DAYWORKS

ITEMS 22-50-001 to 22-79-018 are for the Schedule of Rates. The Engineer will include the relevant items for each specific contract document.

A Provisional Sum shall be included in the Bills of Quantities to cover the payment of equipment, labour and materials for work instructed by the Engineer on a Dayworks basis.

The Contractor shall include prices for all items in the Schedule of Rates, in the Dayworks Bill, and shall carry out work using these rates only if directed by the Engineer.

Measurement and Payment

a. Equipment:

Payment for equipment shall only be made for the time each item of equipment is working. Idle time due to breakdown or incompleteness of the equipment shall not be paid. The rate of equipment shall include for the cost of the following: -

- i. Transport of the equipment to the site
- ii. Operators, drivers and assistants including their overtime
- iii. Fuels and lubricants
- iv. Maintenance, spare parts and all costs of repairs
- v. Depreciation, insurance, overheads and profits.

b. Labour

Payment shall only be made for the time each of worker working on the Dayworks as instructed by the Engineer. The rate for labour shall include the cost of,

- i. All wages, allowances and other payments due to the worker
- ii. Provision of small tools used on Dayworks activities by labourers and tradesmen.
- iii. Insurance, overheads and profit.

c. Materials

Payment shall only be made for materials instructed by the Engineer for use in Dayworks activities. The rate for materials shall include for the cost of provision of the material, transport to site, storage, handling, overheads and profits.

Schedule of Dayworks

The Engineer shall compile a Schedule of the Equipment, Labour and Materials which may apply to Dayworks activities, to be included in the Dayworks Bill.

BILL 25: HIV/AIDS AWARENESS AND PREVENTION CAMPAIGN

This BILL sets out the Contractor's obligations with regard to on-site HIV / AIDS awareness campaign and preventive measures that are to be instituted.

25-50-001 HIV / AIDS Awareness and Prevention Campaign

The Contractor shall institute an HIV / AIDS awareness and prevention campaign amongst his workers for the duration of the Contract. The awareness campaigns shall be carried out in consultation and guidance of Ministry of Public Health or Local service providers approved by the Ministry of Public Health.

The Contractor shall display AIDS awareness posters in all buildings frequented by workers employed on the Contract, where such buildings fall under the control of the Contractor.

In addition at least two of the Contractors vehicles regularly used on site shall display HIV / AIDS awareness posters. The posters shall be printed on gloss paper and shall be at least A1 size on buildings and A3 size or other approved size on vehicles. The message on the posters shall be supplied by the Employer through the Engineer.

Aids awareness shall also be included in the orientation process of all workers employed on the Contract.

As part of the campaign the Contractor will be required to make condoms available to his workers.

Measurement Unit: month

The measurement shall be the calendar month or part thereof, measured over the duration of the campaign.

Payment:

The rate shall include full compensation for equipment; labour and material required for the provision of the item.

25-50-002 Soil Erosion Mitigation Measures

Soil Erosion problems must be identified and appropriate mitigation measures included during the preparation of the contract document. However the Engineer shall provide a Provisional Sum for Soil Erosion Mitigation Measures that were foreseen during the preparation of the document.

Measurement

A Provisional Sum shall be included in the Bill of Quantities for this item.

25-50-003 Baraza's for Cross-cutting Issues

The Contractor shall arrange and conduct meetings and/or training sessions for workers and staff on cross-cutting issues, including Community Participation, Environmental Mitigation, Gender Rights, HIV/AIDS, Workers Rights at times and locations directed by the Engineer.

Measurement

A Provisional Sum shall be included in the Bill of Quantities for this item payable on documented expenditure.