THE REPUBLIC OF UGANDA

District Road Works

VOLUME

4 Technical Manuals

Manual B:

Standard Design Manual

JANUARY 2004

Ministry of Works, Housing and Communications

ACKNOWLEDGEMENTS

These manuals have been prepared by the Ministry of Works, Housing and Communications, Uganda.

The aim of the manuals is to complement the Ministry's effort in providing guidance and building capacity of Local Governments to enable them handle their mandated roles in planning and management of the road sector development.

This manual is part of a set titled District Road Works. The set consists of 5 Volumes, each volume comprising a series of manuals covering varying aspects under the following headings:

Volume 1 Planning Manuals

Volume 2 Contract Management Manuals

Volume 3 Implementation and Monitoring Manuals

Volume 4 Technical Manuals

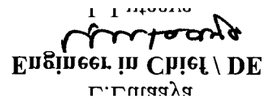
Volume 5 District Administrative and Operational Guidelines

The Manuals describe in detail the organization and techniques for planning, implementation and administration of a district road network. The manuals support Government strategies on sustainable maintenance of district roads; they encourage community participation, promote use of labour based methods and gender balance, ensure protection of the environment, foster work place safety and health in implementation of road works by adopting appropriate contracting practices and support the local construction industry.

They are primarily aimed at Road Engineers, Planners and Managers involved in the planning and management of district road works.
In line with the topics covered in these manuals, related training modules have been designed and are incorporated in the curriculum of the Mount Elgon Labour Based Training Centre.

The manuals are the property of the Ministry of Works, Housing and Communications, but copying and local distribution is not restricted.

We wish to acknowledge the efforts of COWI Consulting Engineers and Planners AS who assisted in the compilation of the Drafts and the invaluable support of the Danish International Development Agency for the financial assistance extended to the Ministry in preparing the manuals.



Volume 4 Manual B

Standard Structure Manual

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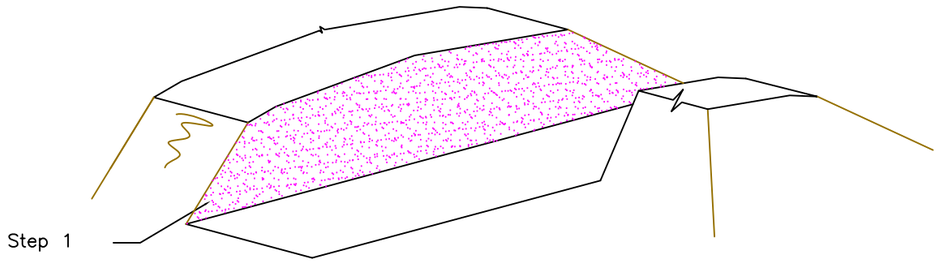
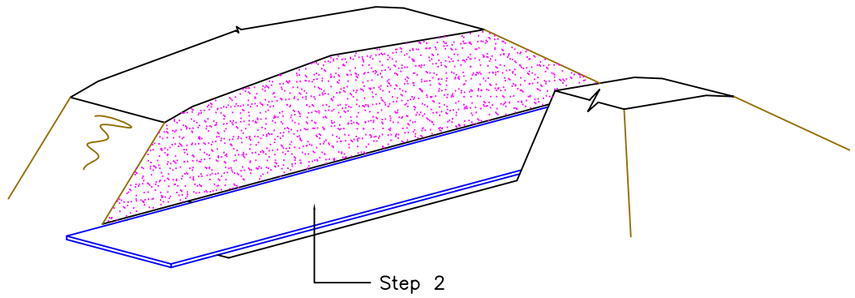
Culverts

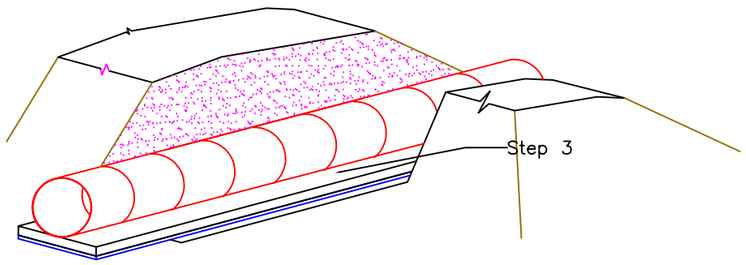
Section B-1
Culverts



Step 1: Excavation and compaction



Step 2: Bedding and compacting



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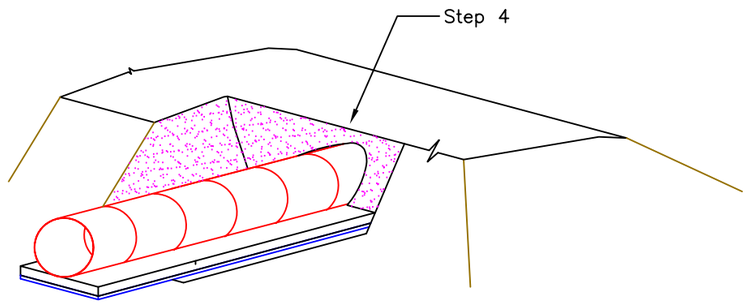
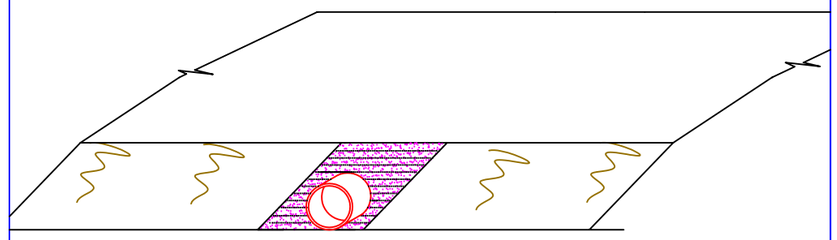


Step 4: Backfilling in layers (150mm–200mm) on either sides and compaction



Completed concrete culvert

Procedures

Step 1: Excavation and compaction
Step 2: Bedding and compacting
Step 3: Culvert laying
Step 4: Backfilling and Compacting in layers (150mm–200mm) on either side

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

\\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: PCUL 001

CONCRETE PIPE CULVERT INSTALLATIONS

Installation

Scale: NTS

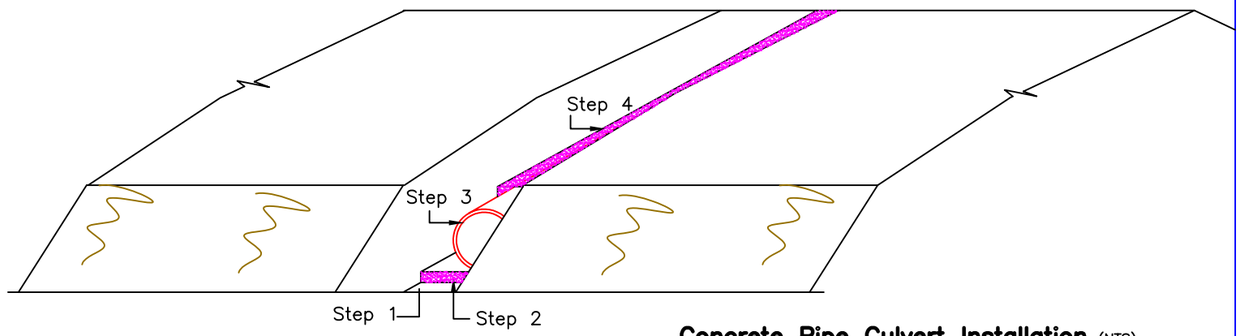
Dimension: mm

File Name: P/Roads and Highways/50999A/Data /Drawings/ Concrete culvert

Date: June 2001

Drawn by	Designed by	Checked by	Approved by
JAU	JAU	FCO	MMK

Sheet: 1/2



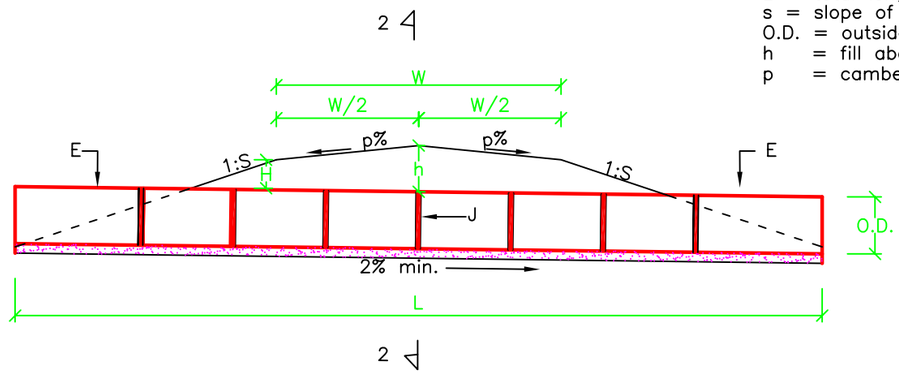
Concrete Pipe Culvert Installation (NTS)

Procedures

Step 1: Excavation and compaction
Step 2: Bedding and compacting
Step 3: Culvert laying
Step 4: Backfilling and Compacting in layers (150mm–200mm) on either side

E: Extra culvert piece to avoid headwall construction
W: Carriageway
J: Joint filled with 1:4 mortar
H: Minimum fill cover

$L = 2s \times (O.D.+h-(Wp/2)) + W$
where:
L = total length of culvert
s = slope of embankment
O.D. = outside diameter
h = fill above culvert
p = camber (%)



Section 1–1
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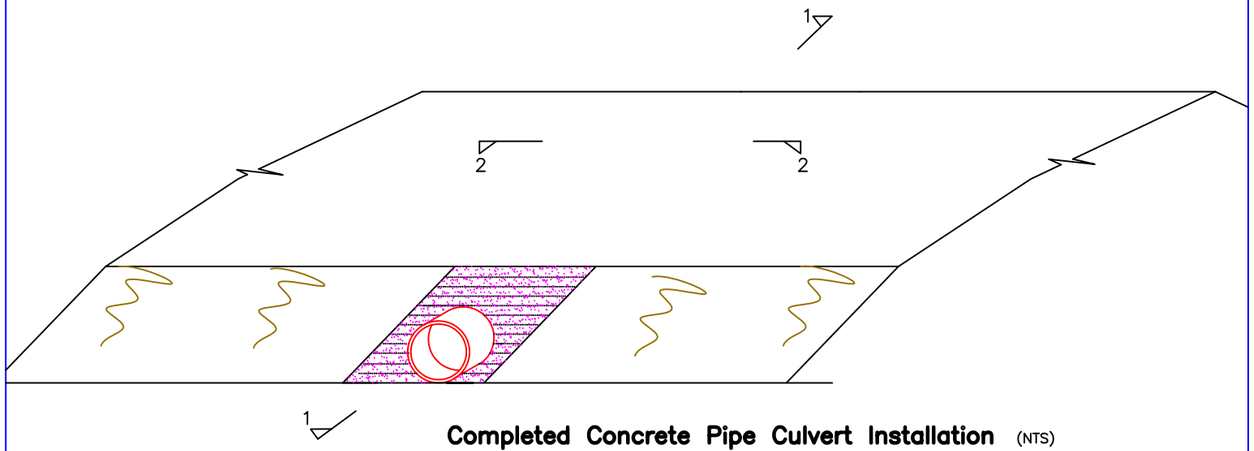
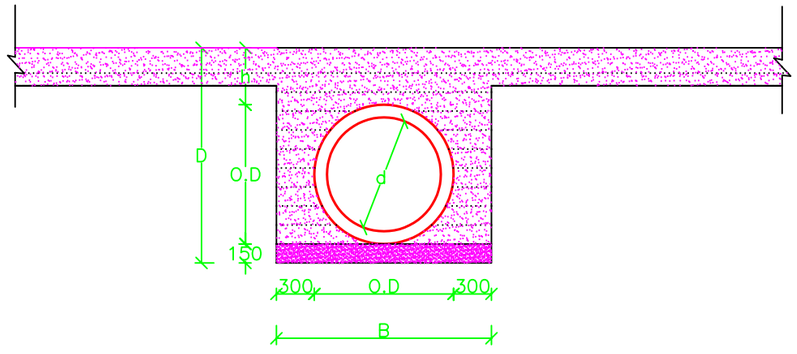


Completed Concrete Pipe Culvert Installation (NTS)



Section 2–2
Scale 1:50

S/N	Culvert diameter, O.D (mm)	Excavation Width, B (mm)	Excavation Depth, D (mm)	Space between multiple Culverts, Min. (mm)	Minimum fill Cover, H (mm)	Bedding Material
1	600	O.D + 600	Varies	300	400	Gravel, Sand, or Class lean concrete
2	900	O.D + 600	Varies	450	500	Gravel, Sand, or Class lean concrete
3	1000	O.D + 600	Varies	600	600	Gravel, Sand, or Class lean concrete
4	1200	O.D + 600	Varies	600	700	Gravel, Sand, or Class lean concrete
5	1500	O.D + 600	Varies	600	800	Gravel, Sand, or Class lean concrete

Table for various culvert sizes

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: PCUL 001

Title: STANDARD STRUCTURES MANUAL

CONCRETE PIPE CULVERT INSTALLATIONS
Elevations and Sections

Scale: As shown
Dimension: mm
Date: June 2001
Sheet: 2/2

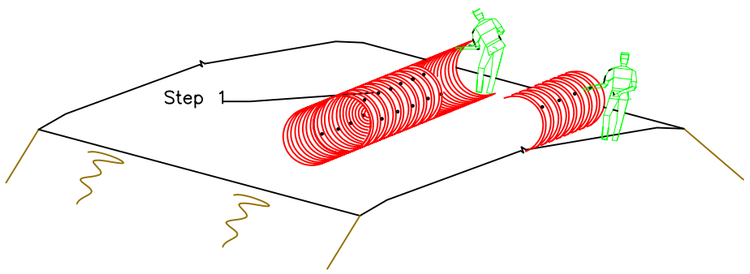
File Name: P/Roads and Highways/50999A/Data /Drawings/ Concrete culvert

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

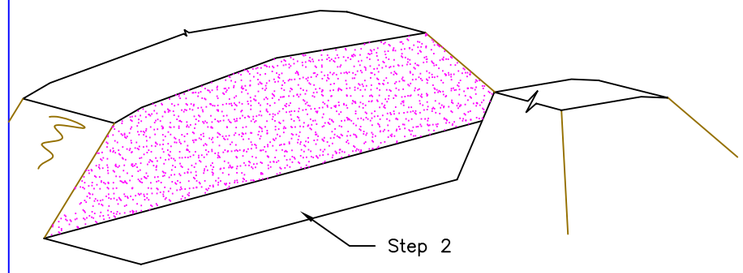
Drawn by	Designed by	Checked by	Approved by
JMA	JMA	FCO	MMK



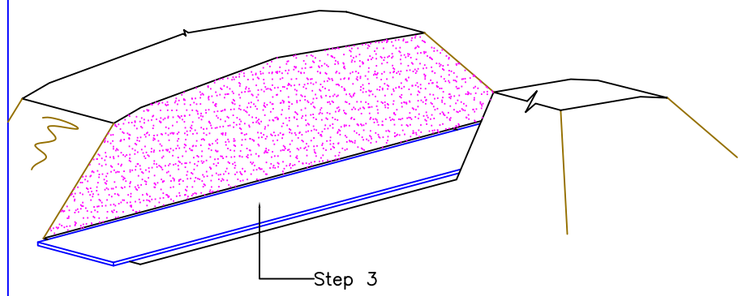
Step 1: Coupling/Assembling

Note:

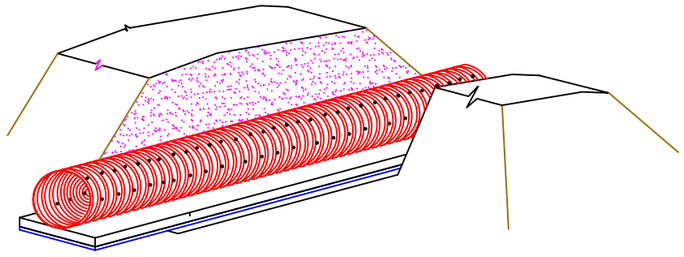
1. Larger pipes to be coupled inside trench



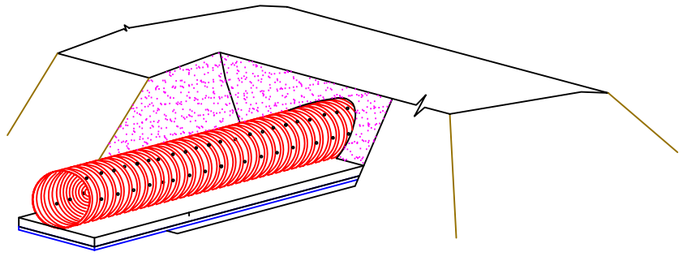
Step 2: Excavation and compaction



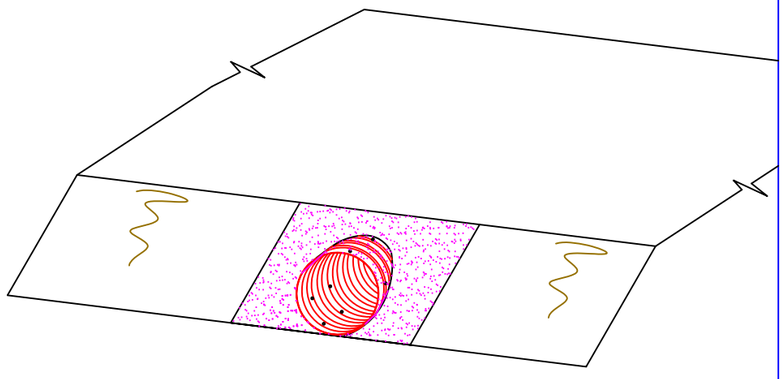
Step 3: Bedding and compacting



Step 4: Culvert Laying



Step 5: Backfilling in layers (150mm–200mm) on either sides and compaction



Completed Armco culvert

Procedures

Step 1: Coupling/Assembling
Step 2: Excavation and compaction
Step 3: Bedding and compacting
Step 4: Culvert Laying
Step 5: Backfilling in layers (150mm–200mm) on either sides and compaction

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

\\Server\pl\Roads & Highways\50999A\Data\Drawings\logo3.jpg

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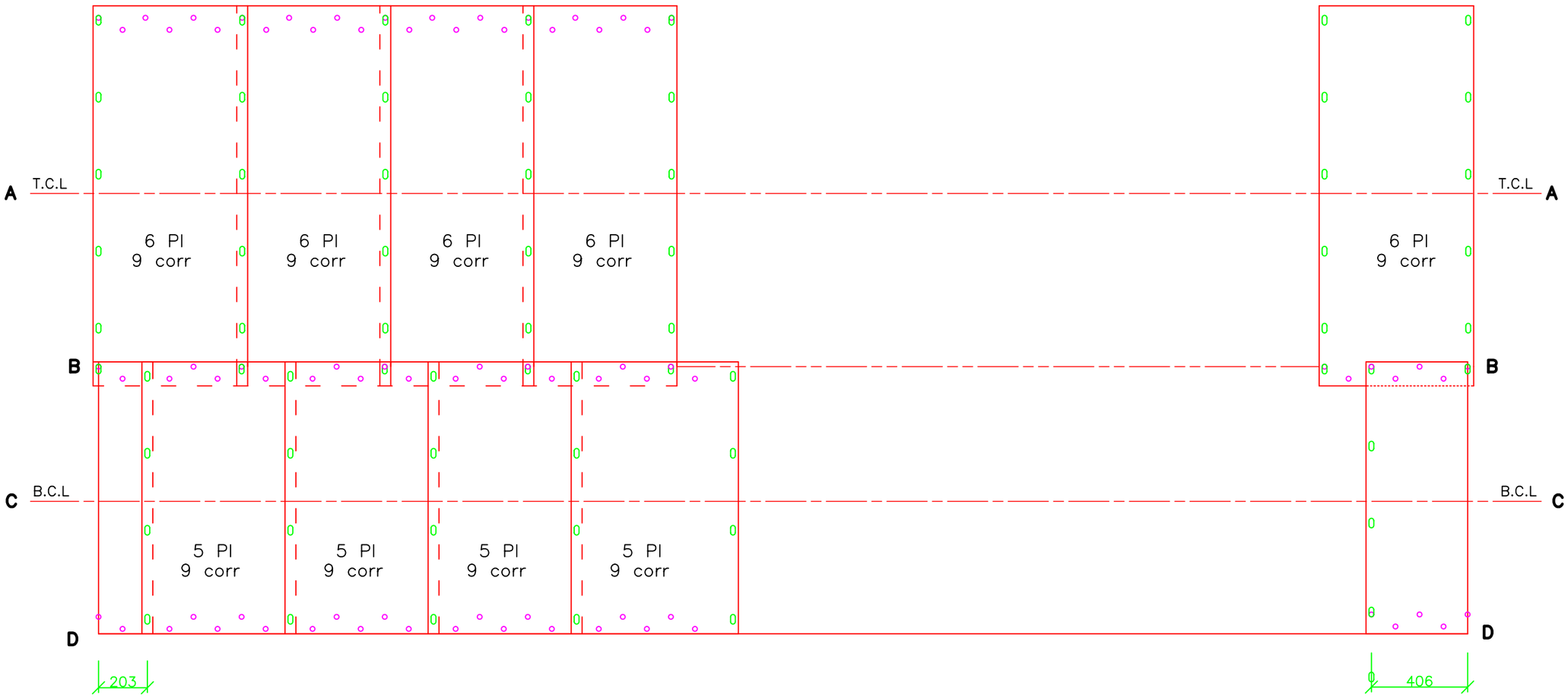
P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: PCUL 002

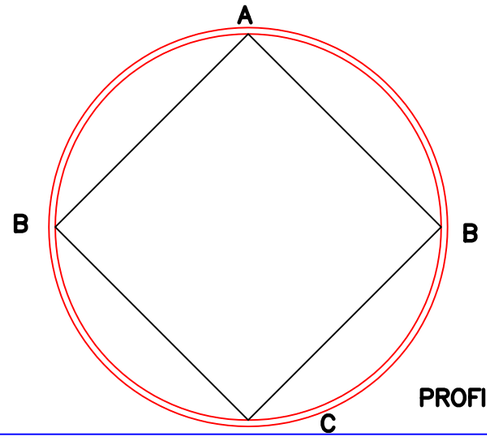
ARMCO PIPE CULVERT Installation

Scale	NTS
Dimension	mm
File Name:	P/Roads and Highways/50999A/Data/Drawings/ArmcoCulverts
Date	June 2001
Drawn by	JAU
Designed by	JAU
Checked by	FCO
Approved by	MMK
Sheet:	1/1



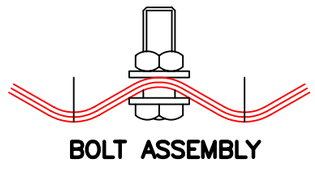
3 CORR. SHEET

6 CORR. SHEET



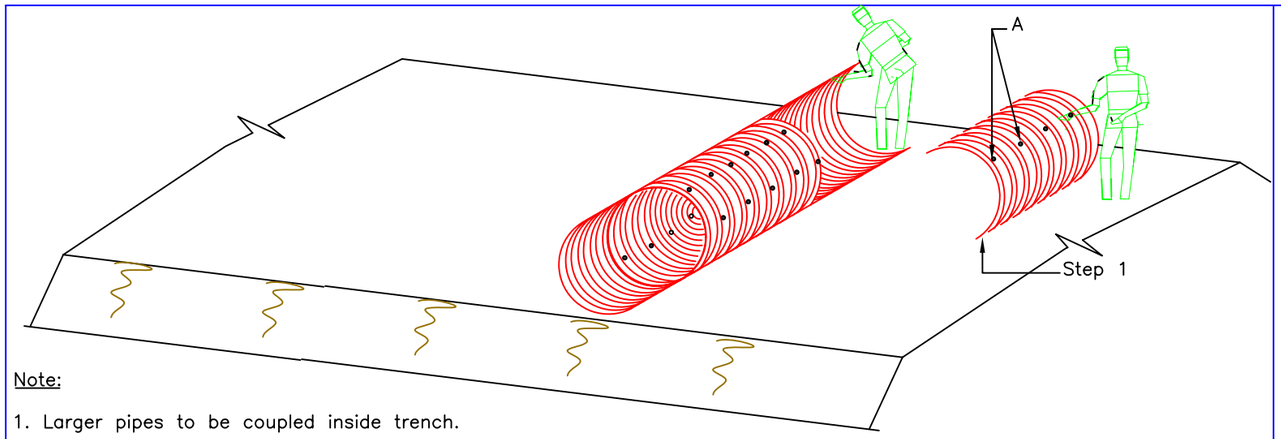
PROFILE SHAPE

PLATE LAYOUT – INSIDE VIEW



BOLT ASSEMBLY

Project: SUPPORT TO DISTRICT ROAD NETWORKS				**Drawing Number:** PCUL 002
Title: STANDARD STRUCTURES MANUAL				**CIRCULAR ARMCO PIPE CULVERT Assembly** — Scale NTS; Dimension mm
\\Server\p\ Roads & Highways\50999A\Data\Drawings\logo3.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425			File Name: P/Roads and Highways/50999A/Data /Drawings/ Armco Culverts — Date June 2001
				Drawn by JMA; Designed by JMA; Checked by FCO; Approved by MMK; Sheet: 1/3



Note:

1. Larger pipes to be coupled inside trench.

Armco pipe Culvert coupling (NTS)

A : Holes to receive bolts & nuts

E: Extra culvert piece to avoid headwall construction

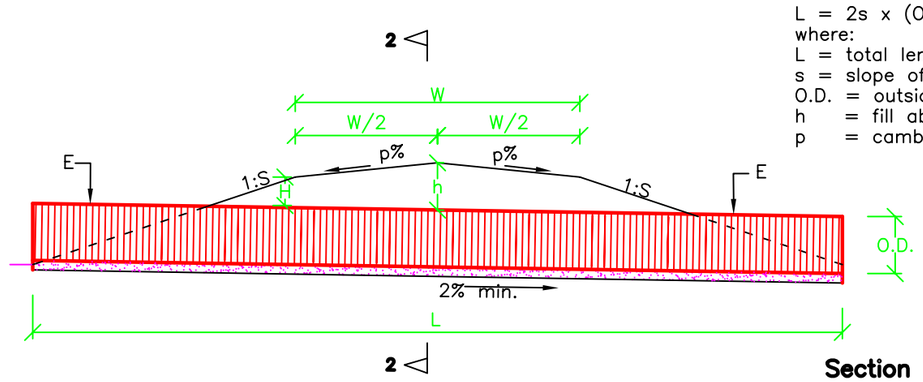
W: Carriageway

H: Minimum fill cover

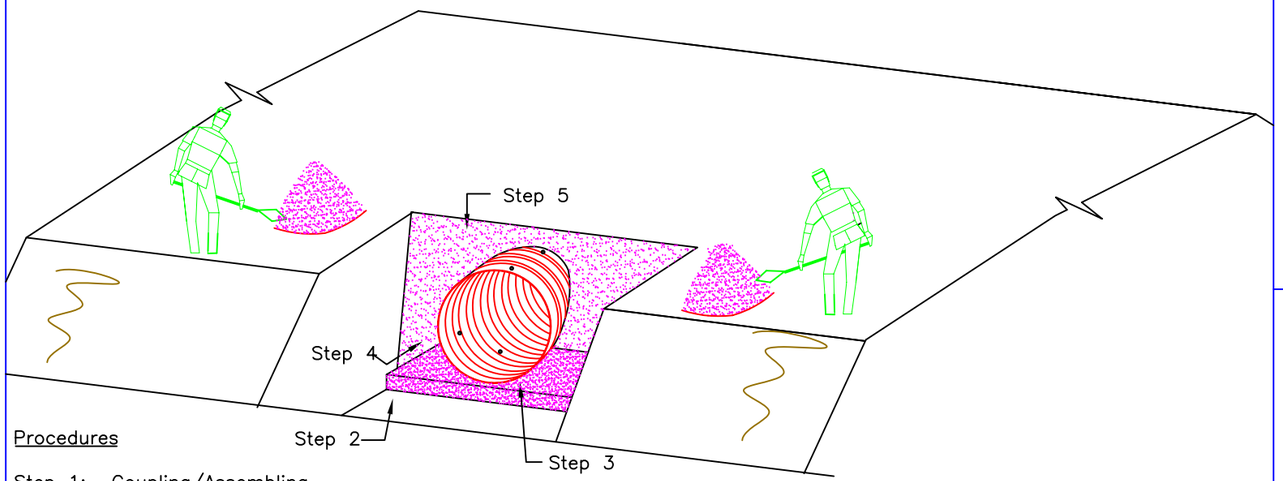
L = 2s x (O.D.+h−(Wp/2)) + W

where:

L = total length of culvert
s = slope of embankment
O.D. = outside diameter
h = fill above culvert
p = camber (%)



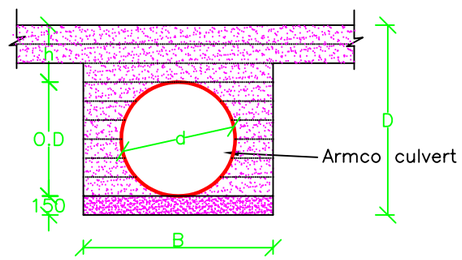
Section 1−1 Scale 1:100



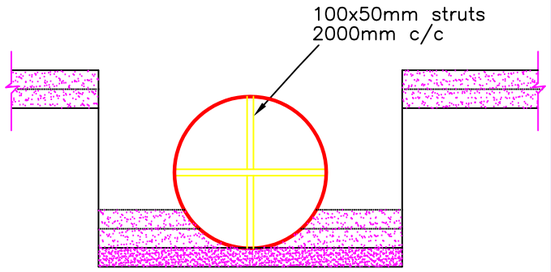
Procedures

Step 1: Coupling/Assembling
Step 2: Excavation and compaction
Step 3: Bedding and compacting
Step 4: Culvert Laying
Step 5: Backfilling in layers (150mm−200mm) on either sides and compaction

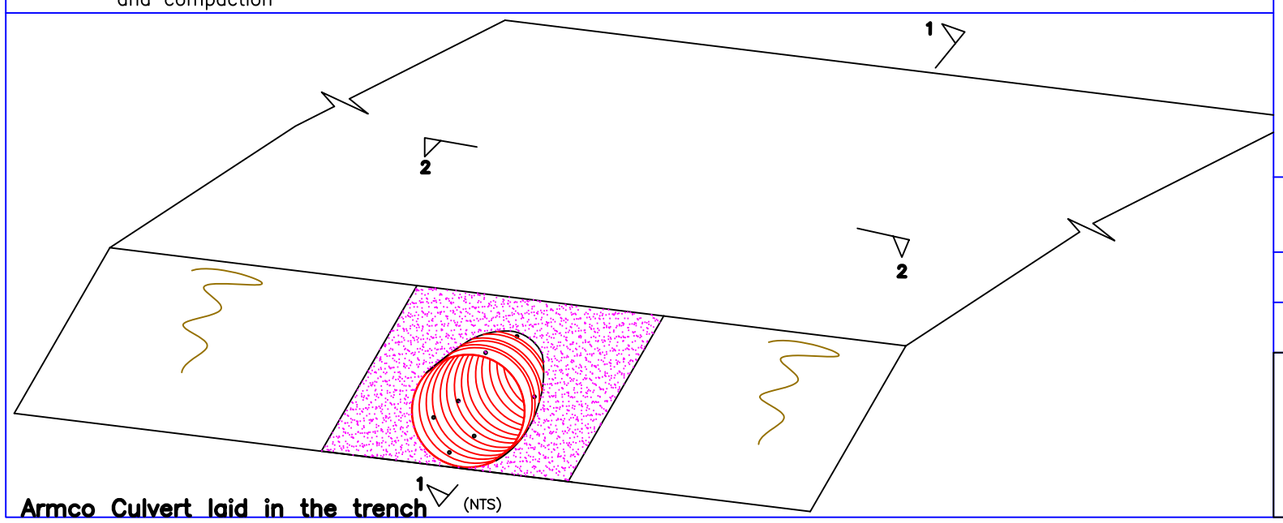
Armco pipe Culvert laying (NTS)



Section 2−2
Scale 1:50



Deformation control during backfilling and compaction in layers Scale 1:50



Armco Culvert laid in the trench (NTS)

S/N	Culvert diameter, d (mm)	Excavation Width, B (mm)	Excavation Depth, D (mm)	Minimum fill Cover, H (mm)	Carriageway width, W (mm)	Deformation Control	Bedding Material
1	600	1200	Varies	300	Varies	No	Gravel, Sand, or Class lean concrete
2	900	1500	Varies	450	Varies	No	Gravel, Sand, or Class lean concrete
3	1000	1600	Varies	500	Varies	Yes	Gravel, Sand, or
4	1200	1800	Varies	600	Varies	Yes	Gravel, Sand, or Class lean concrete
5	1500	2100	Varies	750	Varies	Yes	Gravel, Sand, or Class lean concrete

Table for Various culvert sizes

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: PCUL 002

Title: STANDARD STRUCTURES MANUAL

\\Server\p\ Roads & Highways\50999A\Data\ Drawings\logo1.jpg

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

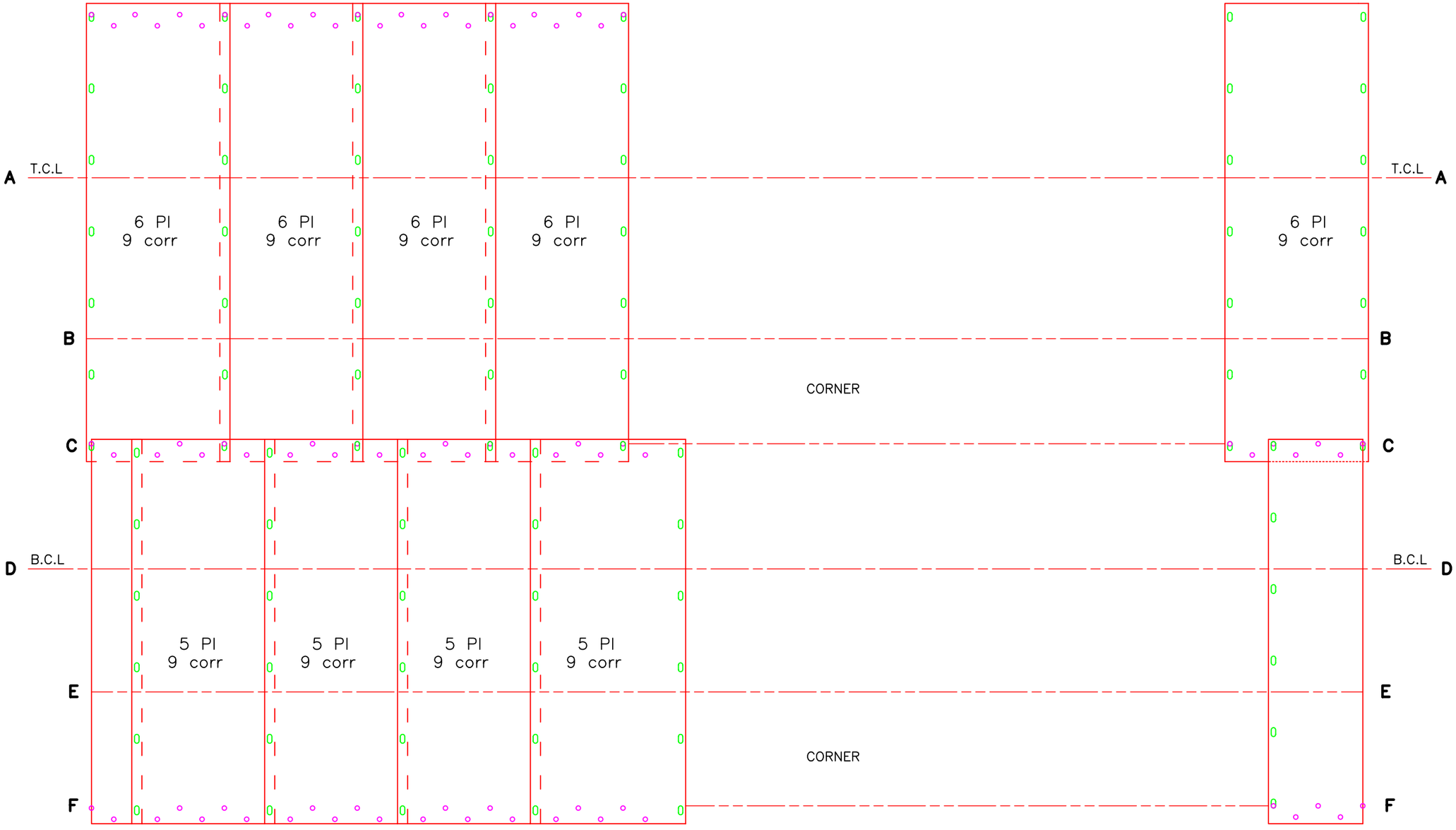
P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

ARMCO PIPE CULVERT
Elevations and Sections

Scale: As shown
Dimension: mm
File Name: P/Roads and Highways/50999A/Data /Drawings/ Armco Culverts
Date: June 2001

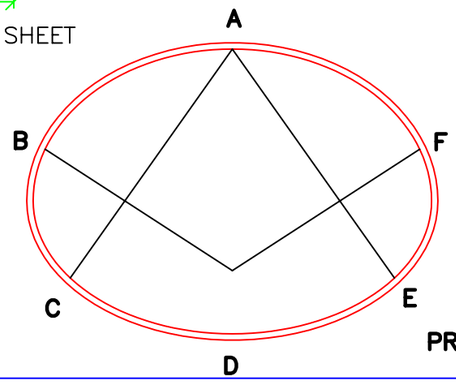
Drawn by	Designed by	Checked by	Approved by	Sheet:
JMA	JMA	FCO	MMK	2/3



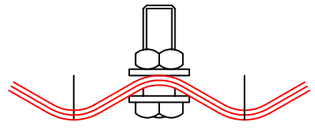
3 CORR. SHEET

6 CORR. SHEET

PLATE LAYOUT – INSIDE VIEW

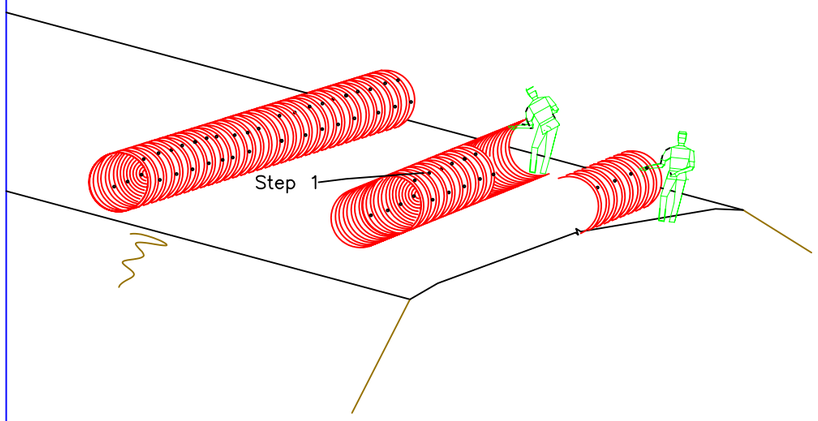


PROFILE SHAPE

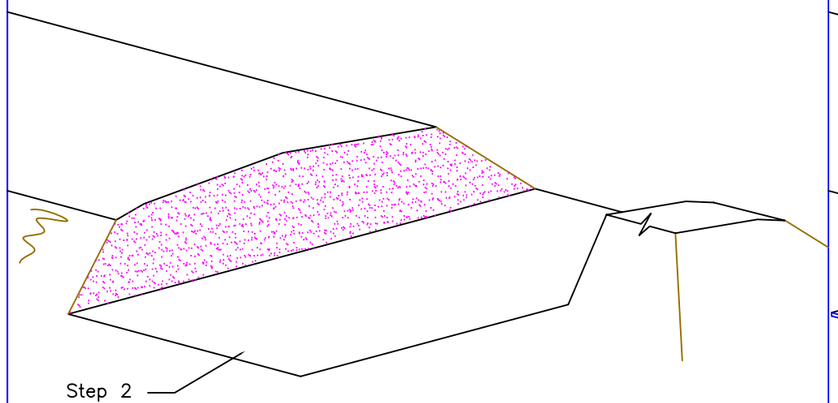


BOLT ASSEMBLY

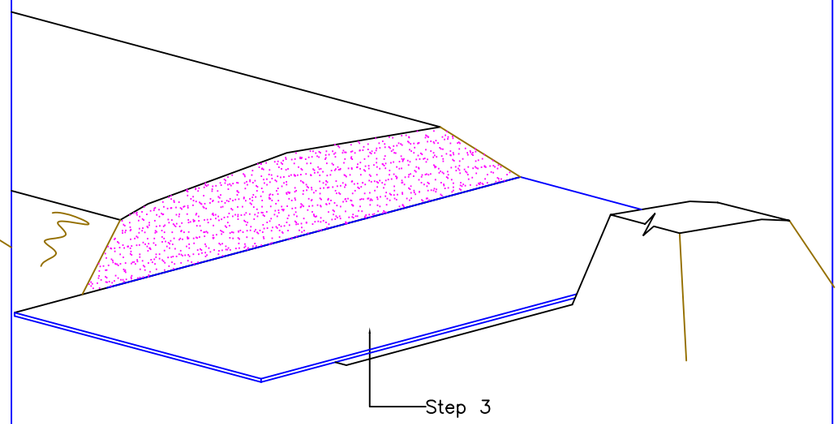
Project: SUPPORT TO DISTRICT ROAD NETWORKS				**Drawing Number:** PCUL 002
Title: STANDARD STRUCTURES MANUAL				**OVAL ARMCO PIPE CULVERT Assembly** — Scale NTS; Dimension mm
\\Server\p\Roads & Highways\50999A\Data Drawings\logo1.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425			File Name: P/Roads and Highways/50999A/Data /Drawings/ Armco Culverts — Date June 2001
				Drawn by JMA; Designed by JMA; Checked by FCO; Approved by MMK; Sheet: 3/3



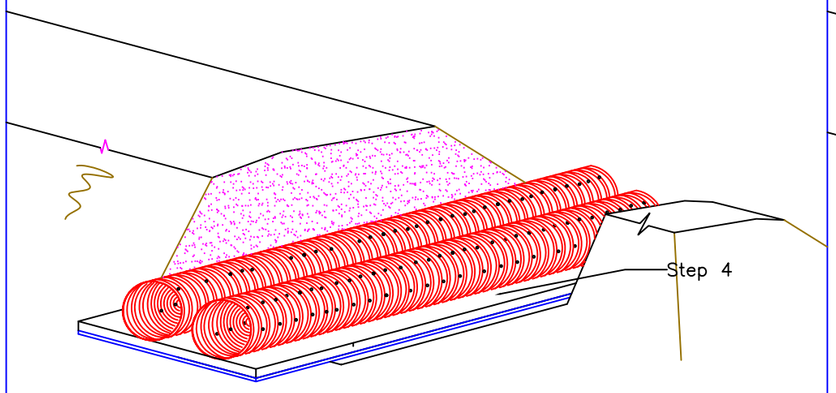
Step 1: Coupling



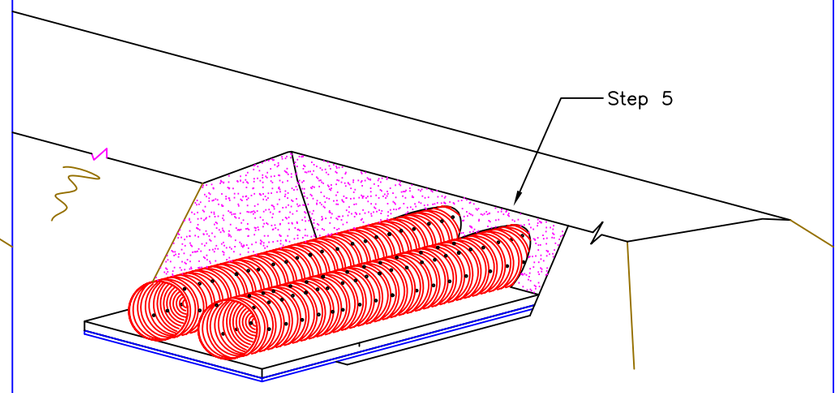
Step 2: Excavation and compaction



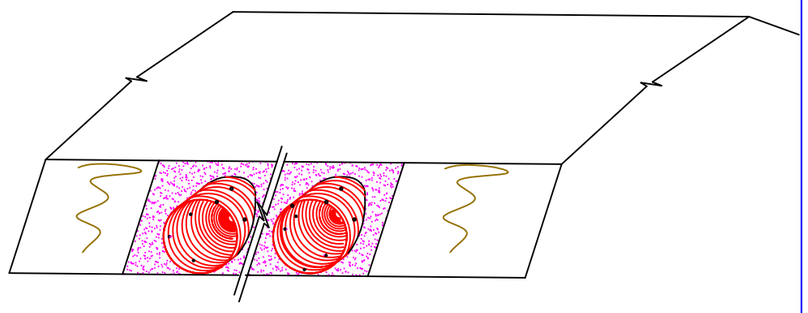
Step 3: Bedding and compacting



Step 4: Culvert Laying



Step 5: Backfilling in layers (150mm–200mm) on either sides and compaction



Completed multiple Armco culverts

Proceedures

Step 1: Coupling
Step 2: Excavation and compaction
Step 3: Bedding and compacting
Step 4: Culvert laying
Step 5: Backfilling and compaction in layers (150mm–200mm)

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

\\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: PCUL 003

MULTIPLE ARMCO PIPE CULVERTS

Installation

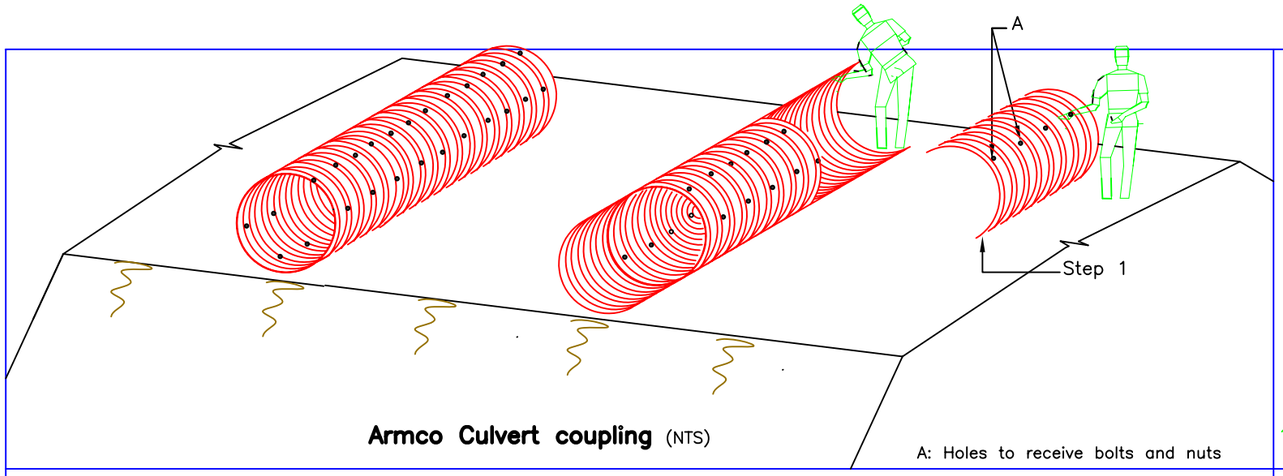
Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data /Drawings/ Multiple culverts

Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	1/1



Armco Culvert coupling (NTS)

A: Holes to receive bolts and nuts

E: Extra culvert piece to avoid headwall construction

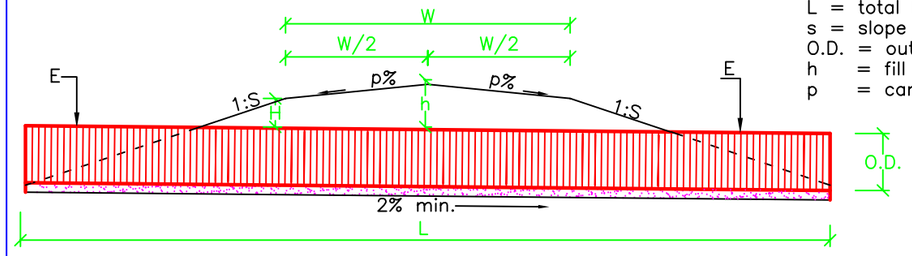
W: Carriageway

H: Minimum fill cover

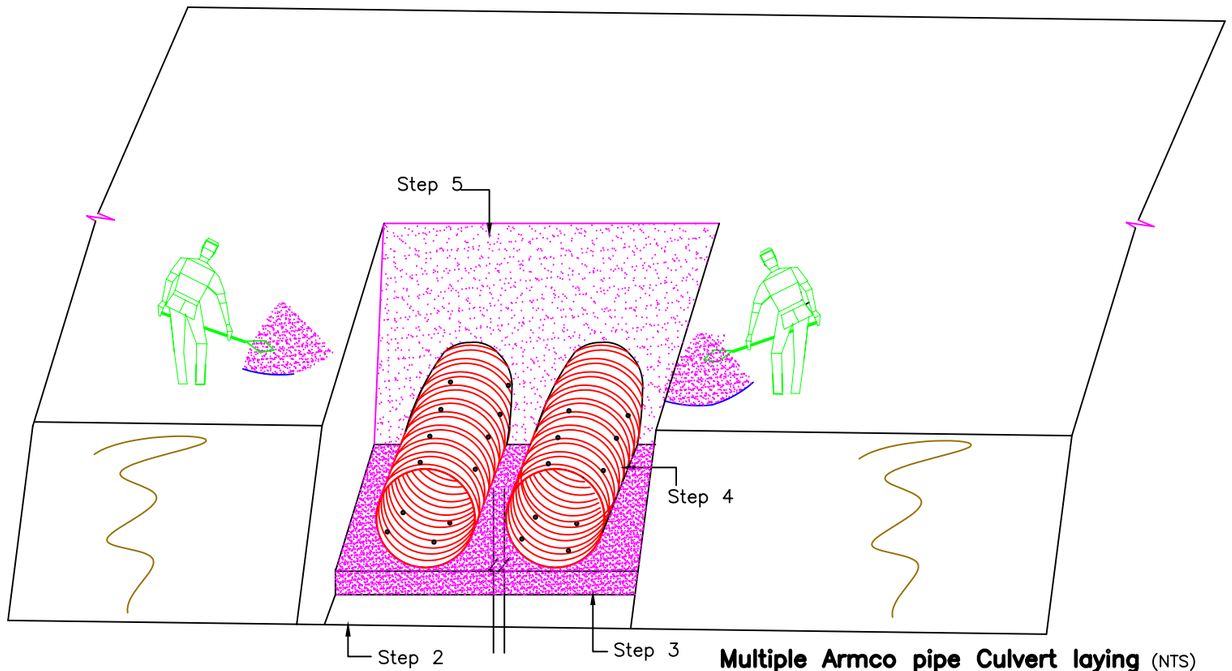
$L = 2s \times (O.D.+h-(Wp/2)) + W$

where:

L = total length of culvert
s = slope of embankment
O.D. = outside diameter
h = fill above culvert
p = camber (%)



Section 1–1 Scale 1:100



Multiple Armco pipe Culvert laying (NTS)

Proceedures

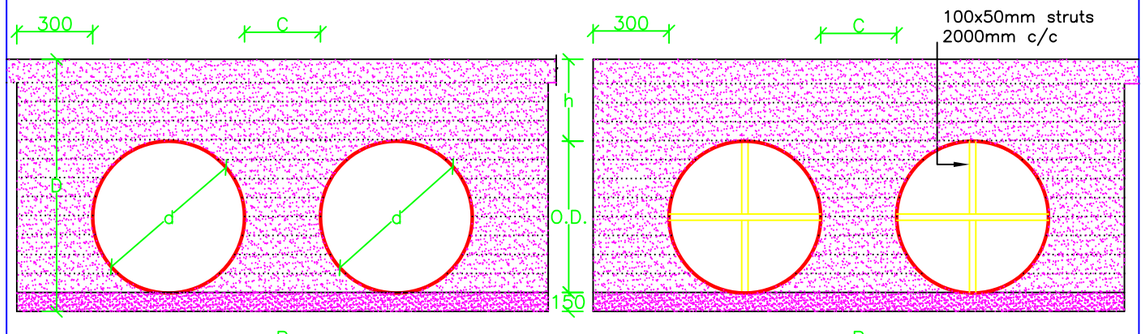
Step 1: Coupling

Step 2: Excavation and compaction

Step 3: Bedding and compacting

Step 4: Culvert laying

Step 5: Backfilling and compaction in layers (150mm–200mm)



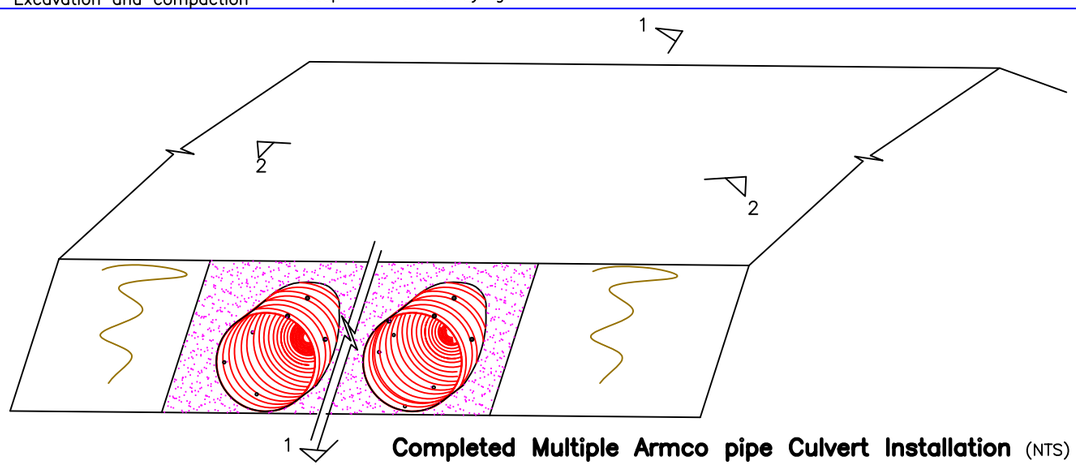
Section 2–2
Scale 1:50

Deformation Control during backfilling and compaction in layers
Scale 1:50

S/N	Culvert diameter, d (mm)	Excavation Width, B (m)	Excavation Depth, D (mm)	Space between Culverts, C Min. (mm)	Minimum fill Cover, H (mm)	Carriageway width, W (mm)	Shoulders (mm)	Deformation Control	Bedding Material
1	600	0.6+(nxOD) +0.3(n–1)	Varies	300	300	Varies	Varies	No	Gravel, Sand, or Class lean concrete
2	900	0.6+(nxOD) +0.3(n–1)	Varies	300	450	Varies	Varies	No	Gravel, Sand, or Class lean concrete
3	1000	0.6+(nxOD) +0.3(n–1)	Varies	300	500	Varies	Varies	Yes	Gravel, Sand, or Class lean concrete
4	1200	0.6+(nxOD) +0.3(n–1)	Varies	300	600	Varies	Varies	Yes	Gravel, Sand, or Class lean concrete
5	1500	0.6+(nxOD) +0.3(n–1)	Varies	300	750	Varies	Varies	Yes	Gravel, Sand, or Class lean concrete

n = Number of lines

Table for Various culvert sizes



Completed Multiple Armco pipe Culvert Installation (NTS)

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: PCUL 003

MULTIPLE ARMCO PIPE CULVERTS
Elevations and Sections

Scale: As shown
Dimension: mm
Date: June 2001
Sheet: 1/1

File Name: P/Roads and Highways/50999A/Data /Drawings/ Multiple culverts

Drawn by	Designed by	Checked by	Approved by
JMA	JMA	FCO	MMK

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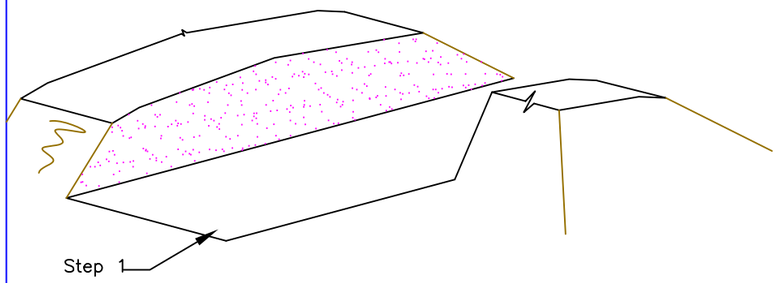
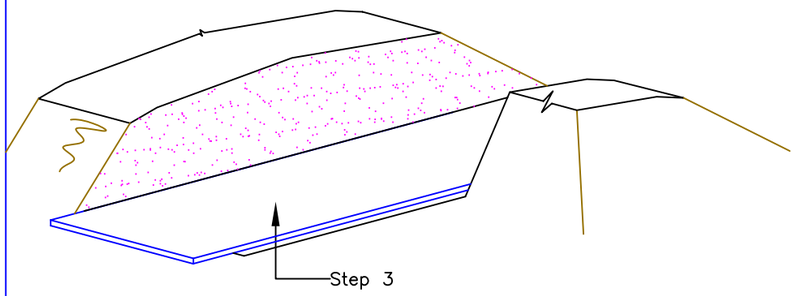
TELEFAX: 321364, 321425



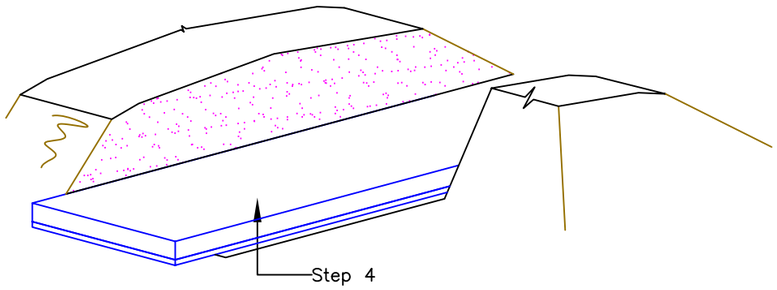
Step 1: Excavation and shaping
Step 2: Prepare and compact foundation

Arch under construction (NTS)



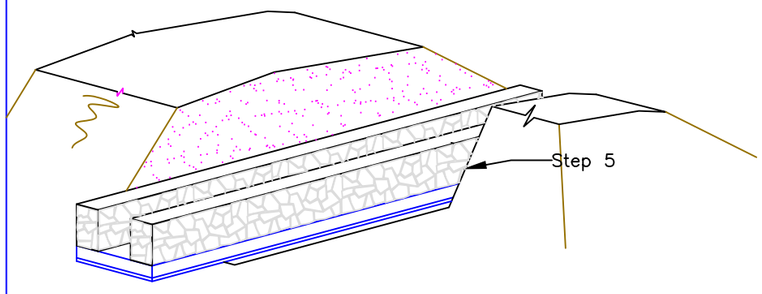
Step 3: Concrete bedding – class Lean concrete

Arch under construction (NTS)



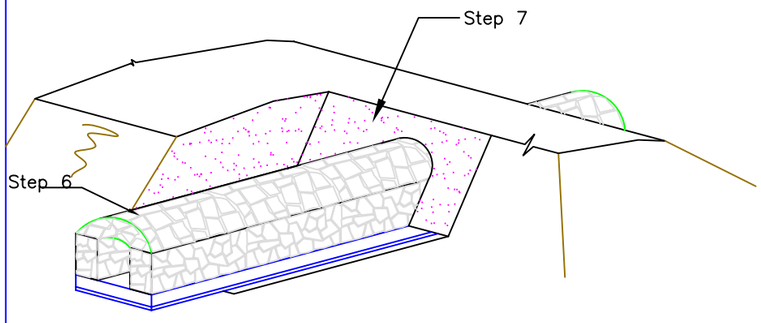
Step 4: Foor slab – class 20

Arch under construction (NTS)



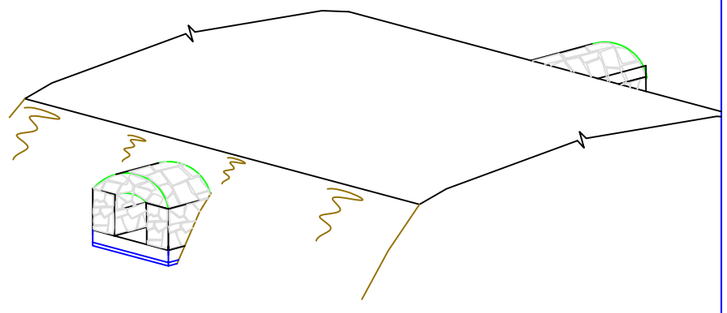
Step 5: Wall construction

Arch under construction (NTS)



Step 6: Arch construction
Step 7: Backfilling and compacting

Arch under construction (NTS)



Completed Arch (NTS)

Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete bedding – class Lean concrete
Step 4: Floor slab
Step 5: Wall construction
Step 6: Arch construction
Step 7: Backfilling and compacting

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

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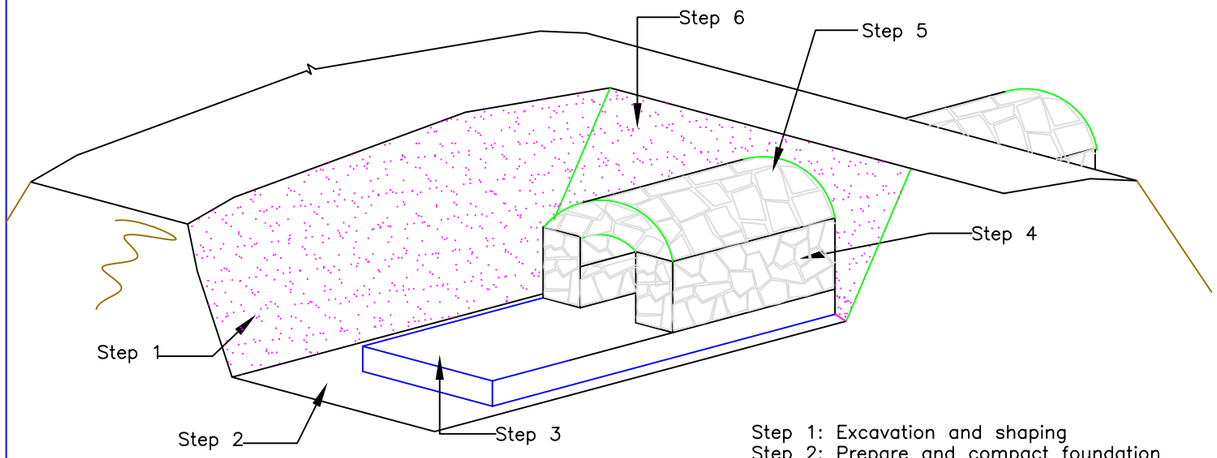
Drawing Number: ARCUL 001

ARCH CULVERT
Installation

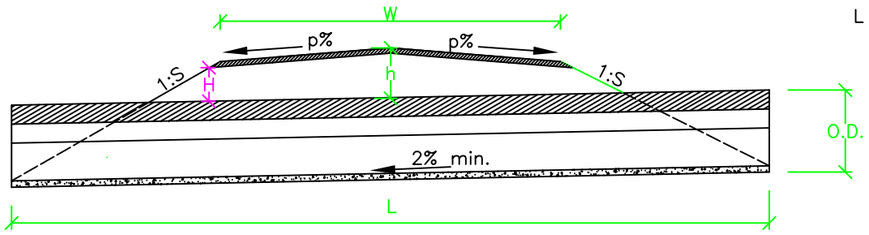
Scale: As shown
Dimension: mm
File Name: P/Roads and Highways/50999A/Data/Drawings/Arch
Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JMA	JMA	FCO	MMK	1/3



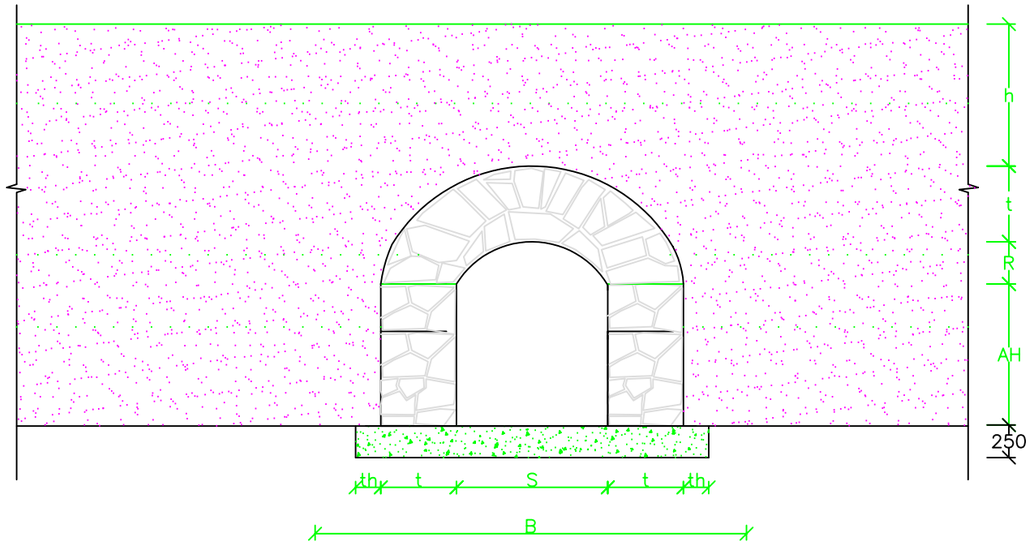
Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete bed – class 20
Step 4: Wall construction
Step 5: Arch construction
Step 6: Backfilling and compacting

Arch under construction (NTS)

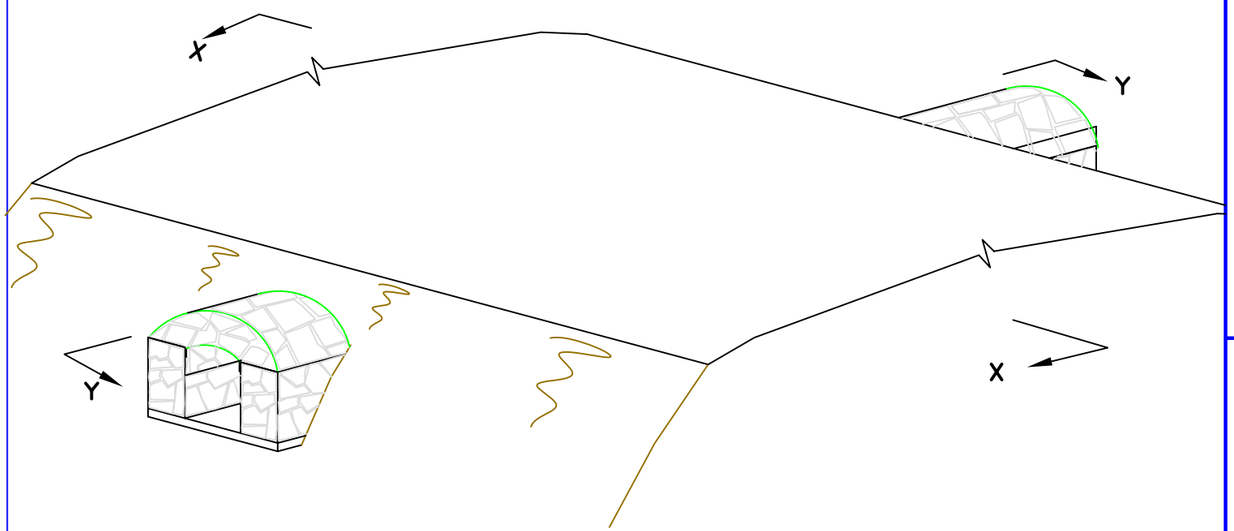


W: Carriageway
H: Minimum fill cover
L = 2s x (O.D.+h–(Wp/2)) + W
where:
L = total length of culvert
s = slope of embankment
O.D. = outside diameter
h = fill above culvert
p = camber (%)

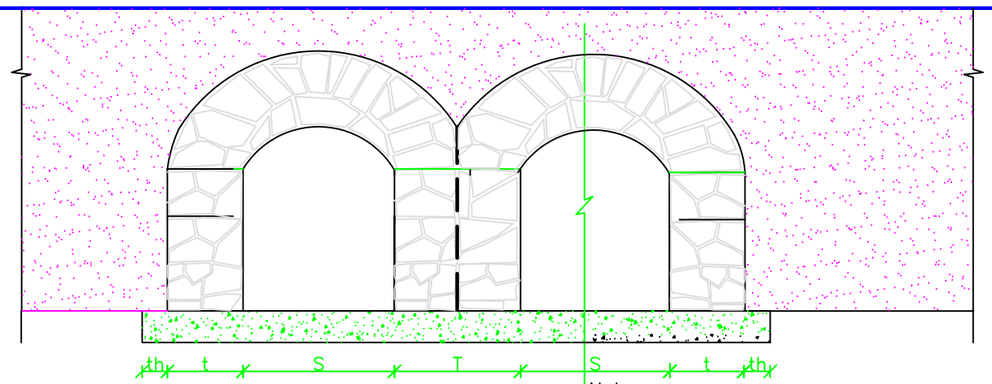
Longitudinal Section Y–Y (Scale 1:25)



Cross Section X–X (Scale 1:25)



Completed Arch (NTS)



Note:
1. Tapering to ends of middle walls (of thickness T)

Cross Section Z–Z

Scale: 1:25

TABLE FOR VARIOUS ARCH CULVERT SIZES

S/N	Arch Span S (mm)	Arch Height, AH (mm)	Excavation width, B (mm)	Min. cover, H (mm)	Rise, R (mm)	Projection th (mm)	Thickness, T (mm)	Wall Thickness t (mm)	W
1	600	600	S+1600	300	1/3 S	100	500	300	Varies
2	900	900	S+1600	450	1/3 S	100	500	300	Varies
3	1000	1000	S+1600	500	1/3 S	100	500	300	Varies
4	1200	1200	S+1700	600	1/3 S	200	600	450	Varies
5	1500	1500	S+1700	750	1/3 S	200	600	450	Varies

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: ARCUL 001

ARCH CULVERT
Installation and Sections

Scale: As shown
Dimension: mm
Date: June 2001
Sheet: 2/3

File Name: P/Roads and Highways/50999A/Data/Drawings/Arch

Drawn by: JMA
Designed by: JMA
Checked by: FCO
Approved by: MMK

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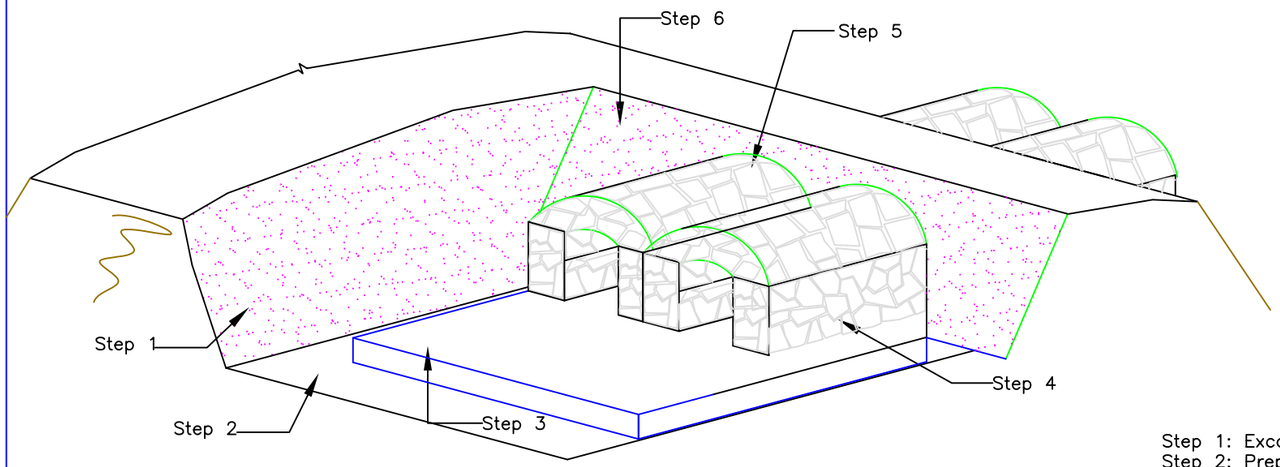
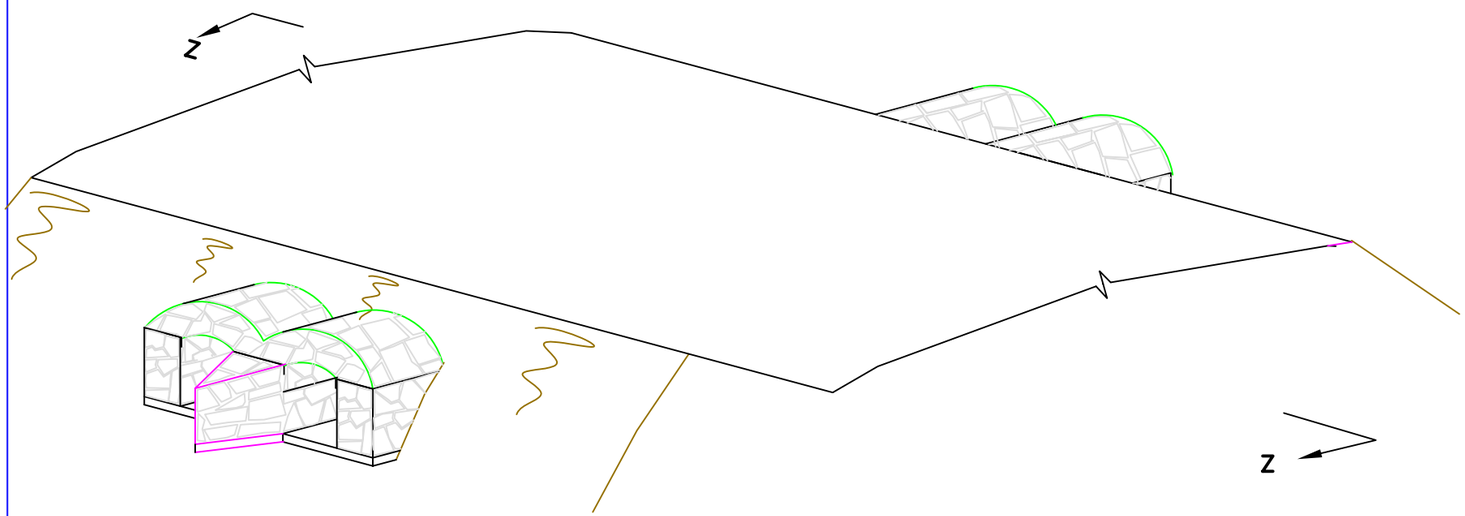
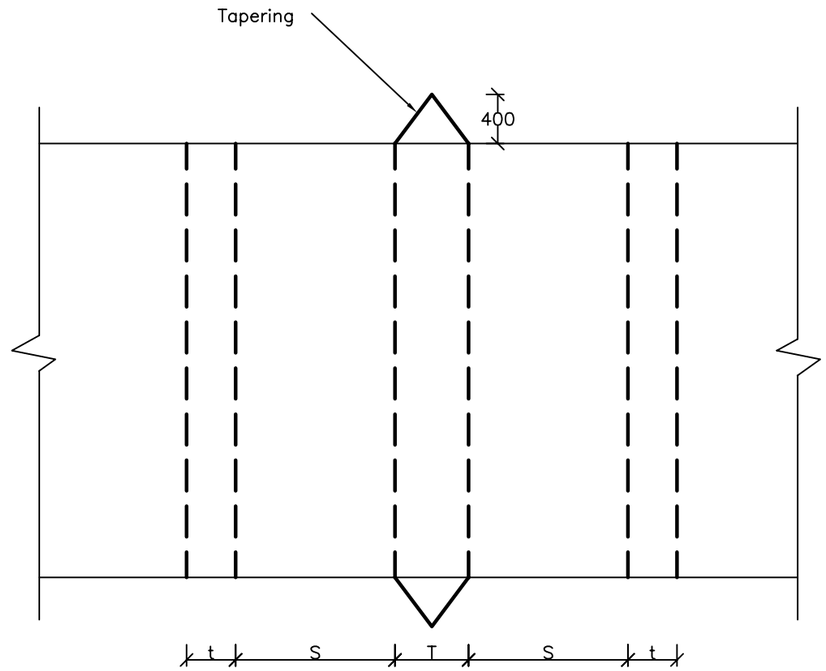


Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete bed – class 20
Step 4: Wall construction
Step 5: Arch construction
Step 6: Backfilling and compacting

Arch under construction (NTS)



Completed Arch (NTS)



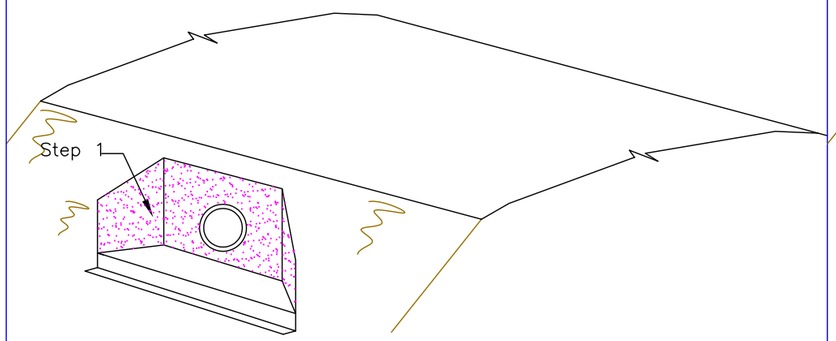
Plan of Multiple Arches

Cross Section through Multiple Arches

Project: SUPPORT TO DISTRICT ROAD NETWORKS				**Drawing Number:** ARCUL 001	
Title: STANDARD STRUCTURES MANUAL				**ARCH CULVERT** **Installation and Sections**	Scale NTS
\\Server\p\Roads & Highways 50999A\Data\Drawings\logo3.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425				Dimension mm
				File Name: P/Roads and Highways/50999A/Data/Drawings/Arch	Date June 2001
				Drawn by: JMA / Designed by: JMA / Checked by: FCO / Approved by: MMK	Sheet: 3/3

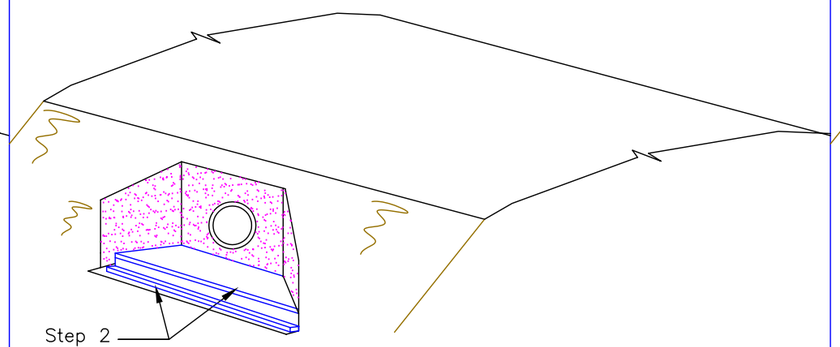
Section B-2
Culvert End Structures

Section B-2
Culvert End Structures



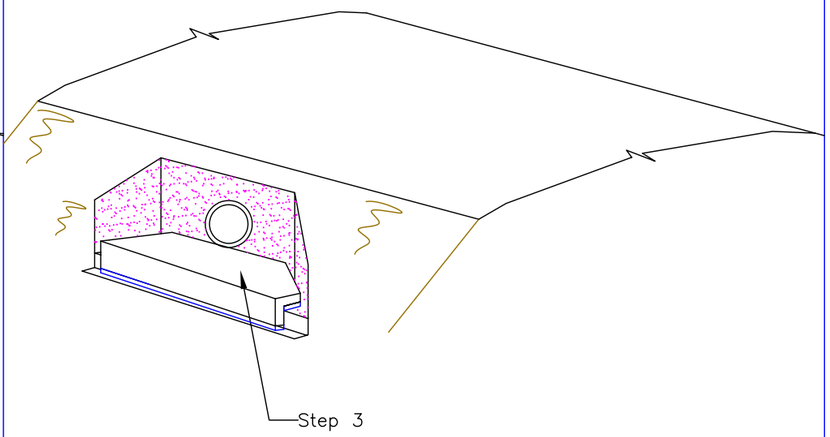
Step 1: Excavation and shaping

Headwall and Wingwalls under construction (NTS)



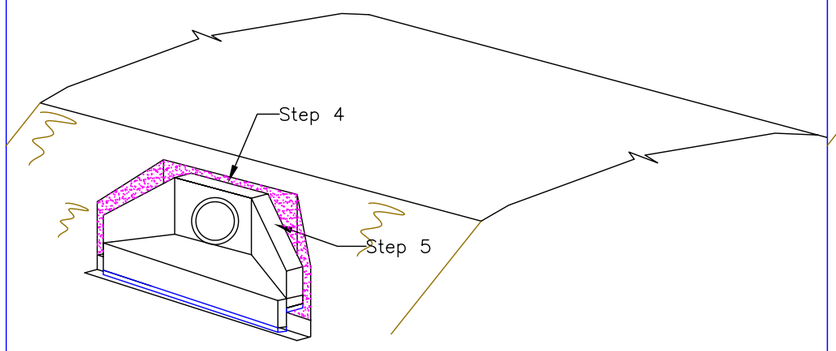
Step 2: Bedding

Headwall and Wingwalls under construction (NTS)



Step 3: Apron and toe construction

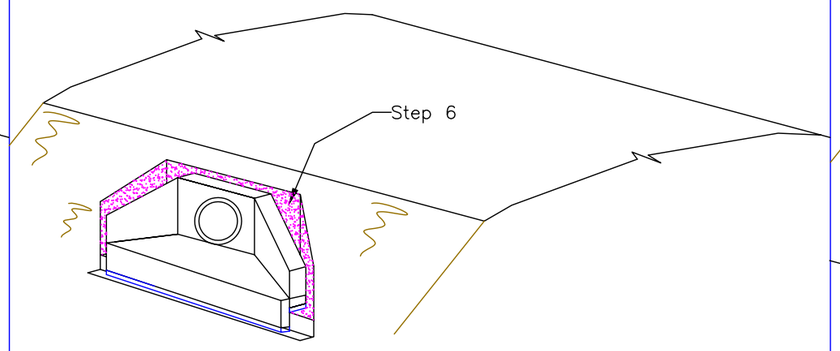
Headwall and Wingwalls under construction (NTS)



Step 4: Headwalls

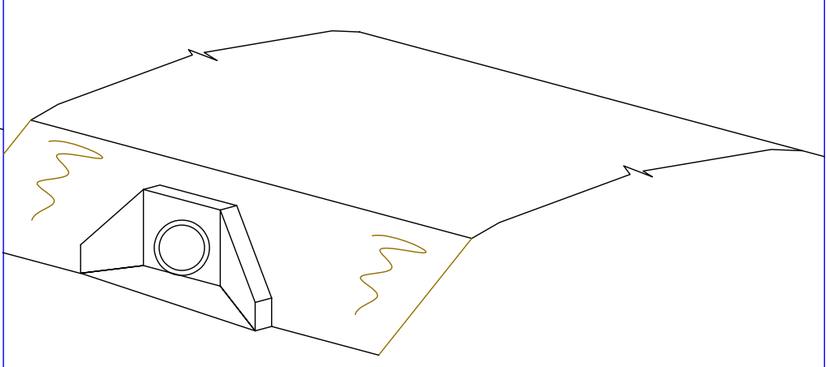
Step 5: Wingwalls

Headwall and Wingwalls under construction (NTS)



Step 6: Backfilling and compacting

Headwall and Wingwalls under construction (NTS)



Completed Head and Wingwalls (NTS)

Step 1: Excavation and shaping
Step 2: Bedding
Step 3: Apron construction
Step 4: Headwalls
Step 5: Wingwalls
Step 6: Backfilling and compacting

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: PCES 001

CULVERT END STRUCTURE HEADWALLS AND WINGWALLS Installation

Scale: As shown

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings /End Structures 2

Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	1/2

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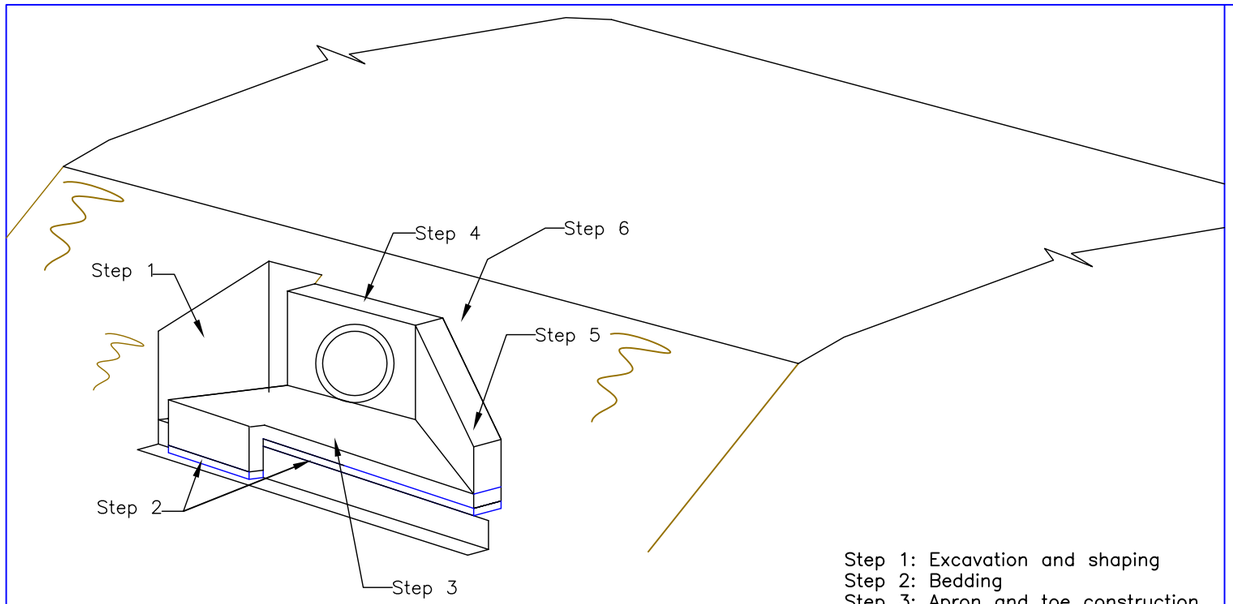
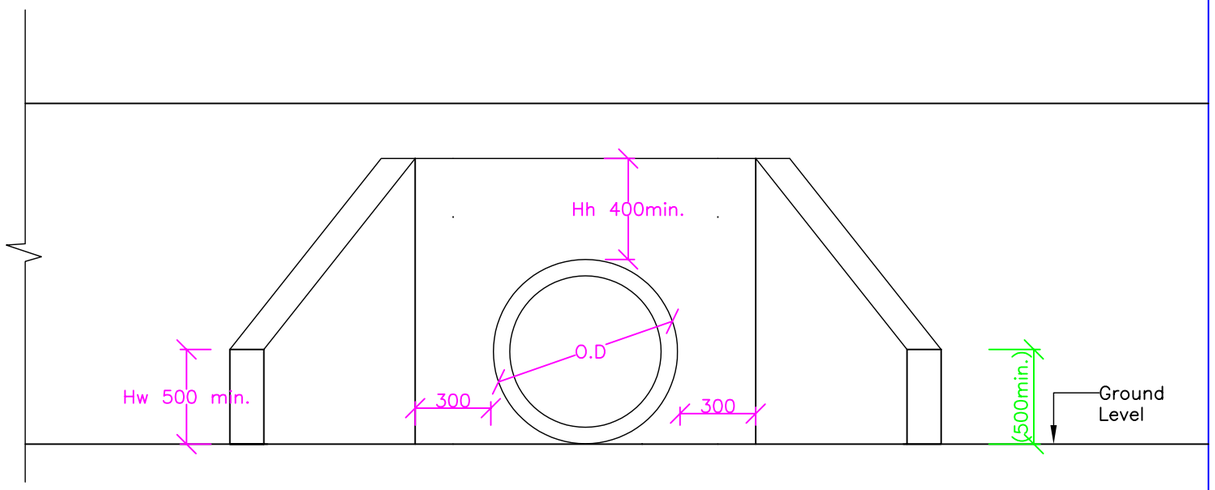
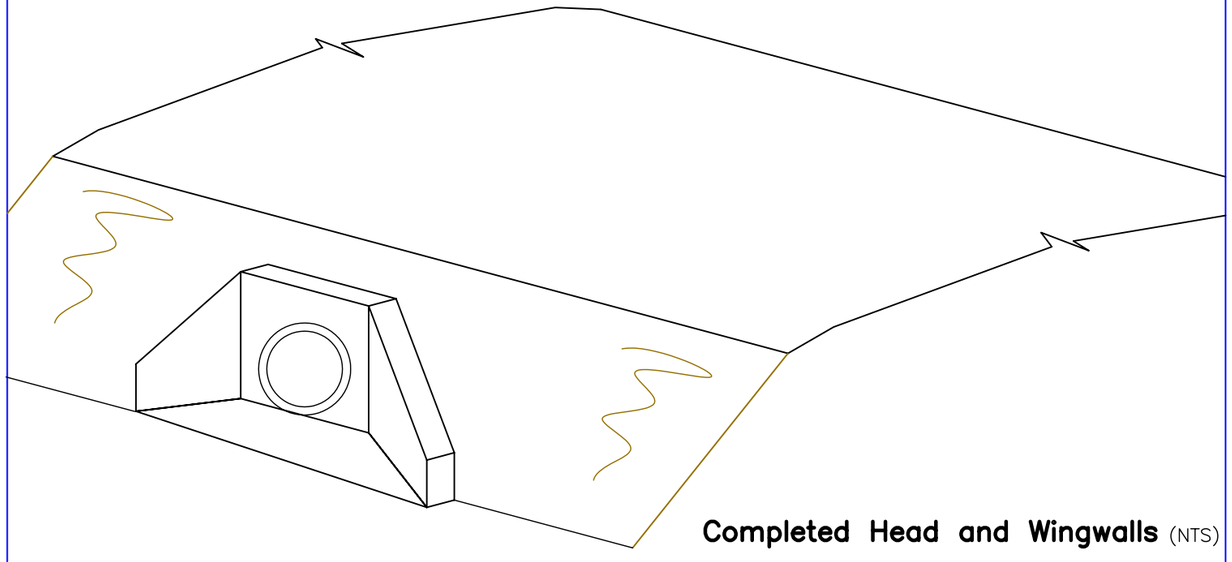


Step 1: Excavation and shaping
Step 2: Bedding
Step 3: Apron and toe construction
Step 4: Headwalls
Step 5: Wingwalls
Step 6: Backfilling and compacting

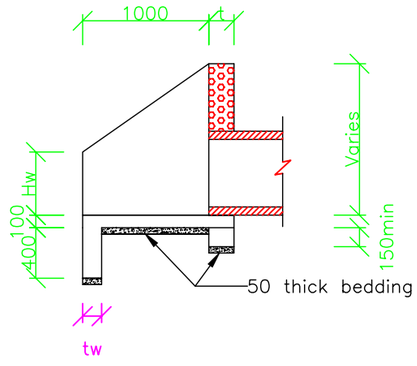
Headwall and Wingwalls under construction (NTS)



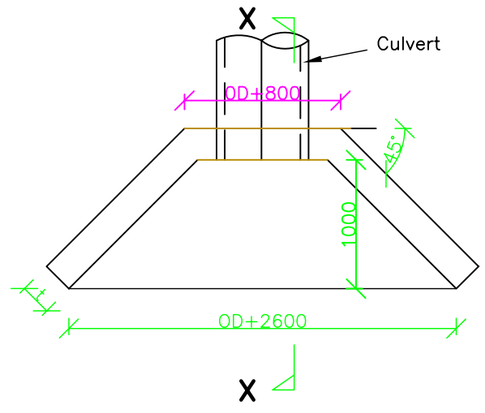
Headwall and Wingwall Elevation (Scale 1:25)



Completed Head and Wingwalls (NTS)



Section X–X (Scale 1:50)



Head and Wingwalls Plan (Scale 1:50)

TABLE: HEAD AND WINGWALL THICKNESSES

S/N	Culvert Dia. d (mm)	Excavation with, B (mm)	Concrete End Structure: Head/wing wall Thickness t (mm)	Concrete Block End Structure: Head/wing wall Thickness t (mm)	Stone Masonry End Structure: Head/wing wall Thickness t (mm)
1	600	2900	200	230	300
2	900	3200	200	230	300
3	1000	3300	200	230	300
4	1200	3500	200	230	300
5	1500	3800	200	230	300

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

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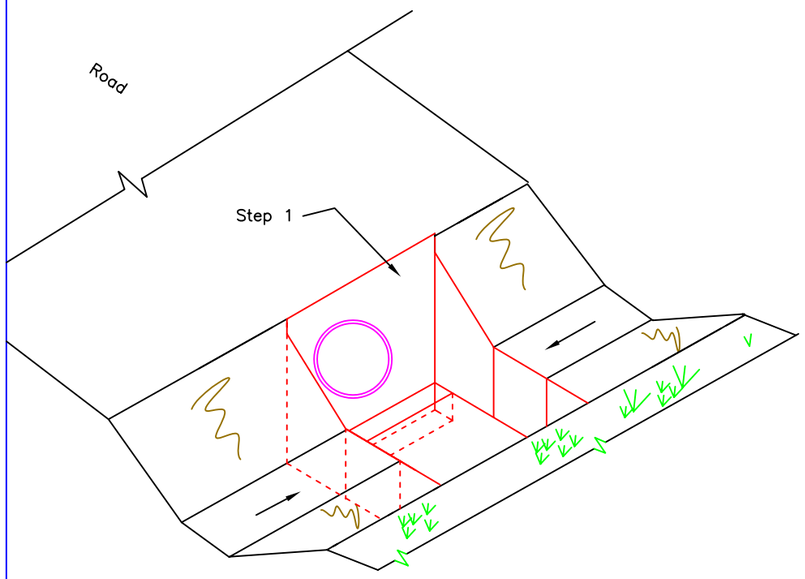
TELEFAX: 321364, 321425

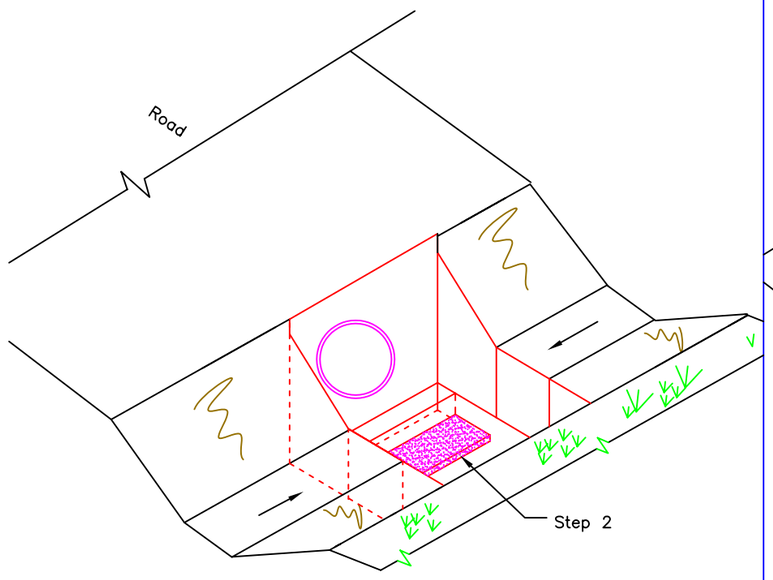
Drawing Number: PCES 001

CULVERT END STRUCTURE
Headwalls and Wingwalls

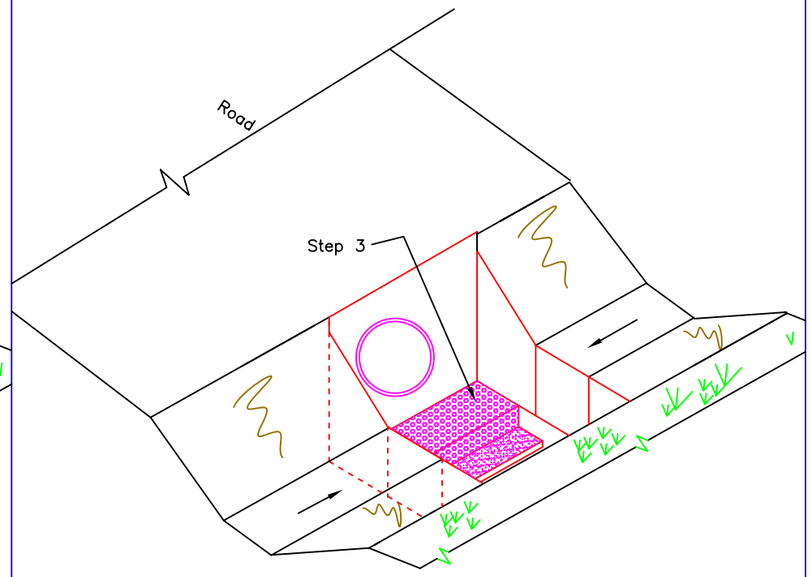
Scale: As shown
Dimension: mm
File Name: P/Roads and Highways/50999A/Data/Drawings /End Structures 2
Date: June 2001
Drawn by: JMA | Designed by: JMA | Checked by: FCO | Approved by: MMK
Sheet: 2/2



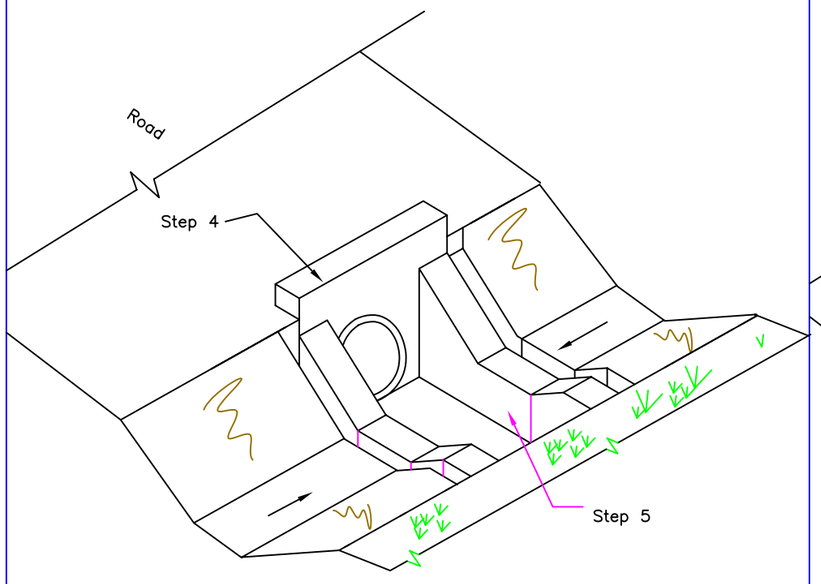
Step 1: Excavation and shaping



Step 2: Bedding and compacting

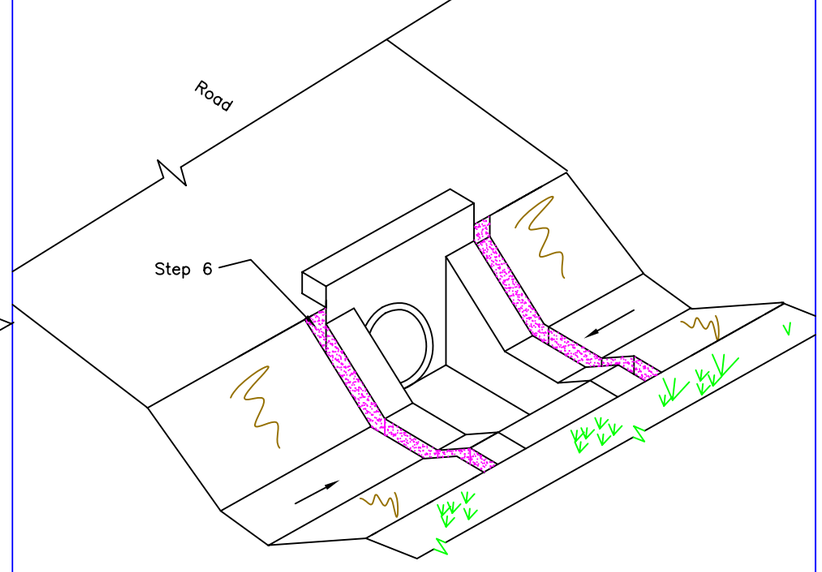


Step 3: Apron and toe construction

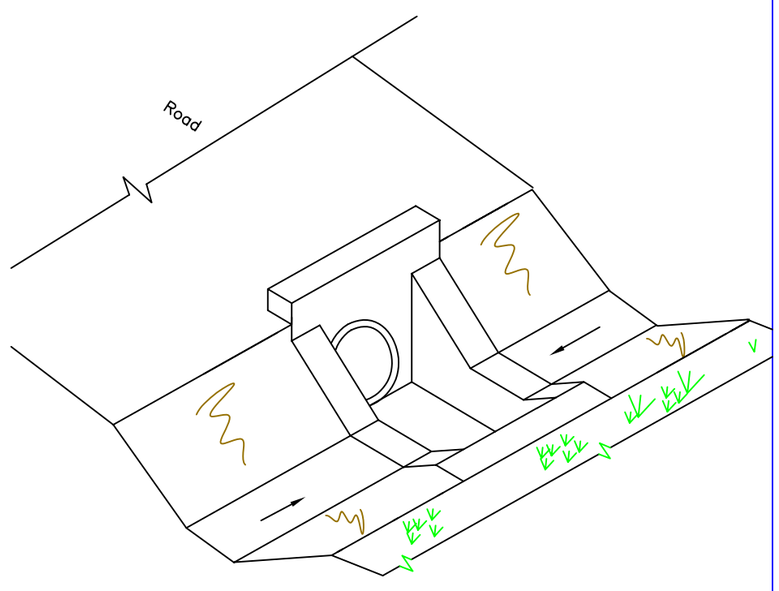


Step 4: Headwall construction

Step 5: Side wall construction

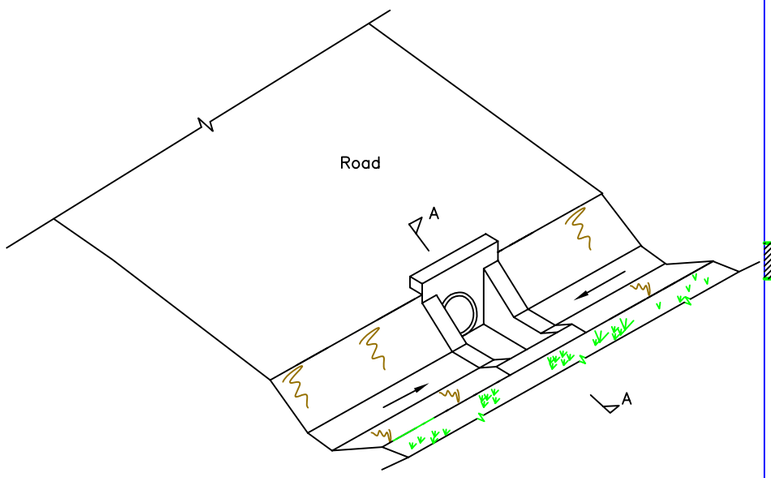


Step 6: Backfilling and compacting

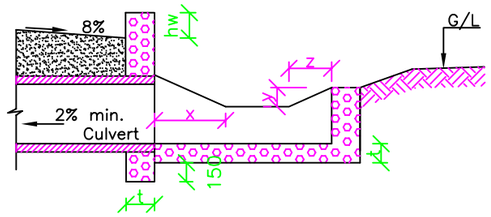


Completed Drop inlet

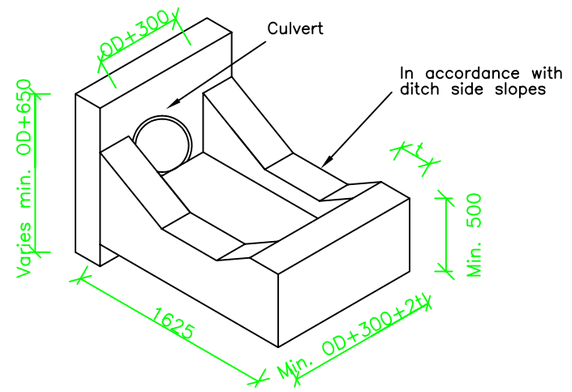
Project: SUPPORT TO DISTRICT ROAD NETWORKS				**Drawing Number:** PCES 002
Title: STANDARD STRUCTURES MANUAL				**RELIEF STRUCTURES** **Drop Inlets** **Plan, Elevations and Sections** — Scale: As shown; Dimension: mm
\\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425			File Name: P/Roads and Highways/50999A/Data /Drawings/ End Structures — Date: June 2001
				Drawn by: JMA; Designed by: JMA; Checked by: FCO; Approved by: MMK; Sheet: 1/2



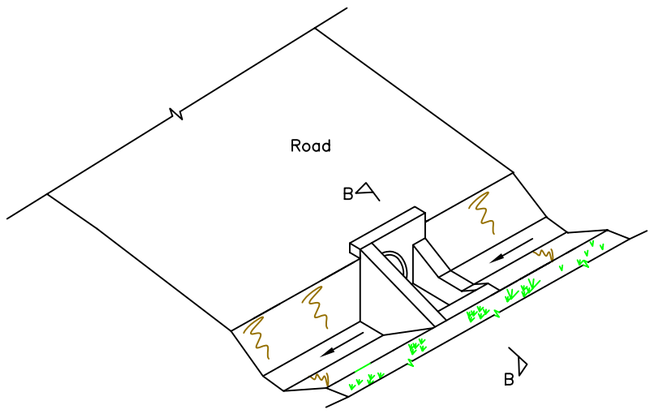
Drop inlet (double inflow) NTS



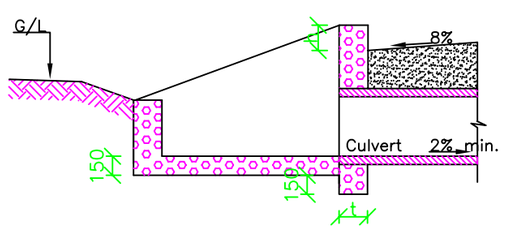
Section A–A (Scale 1:50)



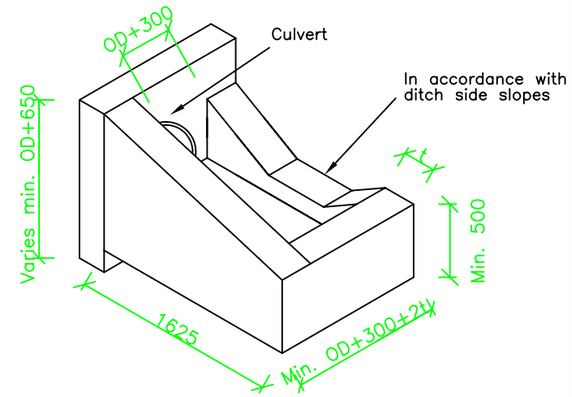
Drop inlet view (double inflow) (Scale 1:50)



Drop inlet (single inflow) NTS



Section B–B (Scale 1:50)



Drop inlet (single inflow) (Scale 1:50)

S/N	Culvert diameter, O.D (mm)	Height, hw (mm)	Thickness (t) (mm)	Material
1	600	150	200	Concrete
			300	Stone masonry
			230	Concrete blocks
2	900	150	200	Concrete
			300	Stone masonry
			230	Concrete blocks
3	1000	150	200	Concrete
			300	Stone masonry
			230	Concrete blocks
4	1200	150	200	Concrete
			300	Stone masonry
			230	Concrete blocks
5	1500	150	200	Concrete
			300	Stone masonry
			230	Concrete blocks

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: PCES 002

RELIEF STRUCTURES
Drop Inlets
Plan, Elevations and Sections

Scale: As shown

Dimension: mm

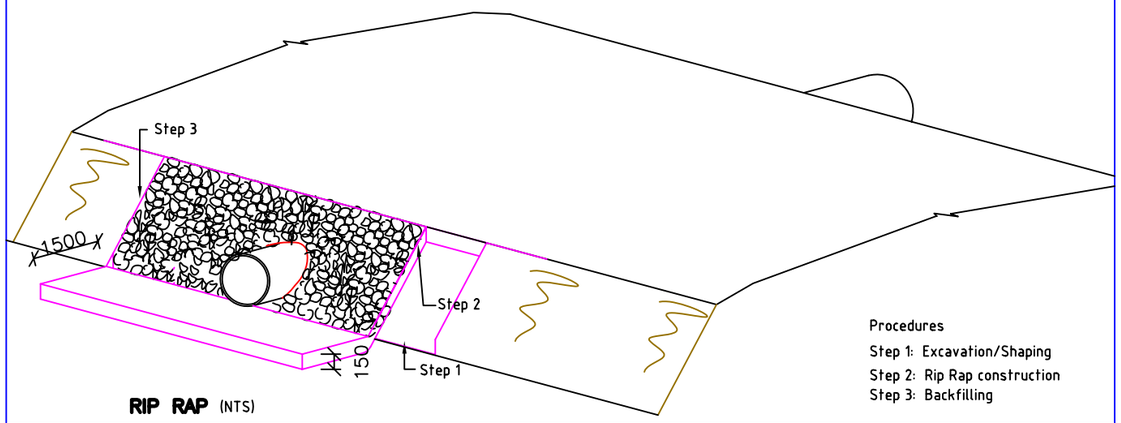
File Name: P/Roads and Highways/50999A/Data /Drawings/ End Structures

Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JMA	JMA	FCO	MMK	2/2

Section B-3
Culvert End Protection

Section B-3
Culvert End Protection



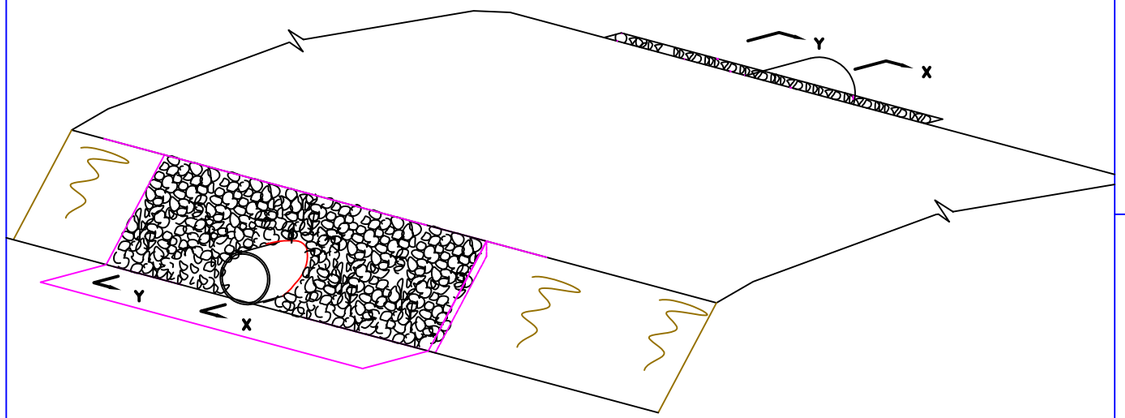
RIP RAP (NTS)

Procedures

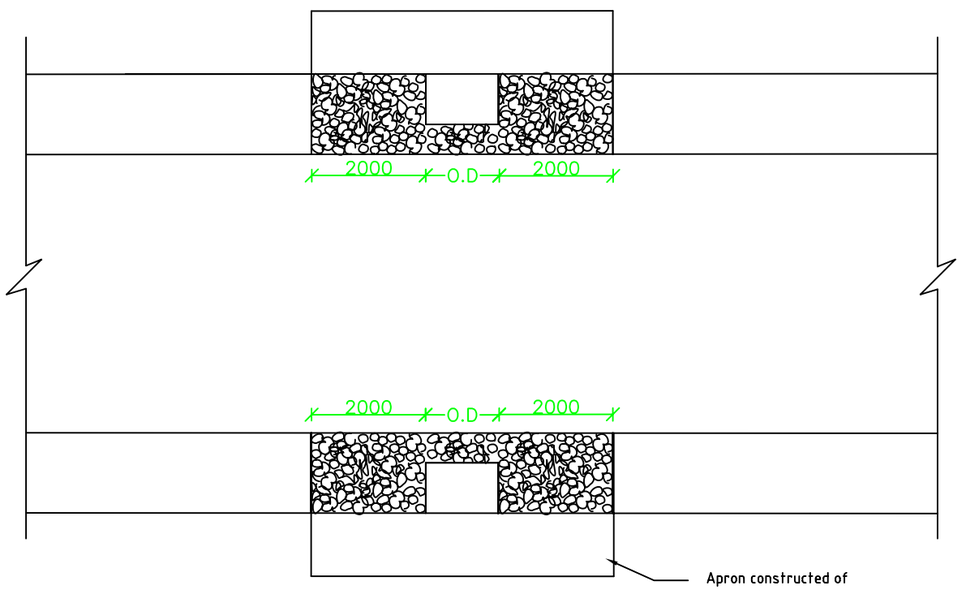
Step 1: Excavation/Shaping

Step 2: Rip Rap construction

Step 3: Backfilling

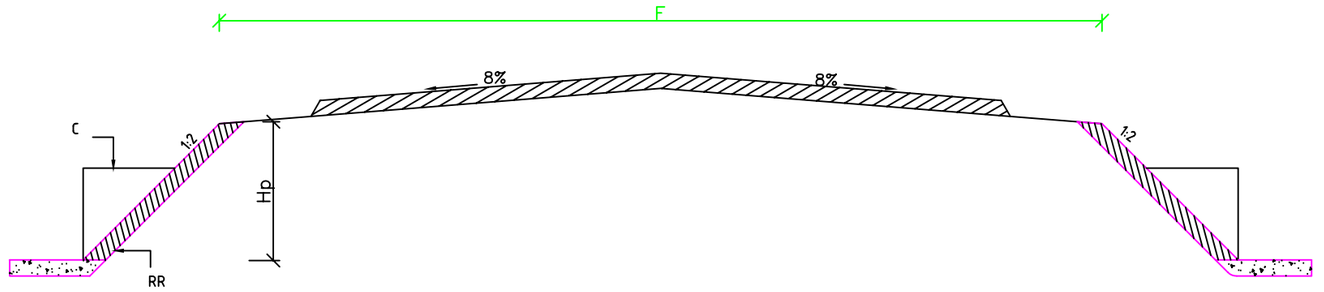


COMPLETED RIP RAP (NTS)



Apron constructed of
Loose stones or
Stone masonry or
Concrete as directed by the Engineer

PLAN (NTS)

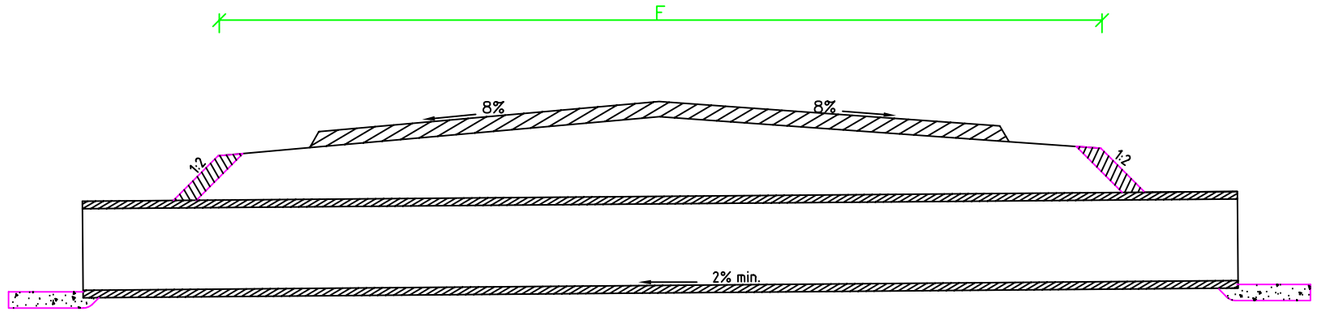


SECTION Y–Y (Scale 1:50)

F: Formation width

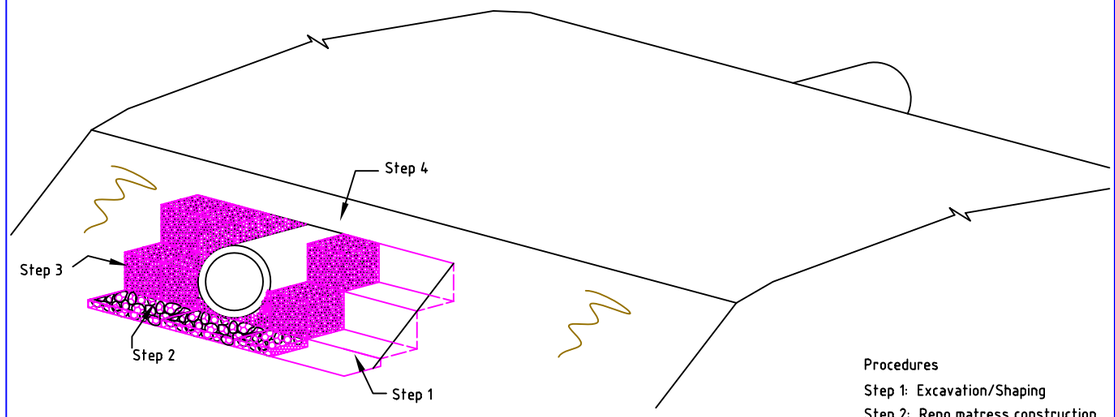
C: Culvert

RR: Rip Rap min. thickness 150mm



SECTION X–X (Scale 1:50)

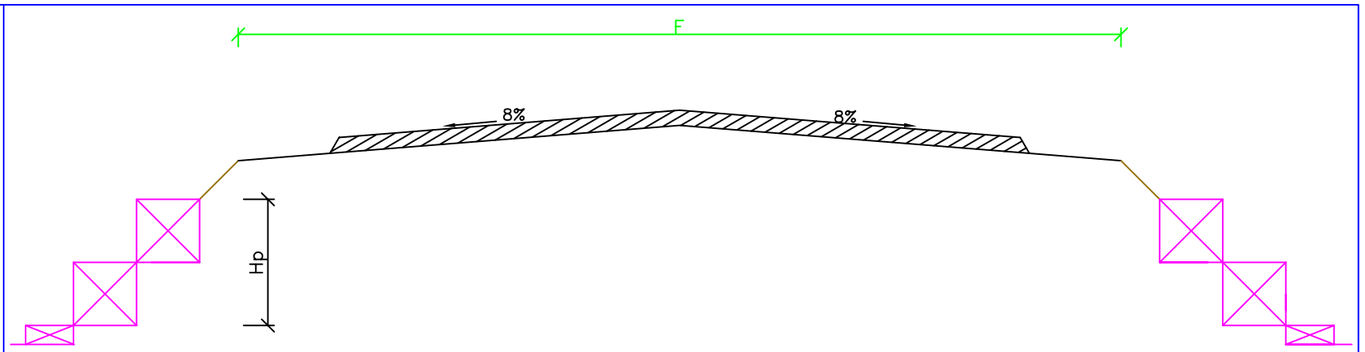
Project: SUPPORT TO DISTRICT ROAD NETWORK PROGRAMME				**Drawing Number:** PCEP 001
Title: STANDARD STRUCTURES MANUAL				**CONCRETE PIPE CULVERT END PROTECTION, RIP RAP** **Plan, Elevations and Sections** — Scale: As shown; Dimension: mm
\\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425			File Name: P/Roads and Highways/50999A/Data/Drawings/End structures 1 — Date: June 2001
				Drawn by: JMA; Designed by: JMA; Checked by: FCO; Approved by: MMK; Sheet: 1/1



Gabion boxes and Reno matress apron construction (NTS)

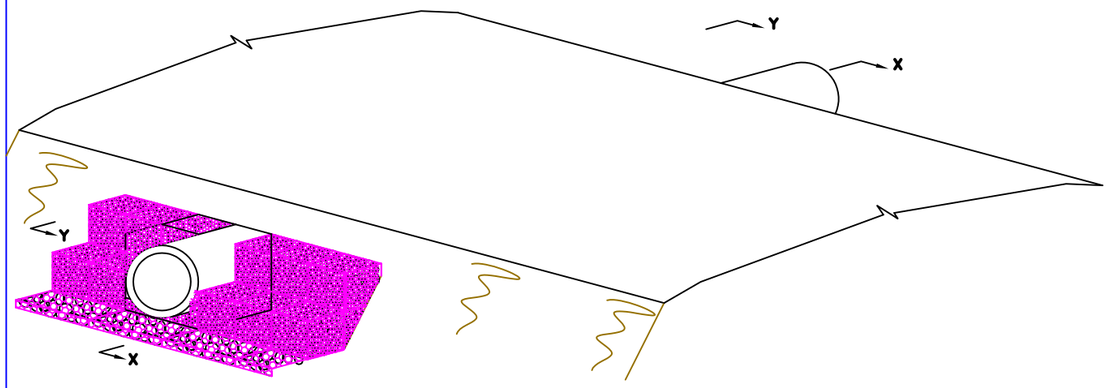
Procedures

Step 1: Excavation/Shaping
Step 2: Reno matress construction
Step 3: Gabion construction
Step 4: Backfilling

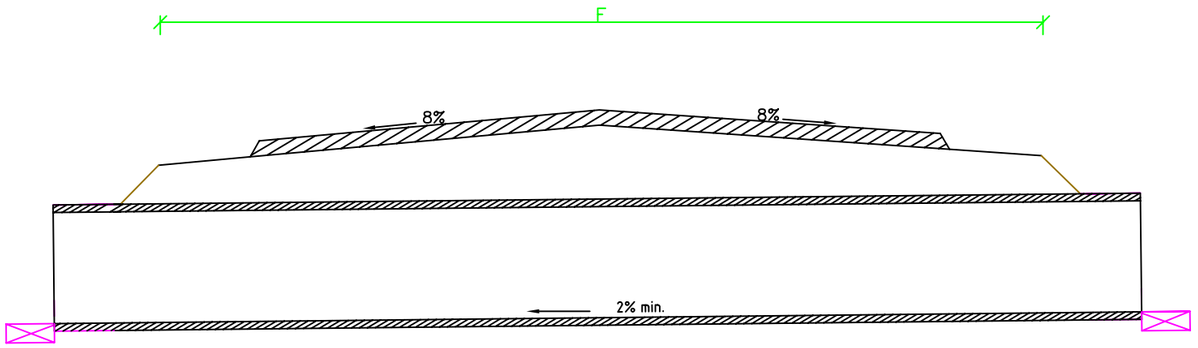


Section Y–Y (Scale 1:50)

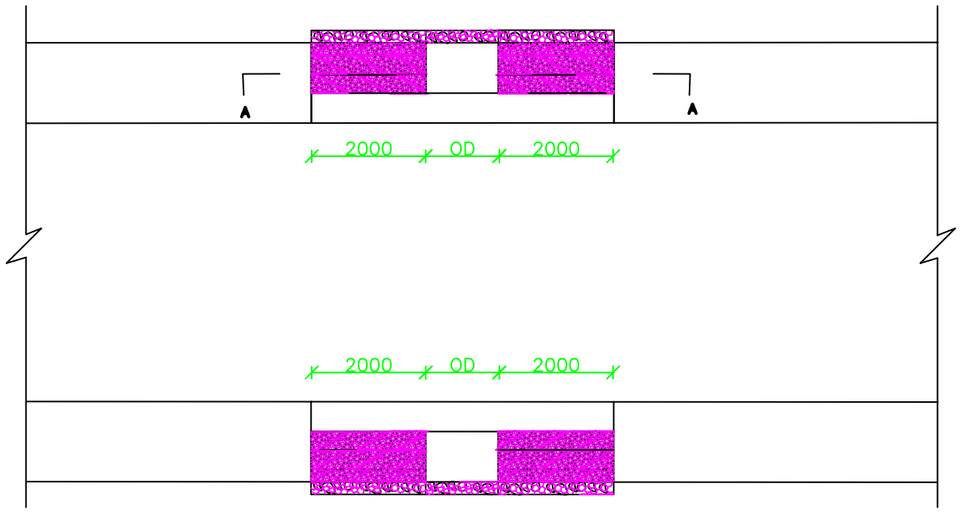
F: Formation



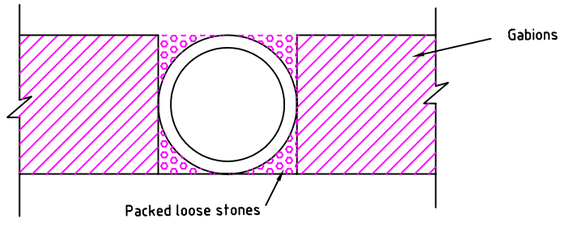
Completed Gabion boxes and Reno matress (NTS)



Section X–X (Scale 1:50)



Plan (NTS)



Section A–A (Scale 1:50)

Project: SUPPORT TO DISTRICT ROAD NETWORK PROGRAMME				**Drawing Number:** PCEP 002	
Title: STANDARD STRUCTURES MANUAL				**CONCRETE PIPE END PROTECTION GABION BOXES** **Plan, Elevations and Sections**	Scale: As shown
					Dimension: mm
				File Name: P/Roads and Highways/50999A/Data/Drawings/ End structures 1	Date: June 2001
					Sheet: 1/1
Drawn by: JMA	Designed by: JMA	Checked by: FCO	Approved by: MMK		

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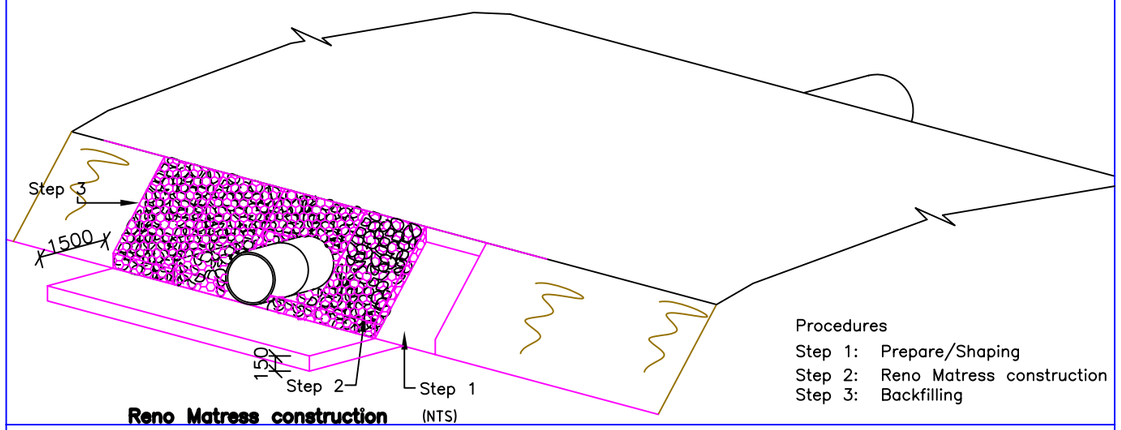
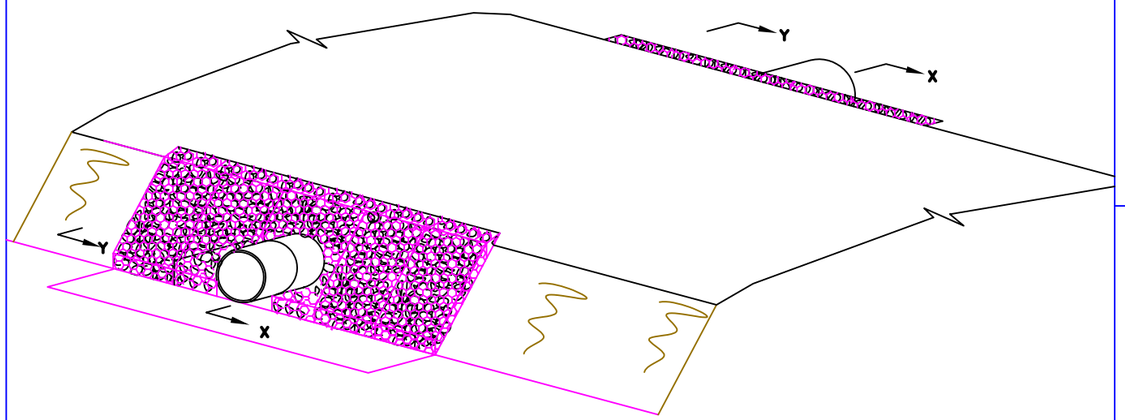


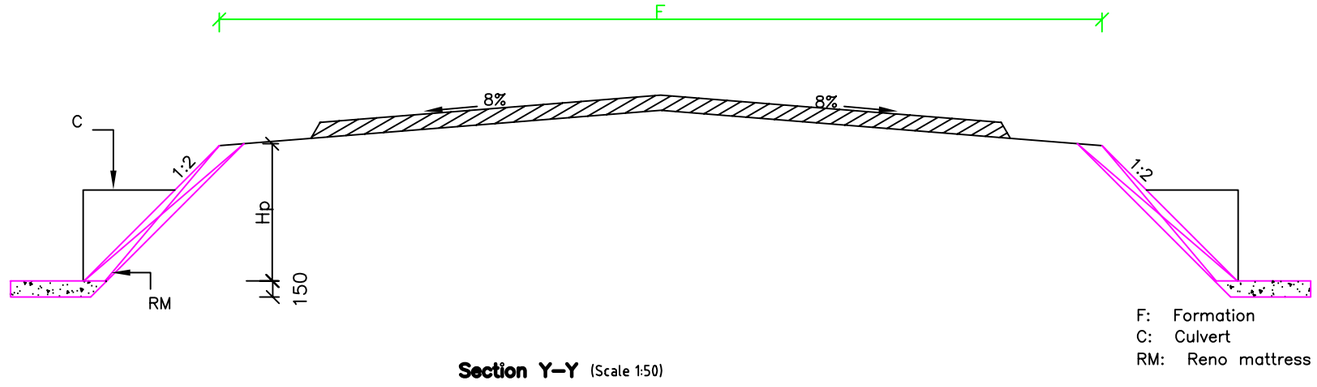
Reno Matress construction (NTS)

Procedures

Step 1: Prepare/Shaping
Step 2: Reno Matress construction
Step 3: Backfilling

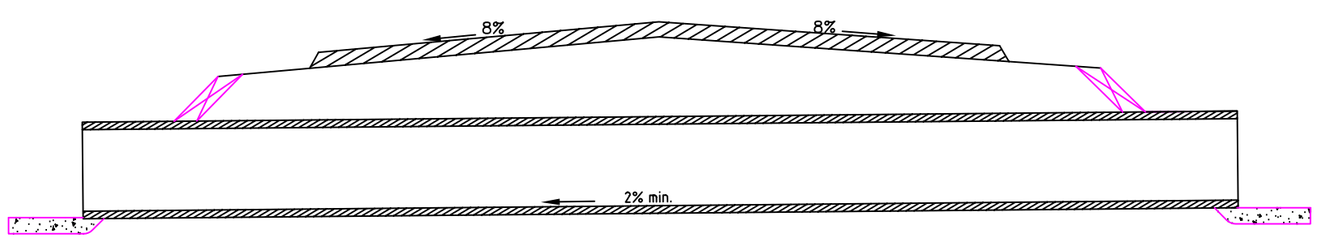


Completed Reno Matresses (NTS)

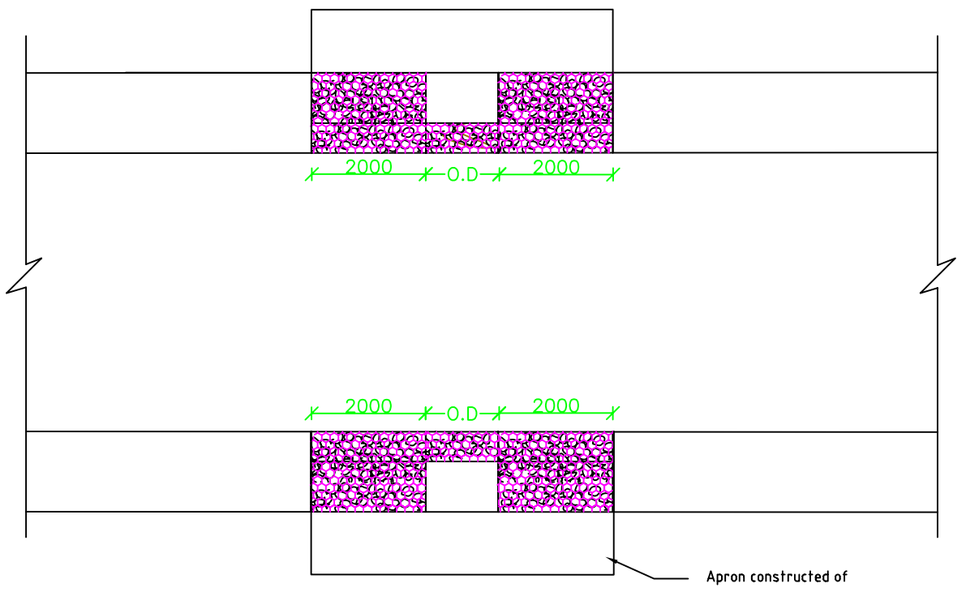


Section Y–Y (Scale 1:50)

F: Formation
C: Culvert
RM: Reno mattress



Section X–X (Scale 1:50)



Apron constructed of
Loose stones or
Stone masonry or
Concrete as directed by the Engineer

Plan (NTS)

Project: SUPPORT TO DISTRICT ROAD NETWORK PROGRAMME

Title: STANDARD STRUCTURES MANUAL

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

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TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: PCEP 003

CONCRETE PIPE CULVERT END PROTECTION RENO MATTRESSES

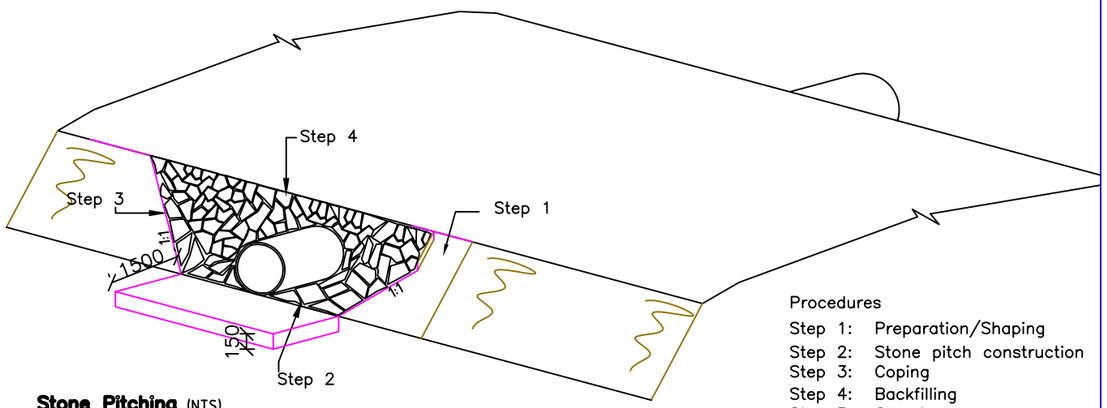
Plan, Elevations and Sections

Scale: As shown
Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/End structures 1

Date: June 2001

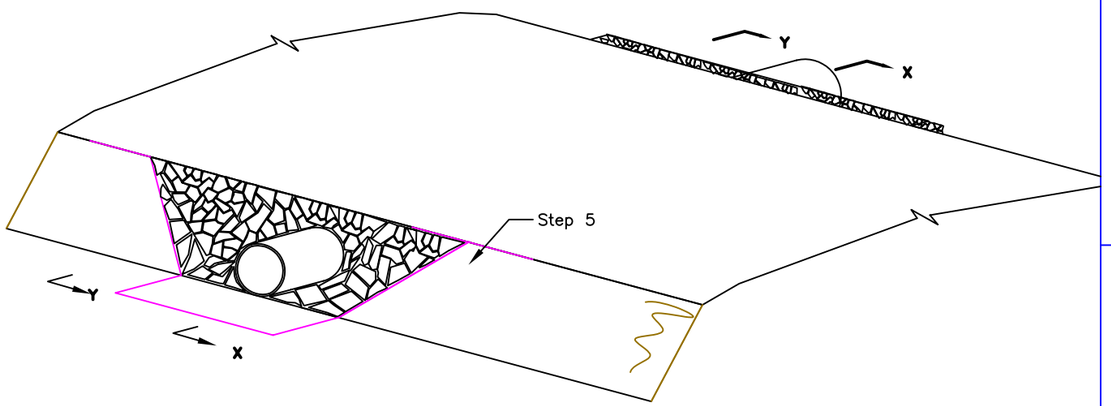
Drawn by	Designed by	Checked by	Approved by	Sheet:
JMA	JMA	FCO	MMK	1/1



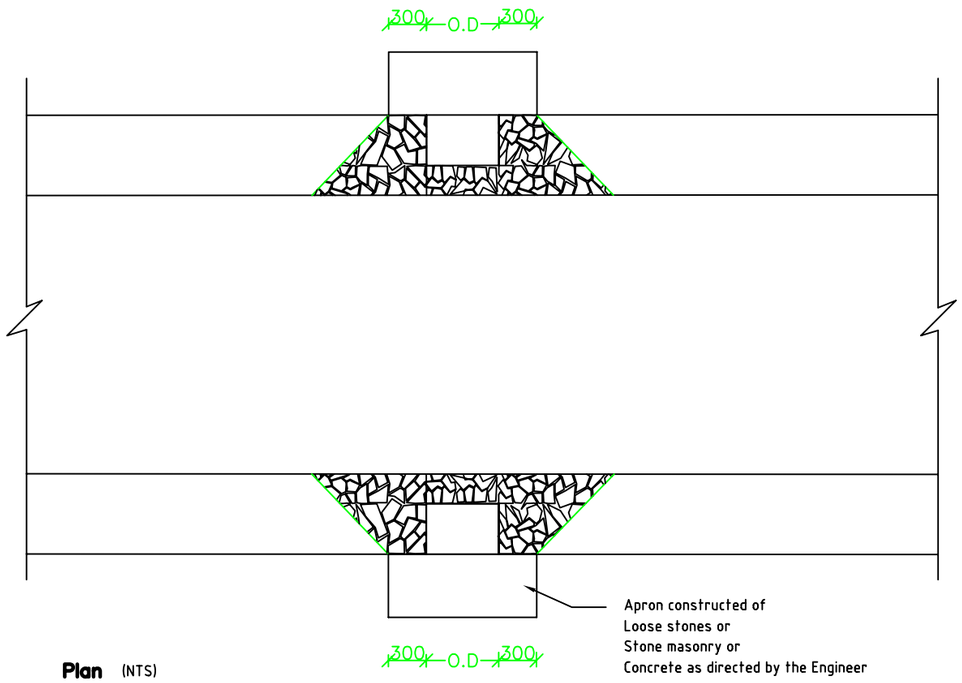
Stone Pitching (NTS)

Procedures

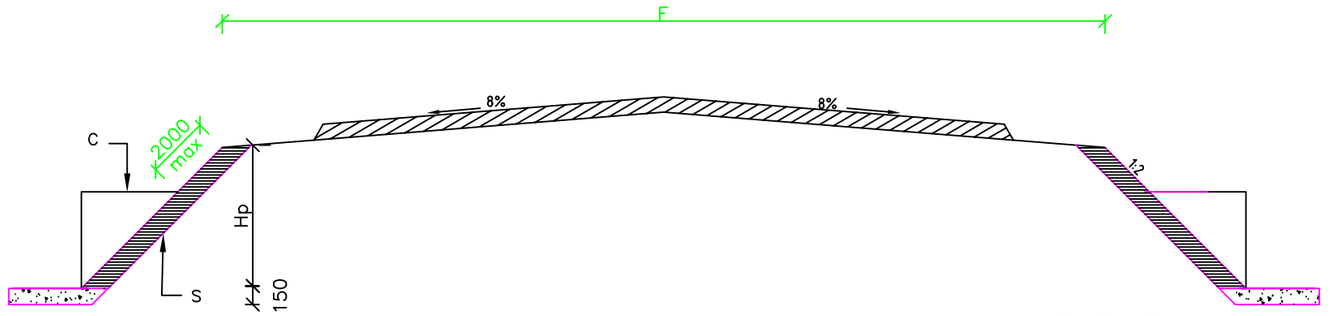
Step 1: Preparation/Shaping
Step 2: Stone pitch construction
Step 3: Coping
Step 4: Backfilling
Step 5: Grassing



Completed Stone pitching (NTS)

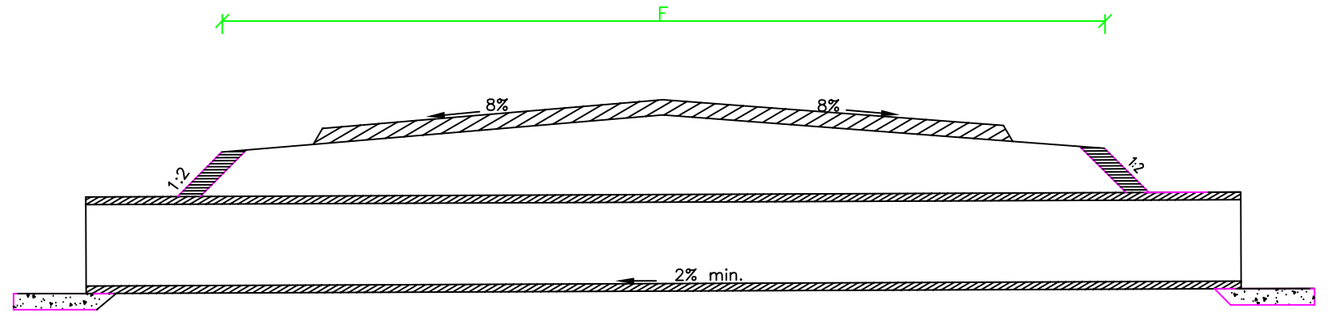


Plan (NTS)



Section Y–Y (Scale 1:50)

F: Formation
C: Culvert
S: Stone pitching 150mm min.

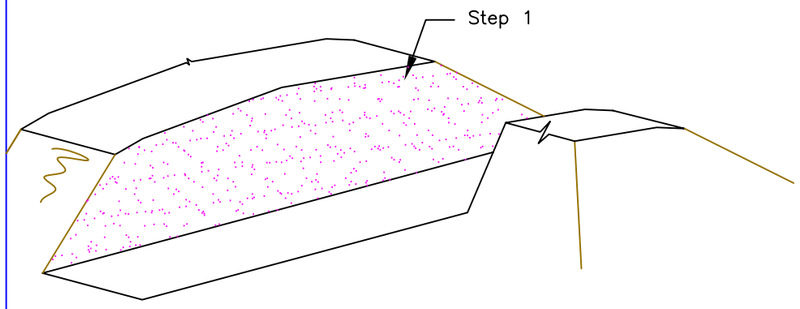


Section X–X (Scale 1:50)

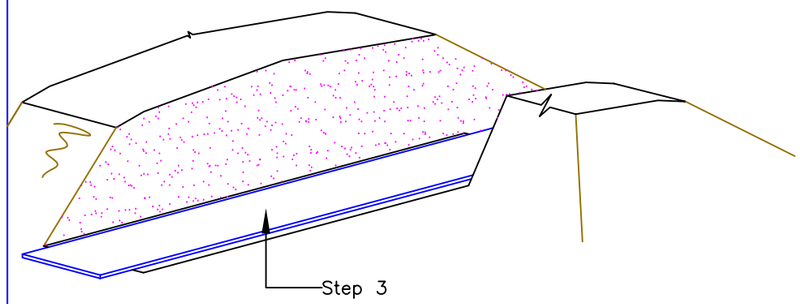
Project: SUPPORT TO DISTRICT ROAD NETWORK PROGRAMME				**Drawing Number:** PCEP 004
Title: STANDARD STRUCTURES MANUAL				**CONCRETE PIPE CULVERT END PROTECTION STONE PITCHING** **Plan, Elevations and Sections** — Scale: As shown; Dimension: mm
\\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425			File Name: P/Roads and Highways/50999A/Data/Drawings/End structures 1 — Date: June 2001
				Drawn by: JMA; Designed by: JMA; Checked by: FCO; Approved by: MMK; Sheet: 1/1

Section B-4
Box Culverts

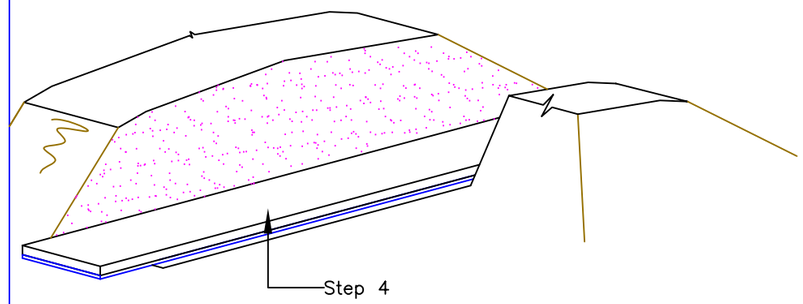
Section B-4
Box Culverts



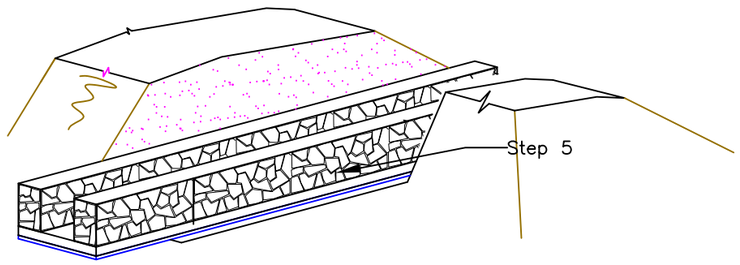
Step 1: Excavation and shaping
Step 2: Prepare and compact foundation



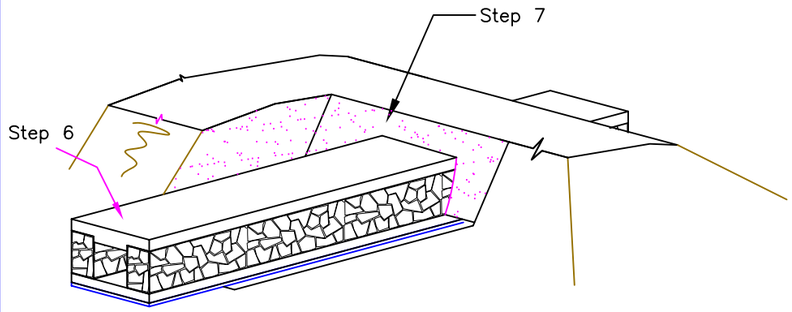
Step 3: Concrete bedding – class Lean concrete



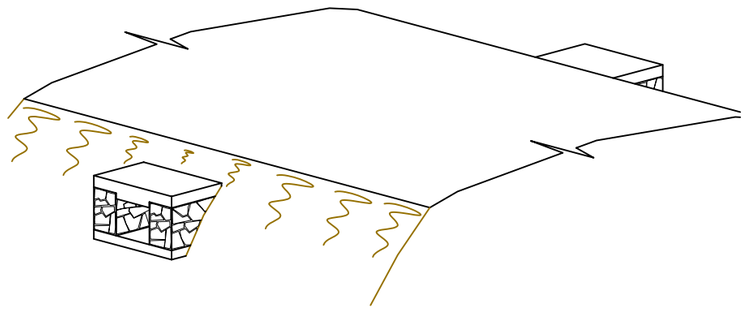
Step 4: Floor slab (C20)



Step 5: Wall construction



Step 6: Place top slab
Step 7: Backfilling and compacting



Completed Box Culvert

Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete blinding
Step 4: Floor slab (C20 concrete)
Step 5: Walls
Step 6: Place top slab
Step 7: Backfilling and compacting

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

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MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: BCSM 001

BOX CULVERT - STONE MASONRY Installation

Scale: NTS

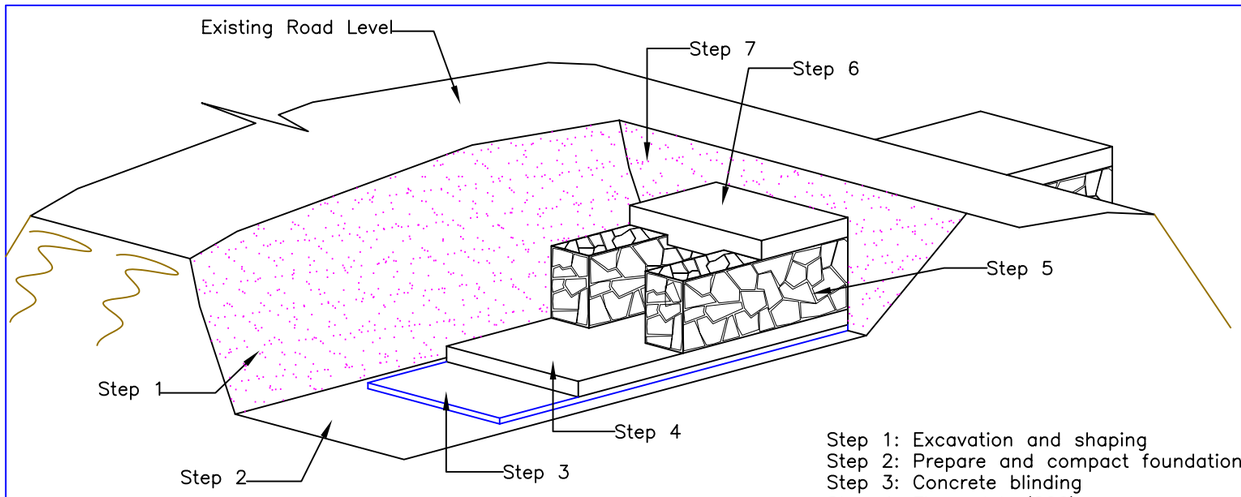
Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Box Culverts

Date: June 2001

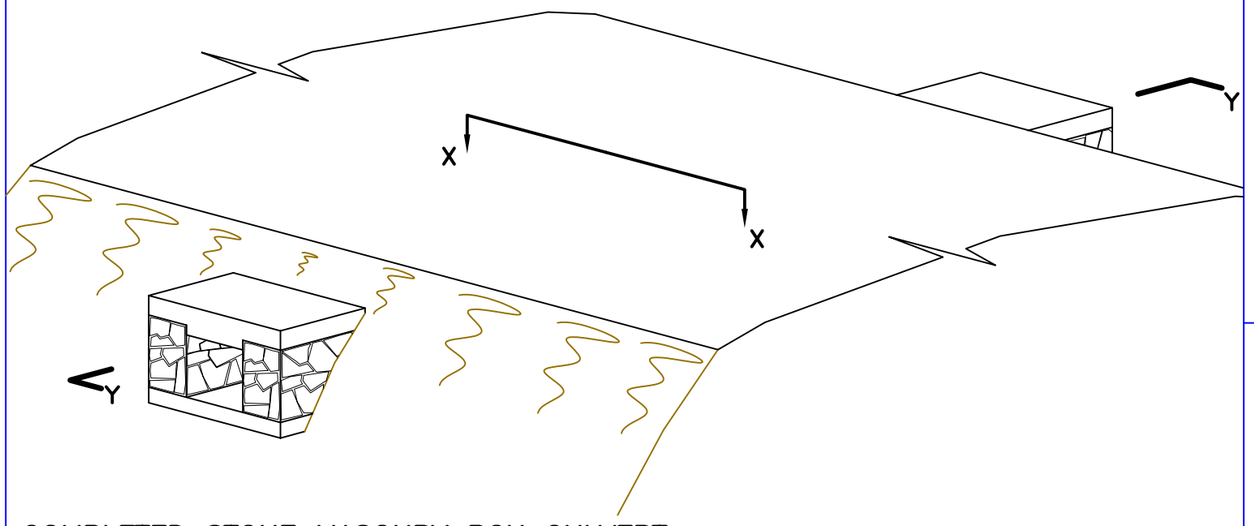
Drawn by	Designed by	Checked by	Approved by
JAU	JAU	FCO	MMK

Sheet: 1/3

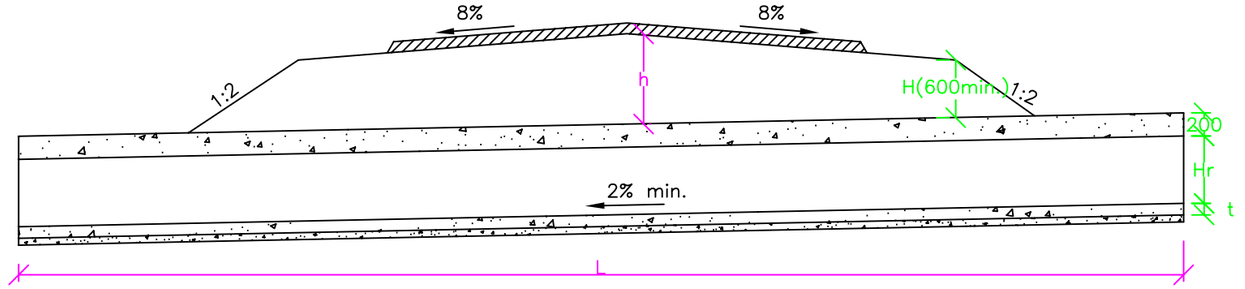


Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete blinding
Step 4: Floor slab (C20)
Step 5: Walls
Step 6: Place top slab
Step 7: Backfilling and compacting

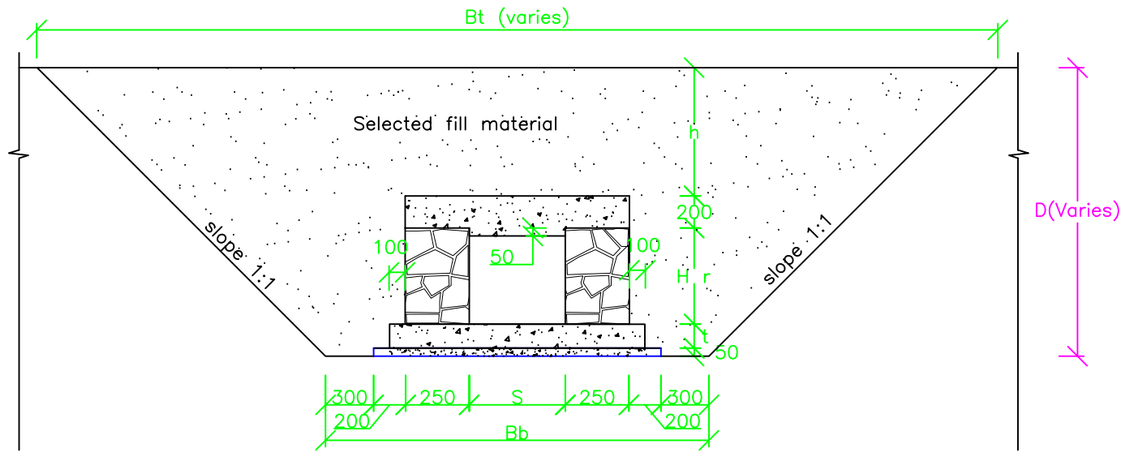
STONE MASONRY BOX CULVERT UNDER CONSTRUCTION



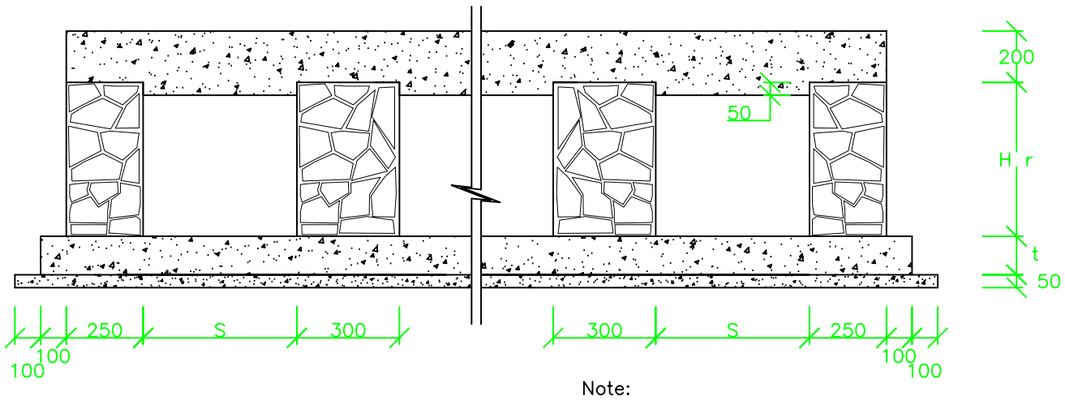
COMPLETED STONE MASONRY BOX CULVERT



LONGITUDINAL SECTION Y–Y Scale:NTS



CROSS SECTION X–X
Scale: 1:40



CROSS SECTION Z–Z Scale 1:25

Note:
1. Tapering to ends of middle walls (of thickness 300)

TABLE FOR VARIOUS BOX CULVERT SIZES

S/N	Culvert Span S (mm)	Culvert Height Hr (mm)	Bottom Excavation Width Bb (mm)	Top Excavation Width Bt (mm)	Excavation Depth D (mm)	Bottom Slab Thickness t (mm)
1	600	600	S+1500	Bb+2(Hr+h+t+250)	Hr+h+t+250	150
2	900	900	S+1500	Bb+2(Hr+h+t+250)	Hr+h+t+250	150
3	1000	1000	S+1500	Bb+2(Hr+h+t+250)	Hr+h+t+250	200
4	1200	1200	S+1500	Bb+2(Hr+h+t+250)	Hr+h+t+250	200
5	1500	1500	S+1500	Bb+2(Hr+h+t+250)	Hr+h+t+250	200

Notes:

1. All structural concrete to be C20)
2. All blinding concrete to be class lean concrete

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: BCSM 001

Title: STANDARD STRUCTURES MANUAL

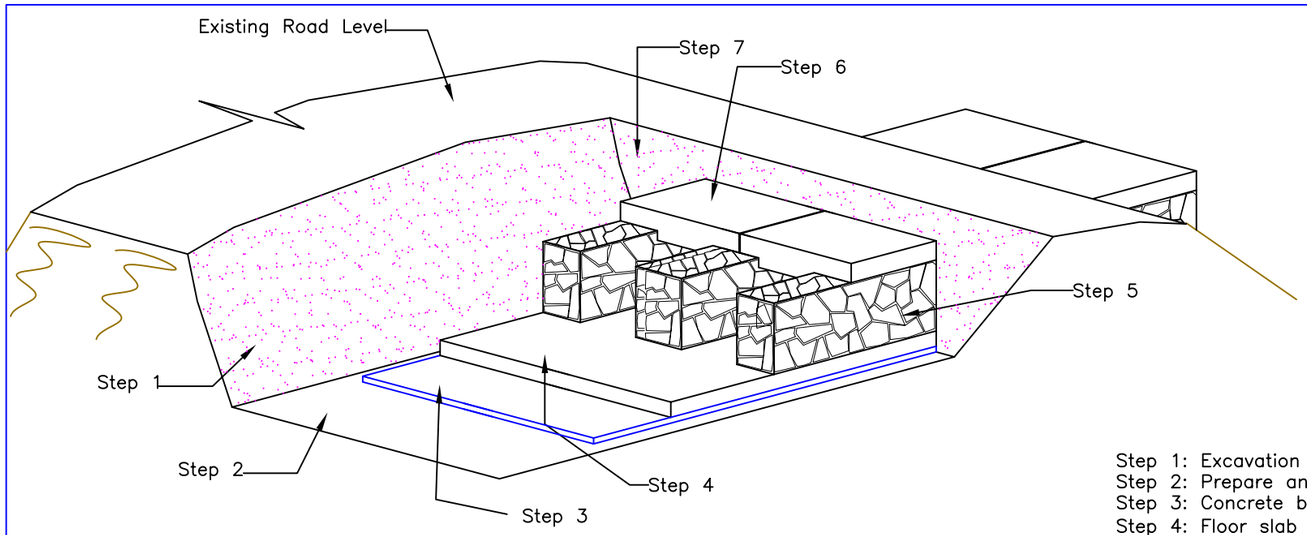
MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

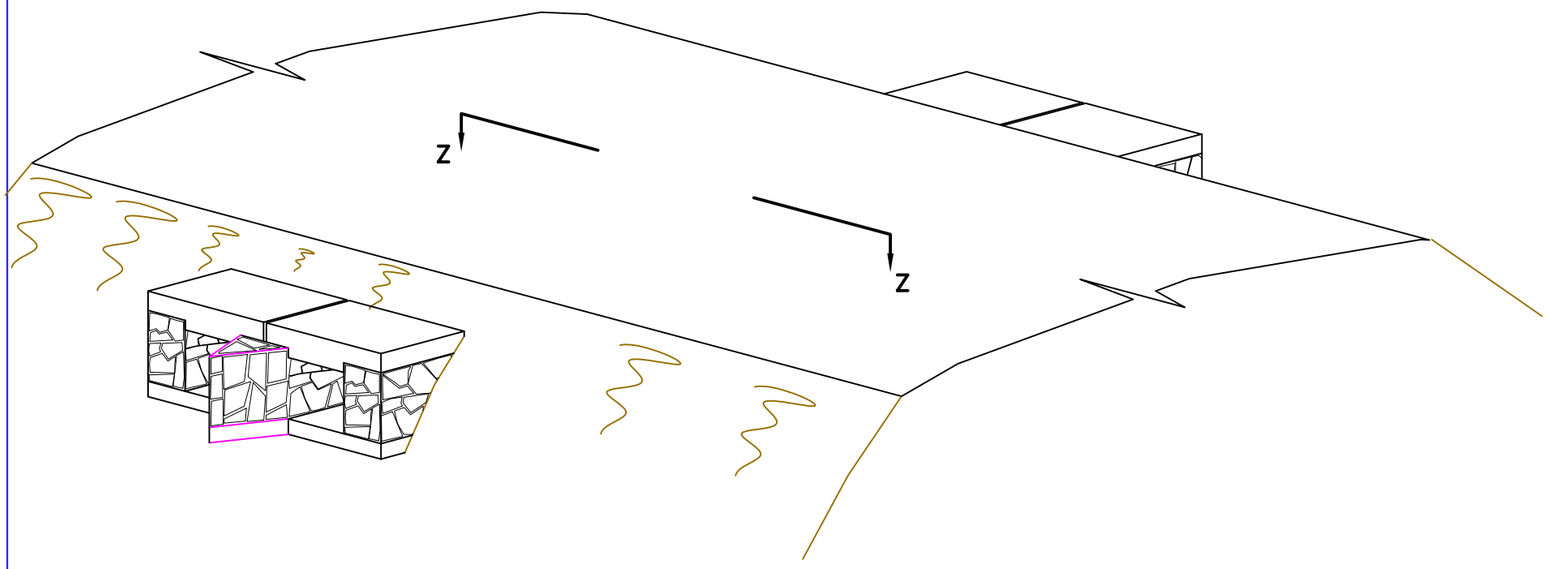
BOX CULVERT - STONE MASONRY
Installation and Sections

Scale	1:25, 1:40, NTS
Dimension	mm
File Name:	P/Roads and Highways/50999A/Data/Drawings/Box Culverts
Date	June 2001
Drawn by	JAU
Designed by	JAU
Checked by	FCO
Approved by	MMK
Sheet:	2/3

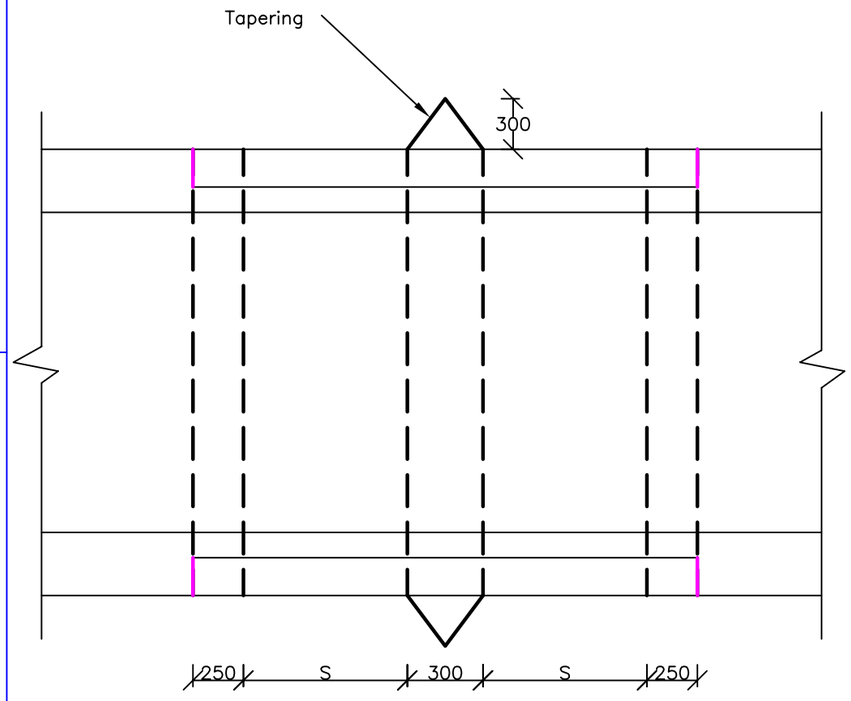


Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete blinding
Step 4: Floor slab (C20)
Step 5: Walls
Step 6: Place top slab
Step 7: Backfilling and compacting

STONE MASONRY BOX CULVERT UNDER CONSTRUCTION



COMPLETED STONE MASONRY BOX CULVERT

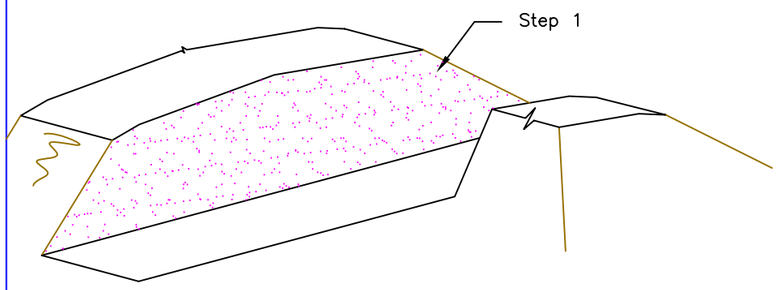


Plan of Multiple Box Culverts

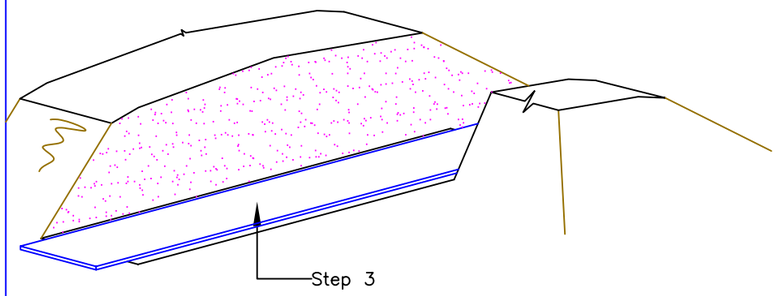
Notes:

1. All structural concrete to be C20)
2. All blinding concrete to be class lean concrete

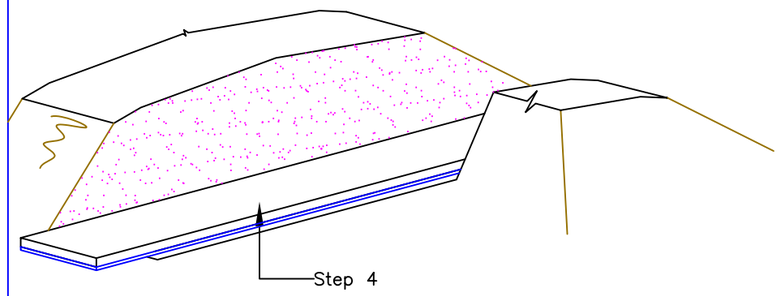
Project: SUPPORT TO DISTRICT ROAD NETWORKS				**Drawing Number: BCSM 001**
Title: STANDARD STRUCTURES MANUAL				
MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425				**BOX CULVERT - STONE MASONRY Installation and Sections** — Scale: NTS; Dimension: mm
				File Name: P/Roads and Highways/50999A/Data/Drawings/Box Culverts — Date: June 2001
	Drawn by: JAU	Designed by: JAU	Checked by: FCO	Approved by: MMK — Sheet: 3/3



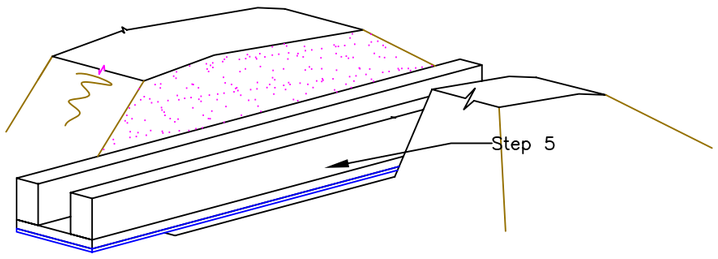
Step 1: Excavation and shaping
Step 2: Prepare and compact foundation



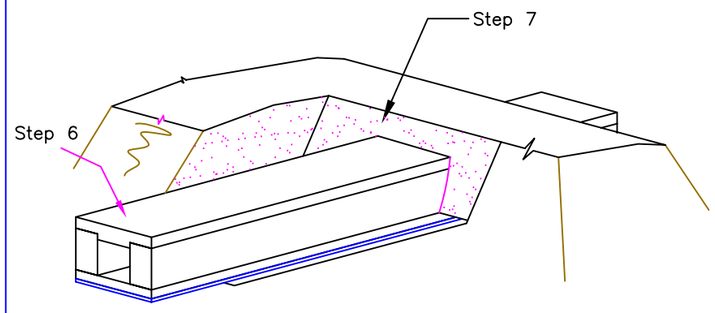
Step 3: Concrete bedding – class Lean concrete



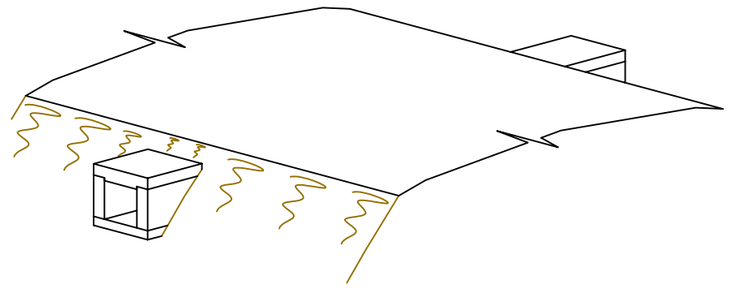
Step 4: Floor slab (C20)



Step 5: Wall construction



Step 6: Place top slab
Step 7: Backfilling and compacting



Completed Box Culvert

Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete blinding
Step 4: Floor slab (C20 concrete)
Step 5: Walls
Step 6: Place top slab
Step 7: Backfilling and compacting

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

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P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: BCRC 001

BOX CULVERT – REINFORCED CONCRETE Installation

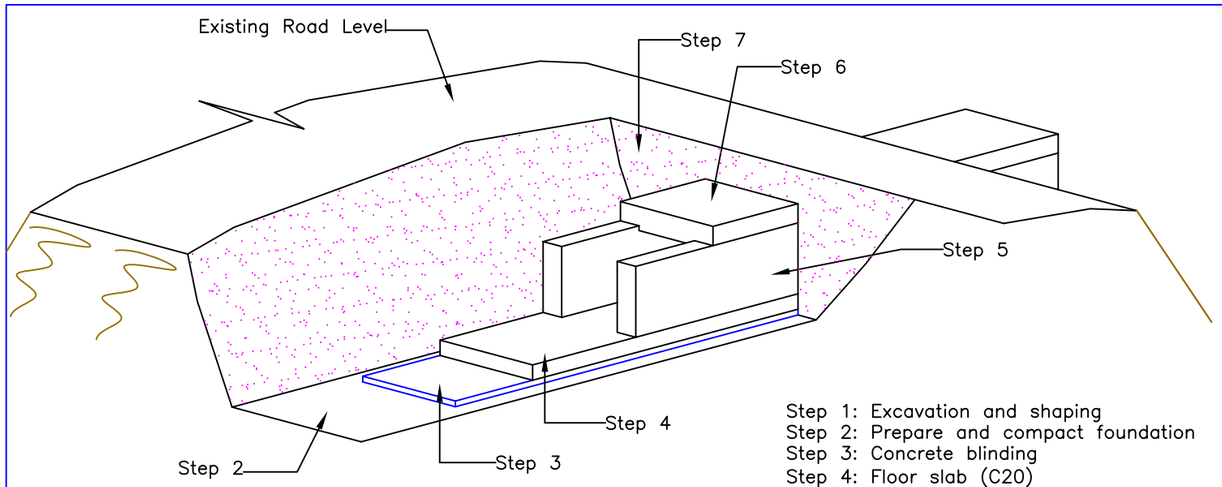
Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Box Culverts

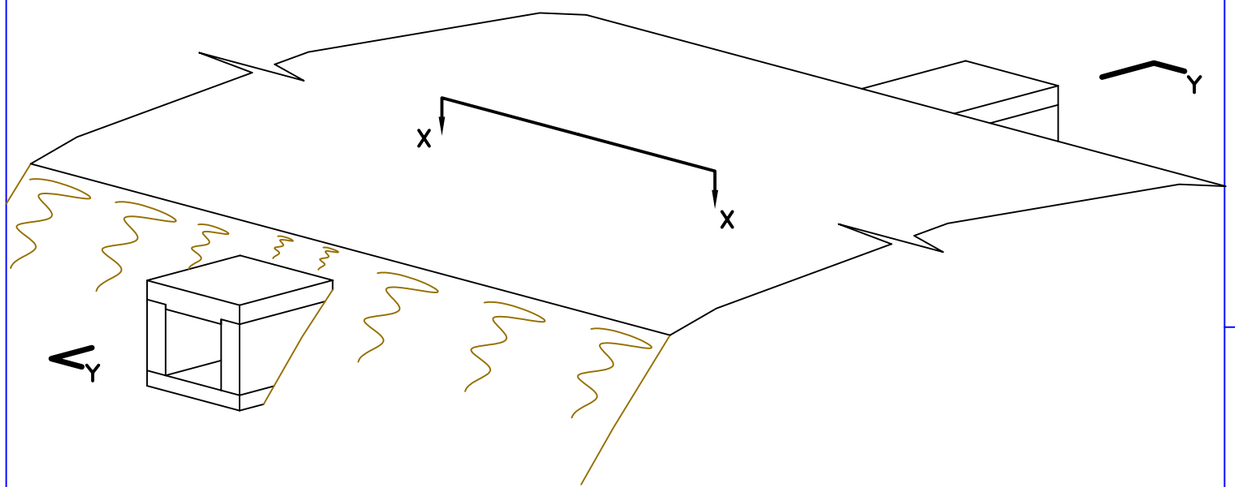
Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	1/5



Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete blinding
Step 4: Floor slab (C20)
Step 5: Walls
Step 6: Place top slab
Step 7: Backfilling and compacting

REINFORCED CONCRETE BOX CULVERT UNDER CONSTRUCTION



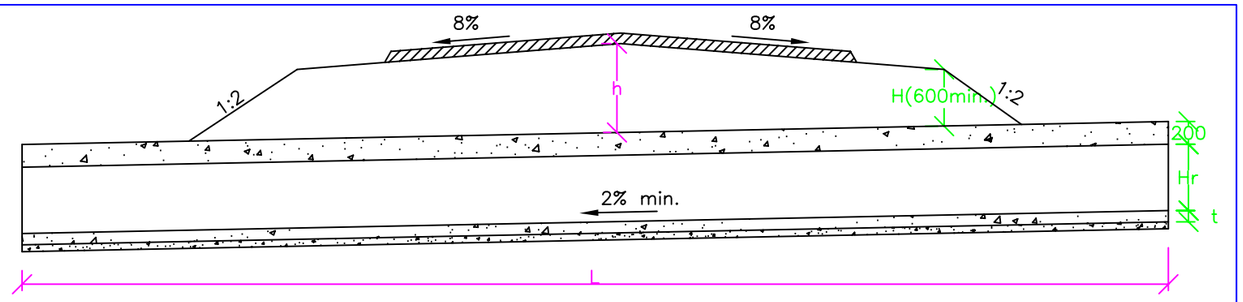
COMPLETED REINFORCED CONCRETE BOX CULVERT

TABLE FOR VARIOUS BOX CULVERT SIZES

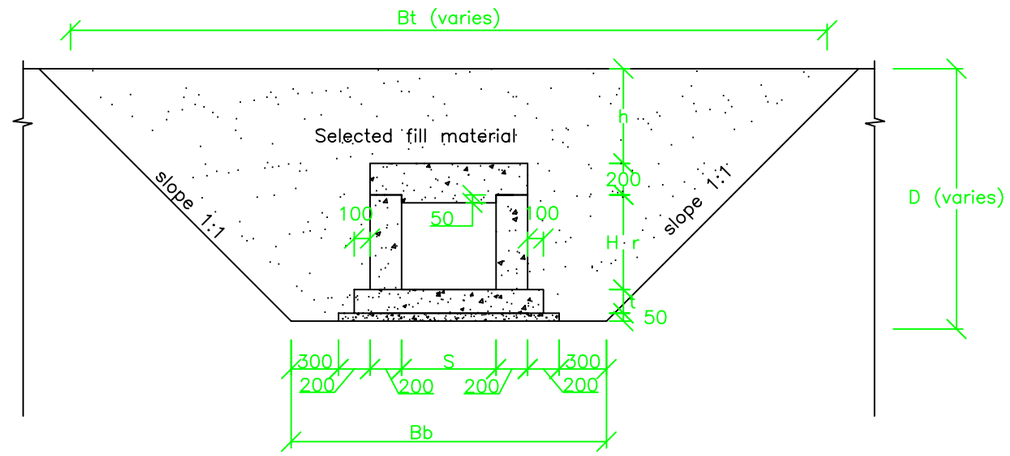
S/N	Culvert Span S (mm)	Culvert Height Hr (mm)	Bottom Excavation Width Bb (mm)	Top Excavation Width Bt (mm)	Excavation Depth D (mm)	Bottom Slab Thickness t (mm)
1	600	600	1800	Bb+2(Hr+h+t+250)	Hr+h+t+250	150
2	900	900	2100	Bb+2(Hr+h+t+250)	Hr+h+t+250	150
3	1000	1000	2200	Bb+2(Hr+h+t+250)	Hr+h+t+250	200
4	1200	1200	2400	Bb+2(Hr+h+t+250)	Hr+h+t+250	200
5	1500	1500	2700	Bb+2(Hr+h+t+250)	Hr+h+t+250	200

Notes:

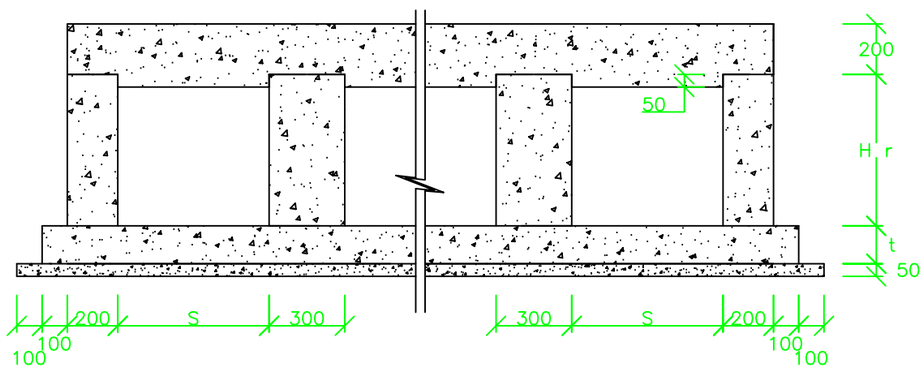
1. To be read with Drawing No. BCRC 001, sheets 2/3.
2. All structural concrete to be C20
3. All blinding concrete to be class lean concrete



LONGITUDINAL SECTION Y–Y Scale: NTS



CROSS SECTION X–X
Scale: 1:40



CROSS SECTION Z–Z Scale: 1:25

Note:
1. Tapering to ends of middle walls (of thickness 300)

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: BCRC 001

Title: STANDARD STRUCTURES MANUAL

BOX CULVERT – REINFORCED CONCRETE Installation and Sections

Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Box Culverts

Date: June 2001

Drawn by: JAU | Designed by: JAU | Checked by: FCO | Approved by: MMK

Sheet: 2/5

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

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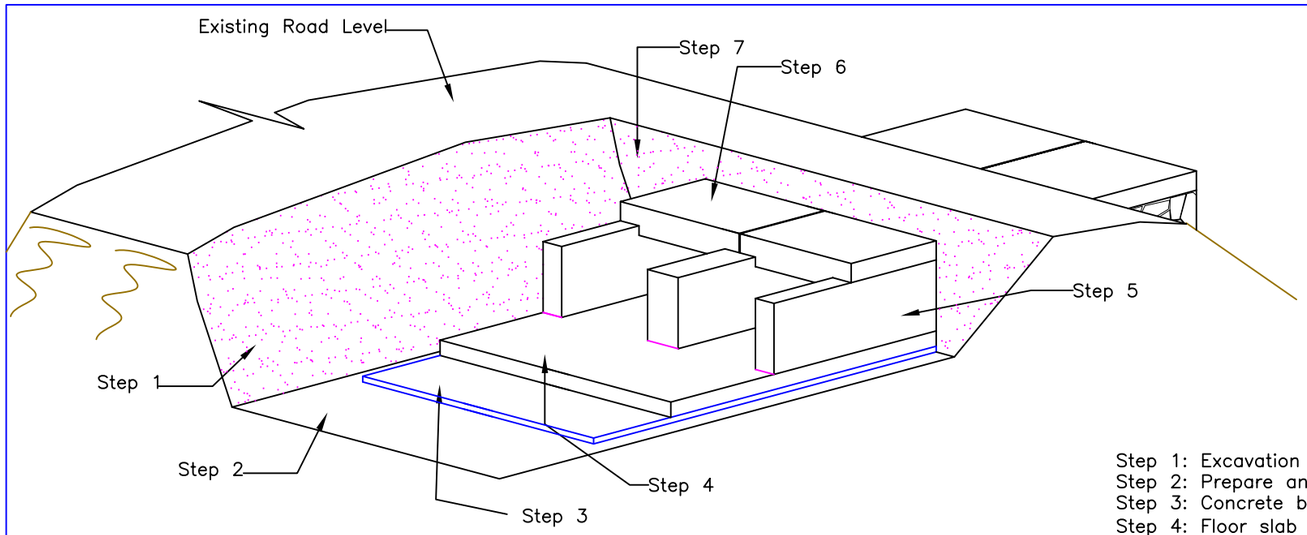
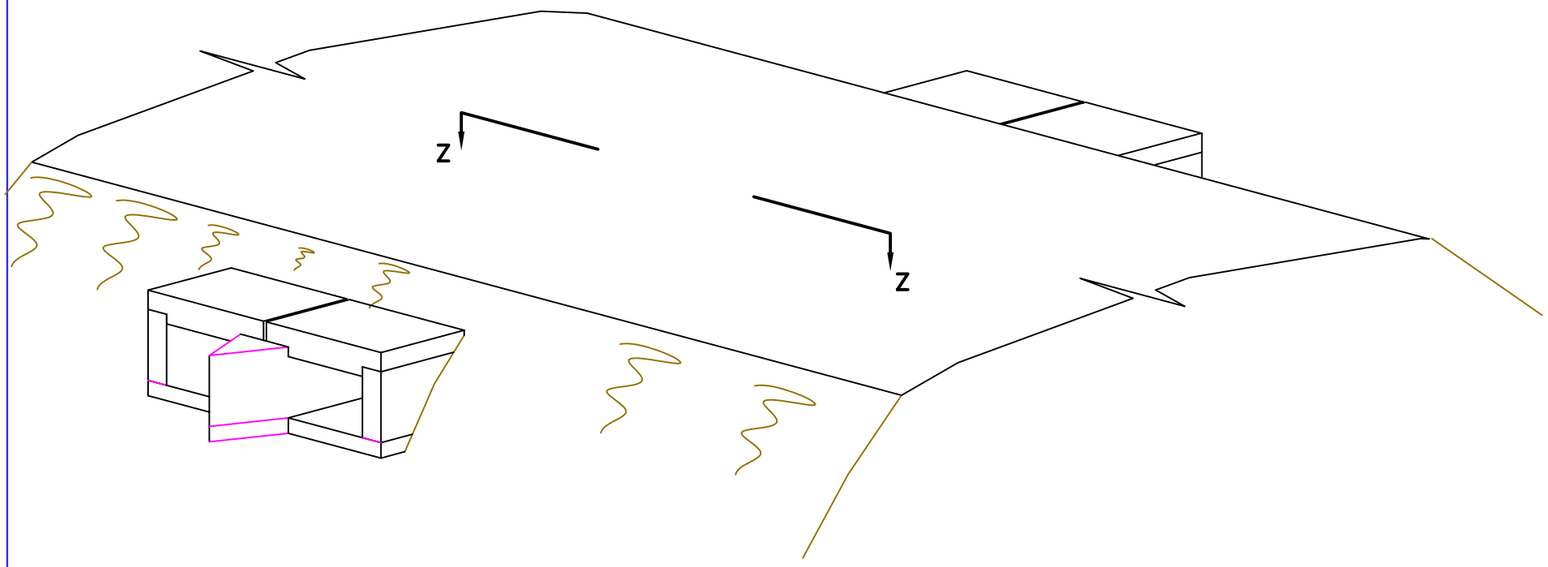
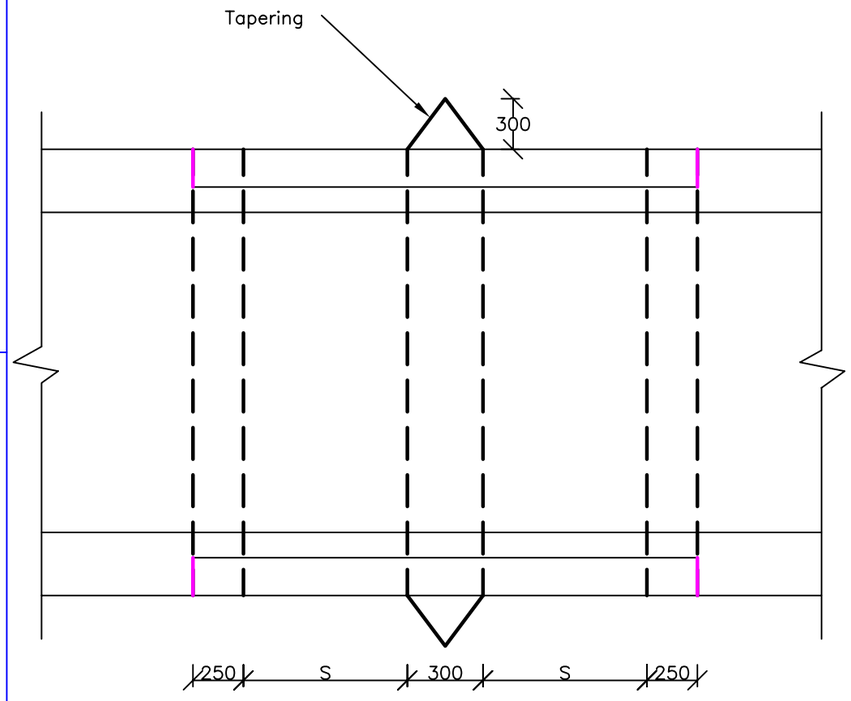


Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete blinding
Step 4: Floor slab (C20)
Step 5: Walls
Step 6: Place top slab
Step 7: Backfilling and compacting

STONE MASONRY BOX CULVERT UNDER CONSTRUCTION



COMPLETED STONE MASONRY BOX CULVERT



Plan of Multiple Box Culverts

Notes:

1. All structural concrete to be C20)
2. All blinding concrete to be class lean concrete

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: BCRC 001

BOX CULVERT - REINFORCED CONCRETE Installation and Sections

Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Box Culverts

Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	3/5

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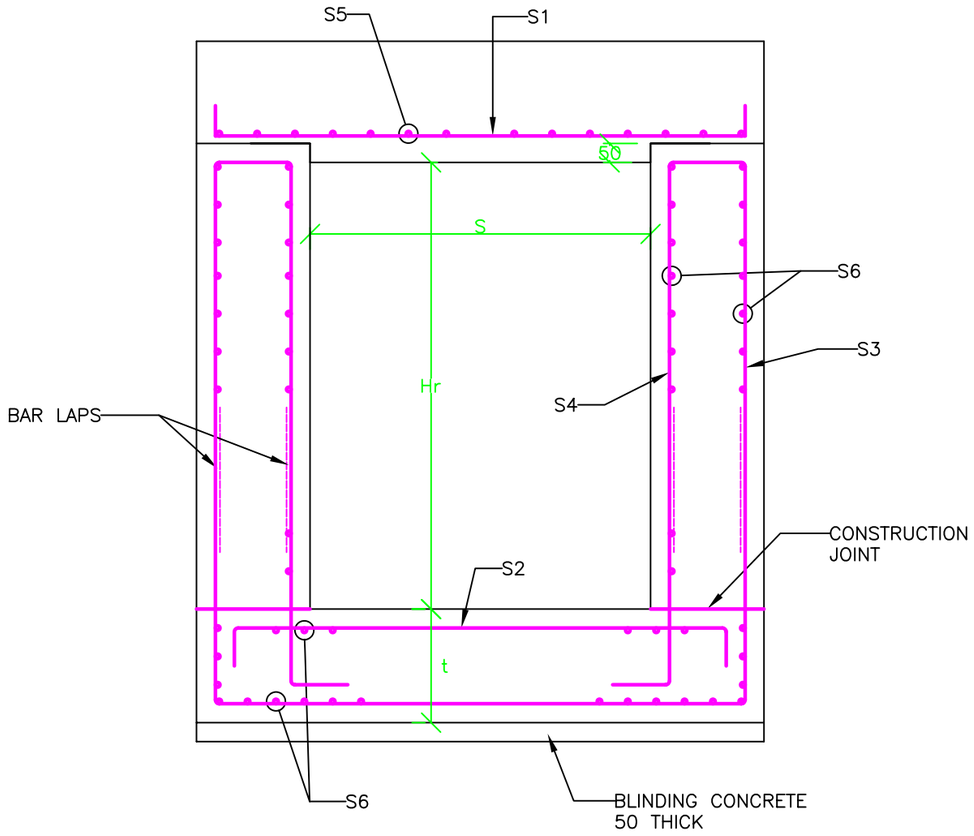
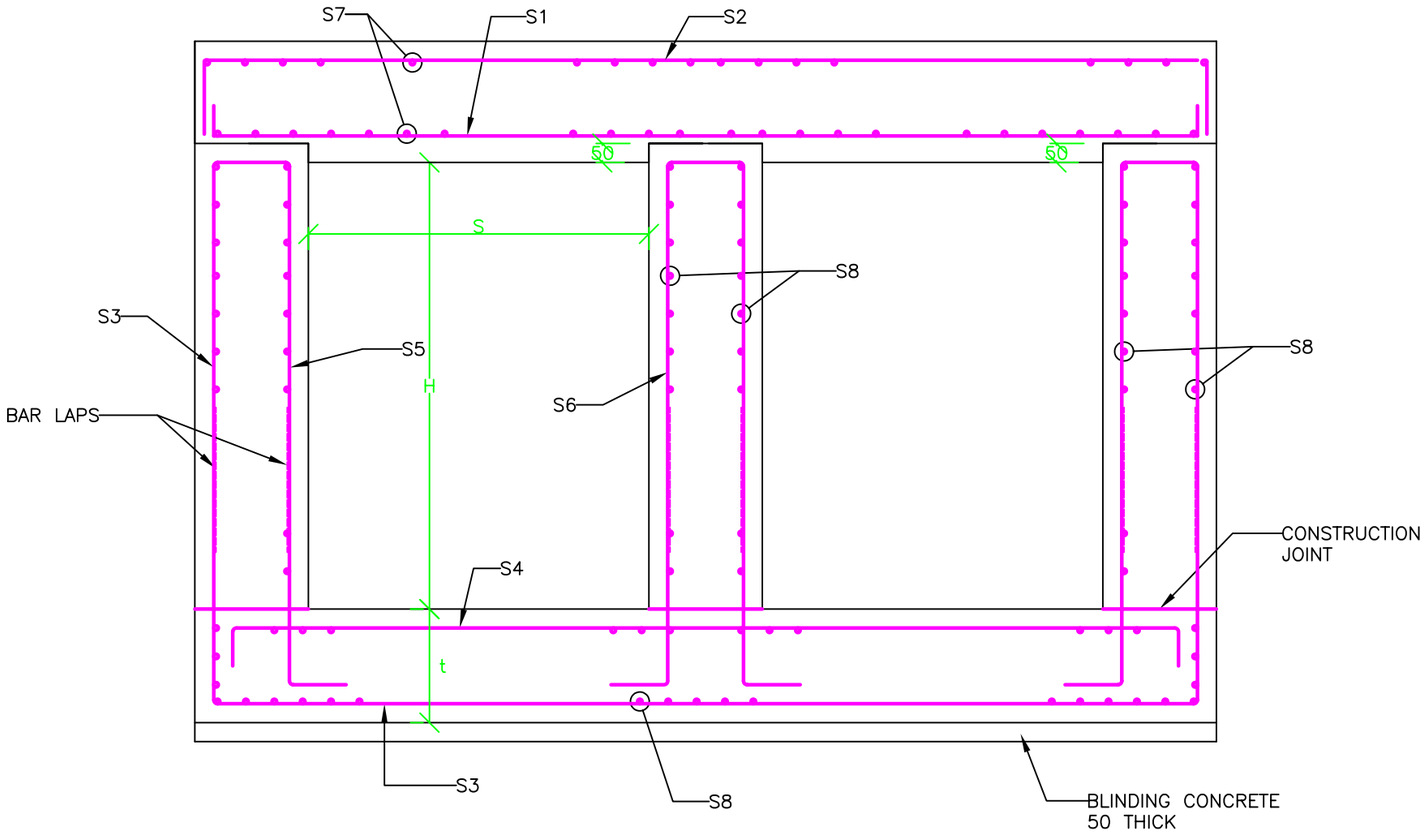
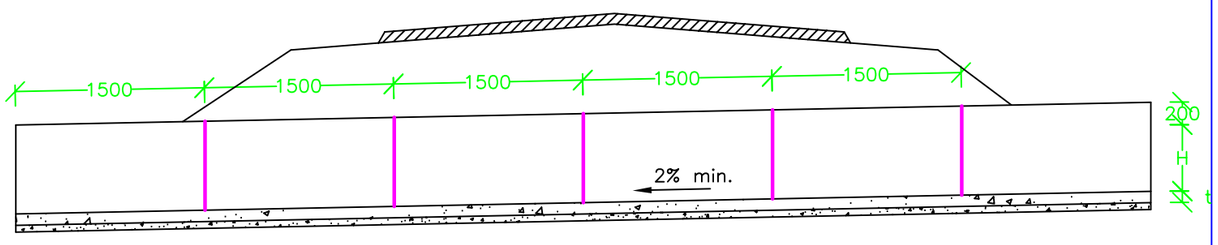


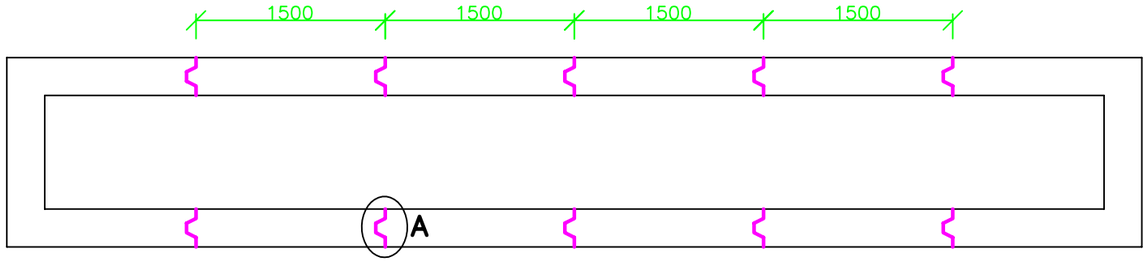
REINFORCEMENT DETAILS – SINGLE CELL CULVERT



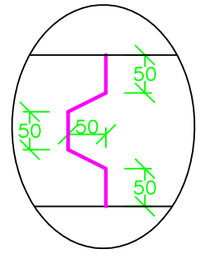
REINFORCEMENT DETAILS – MULTIPLE CELL CULVERT



SIDE ELEVATION OF WALL SHOWING JOINTS Scale: NTS



HORIZONTAL SECTION THROUGH WALL SHOWING JOINTS Scale: NTS



JOINT DETAIL A

NOTES:

1. To be read with Drawings No. BCRC 001, sheets 1/3 and 3/3
2. For reinforcement tables, see Drawing No. BCRC 001, sheets 3/3.
3. All structural concrete to be C20
4. All blinding concrete to be Class lean concrete
5. 50mm min. cover to all reinforcement and minimum bar lap = 50ø

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: BCRC 001

Title: STANDARD STRUCTURES MANUAL

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BOX CULVERT – REINFORCED CONCRETE Reinforcement and Joint Details

Scale	NTS
Dimension	mm
File Name:	P/Roads and Highways/50999A/Data/Drawings/Box Culverts
Date	June 2001
Drawn by	JAU
Designed by	JAU
Checked by	FCO
Approved by	MMK
Sheet:	4/5

TABLE: Single Box Culvert – high yield steel

Span S mm	Height H mm	S1	S2	S3	S4	S5	S6
600	600	T16@200	T16@200	T16@200	T16@200	T10@200	T10@200
900	900	T16@200	T16@200	T16@200	T16@200	T10@200	T10@200
1000	1000	T16@200	T16@200	T16@200	T16@200	T10@200	T10@200
1200	1200	T16@200	T16@200	T16@200	T16@200	T10@200	T10@200
1500	1500	T16@200	T16@200	T16@200	T16@200	T10@200	T10@200

TABLE: Twin Box Culvert – high yield steel

Span S mm	Height H mm	S1	S2	S3	S4	S5	S6	S7	S8
600	600	T16@200	T16@200	T16@200	T16@200	T16@200	T16@200	T10@200	T10@200
900	900	T16@200	T16@200	T16@200	T16@200	T16@200	T16@200	T10@200	T10@200
1000	1000	T16@200	T16@200	T16@200	T16@200	T16@200	T16@200	T10@200	T10@200
1200	1200	T16@200	T16@200	T16@200	T16@200	T16@200	T16@200	T10@200	T10@200
1500	1500	T16@200	T16@200	T16@200	T16@200	T16@200	T16@200	T10@200	T10@200

NOTES:

1. To be read with Drawing No. BCRC 001, sheet 2/3
2. All structural concrete to be C20
3. All blinding concrete to be Class Lean concrete
4. 50mm min. cover to all reinforcement and minimum bar lap = 50ø

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: BCRC 001

Title: STANDARD STRUCTURES MANUAL

BOX CULVERT – REINFORCED CONCRETE
Reinforcement and Joint Details

Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Box Culverts

Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	5/5

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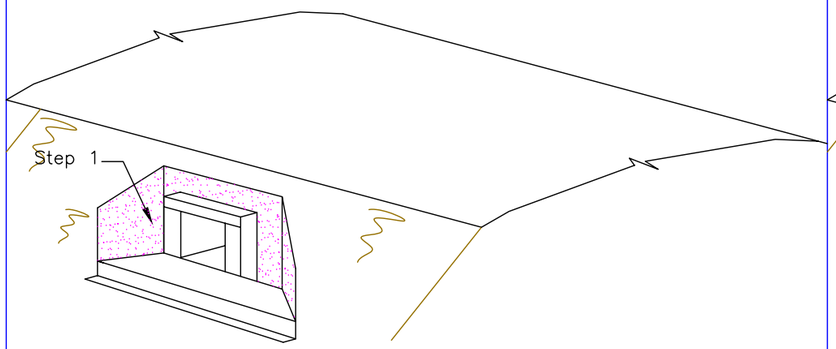
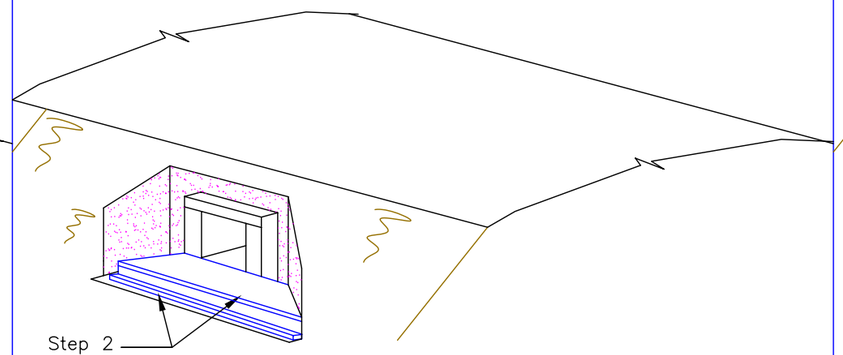
Section B-5
Box Culvert End Protection

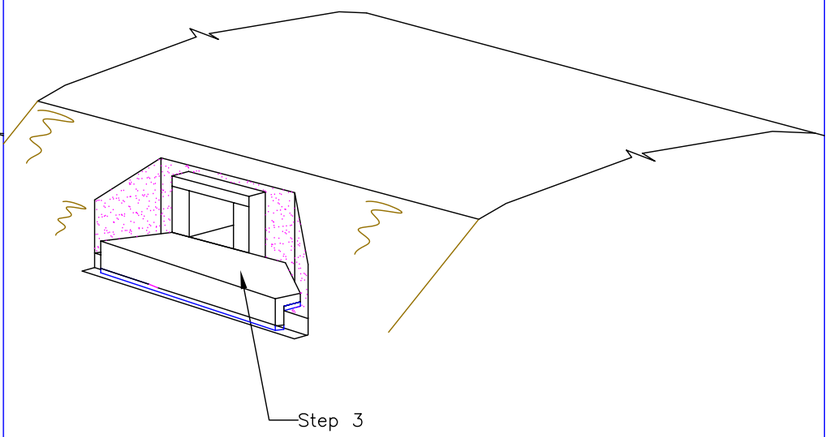
Section B-5
Box Culvert End Protection



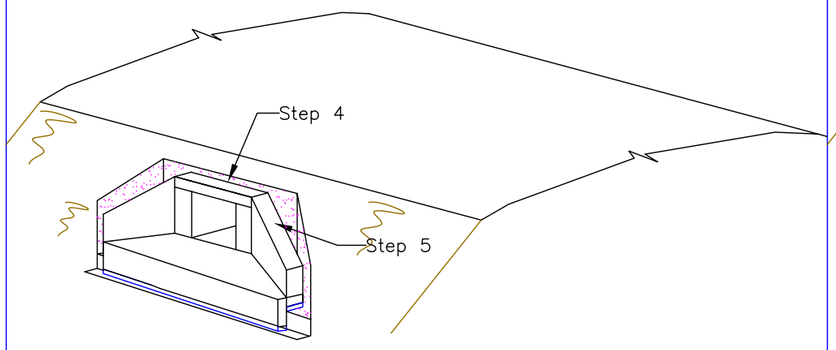
Step 1: Excavation and shaping



Step 2: Bedding

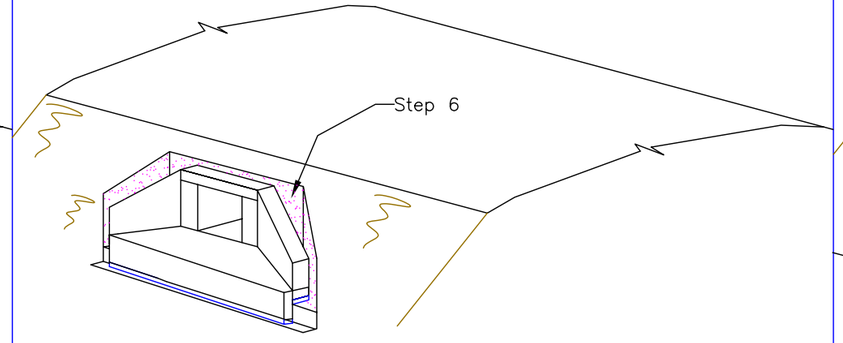


Step 3: Apron construction

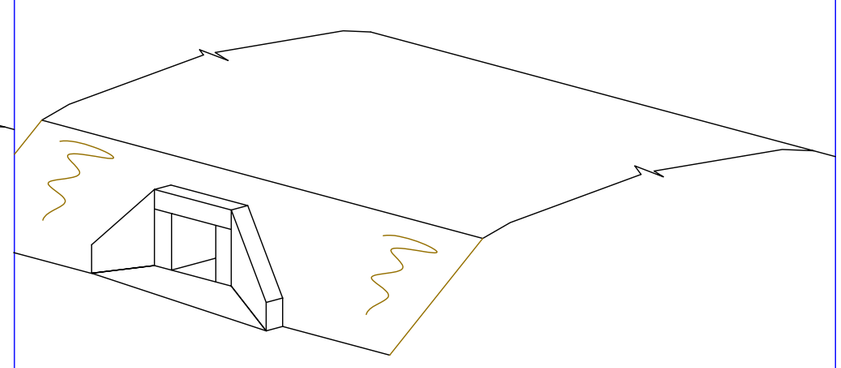


Step 4: Headwalls

Step 5: Wingwalls



Step 6: Backfilling and compacting



Completed Head and Wingwalls (NTS)

Step 1: Excavation and shaping
Step 2: Bedding
Step 3: Apron construction
Step 4: Headwalls
Step 5: Wingwalls
Step 6: Backfilling and compacting

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: BCEP 001

BOX CULVERT END PROTECTION
Wingwalls and Headwalls
Installation

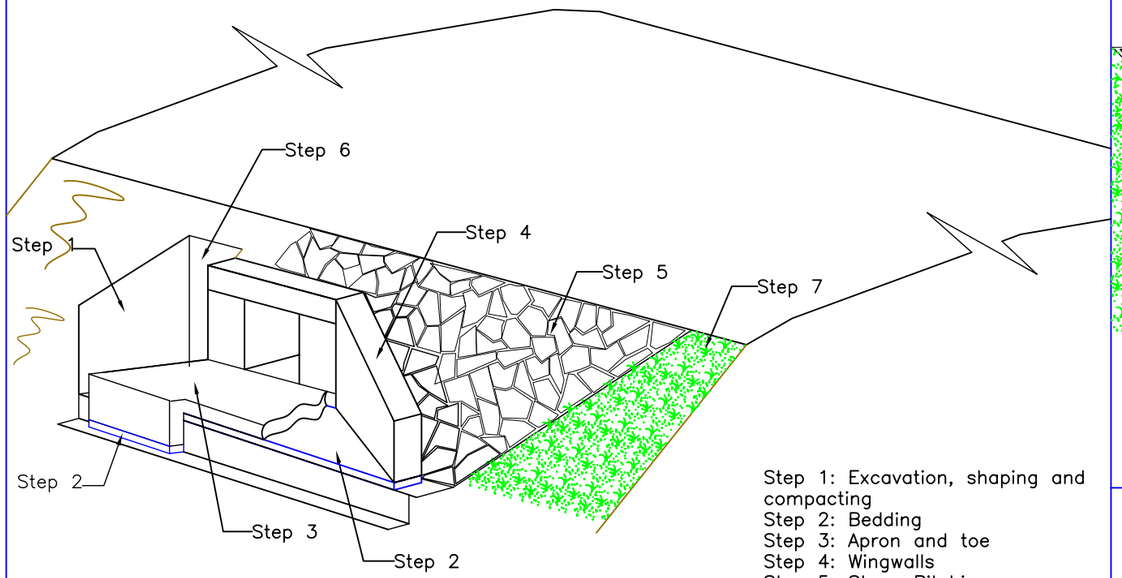
Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings /End Structures 2

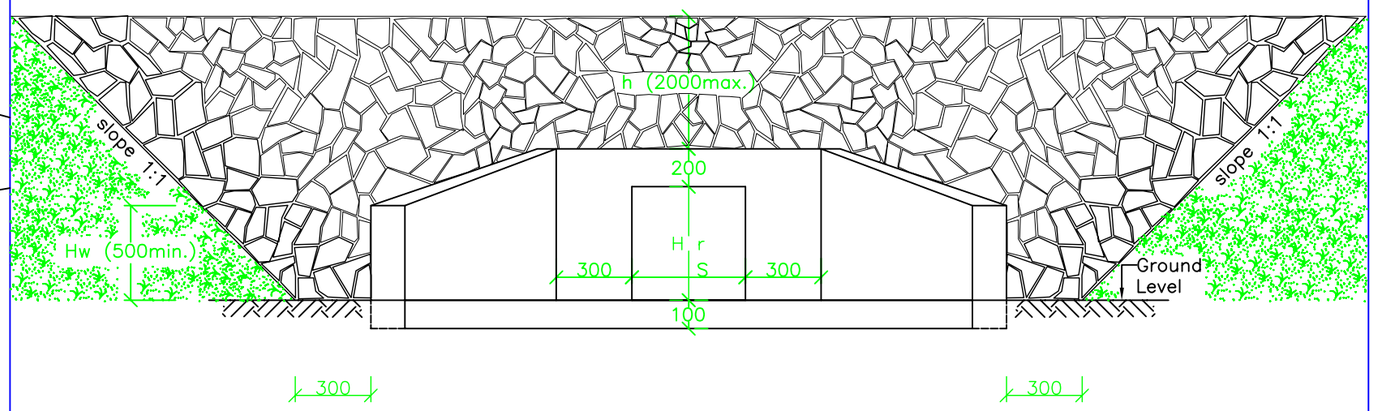
Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	1/4

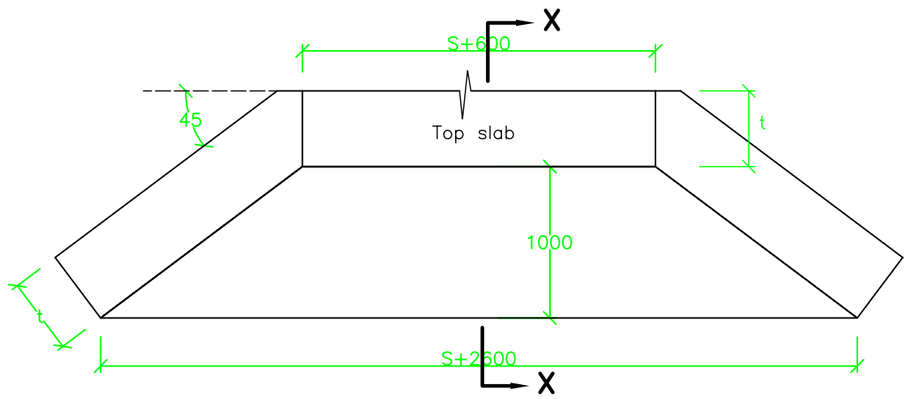


WINGWALLS UNDER CONSTRUCTION

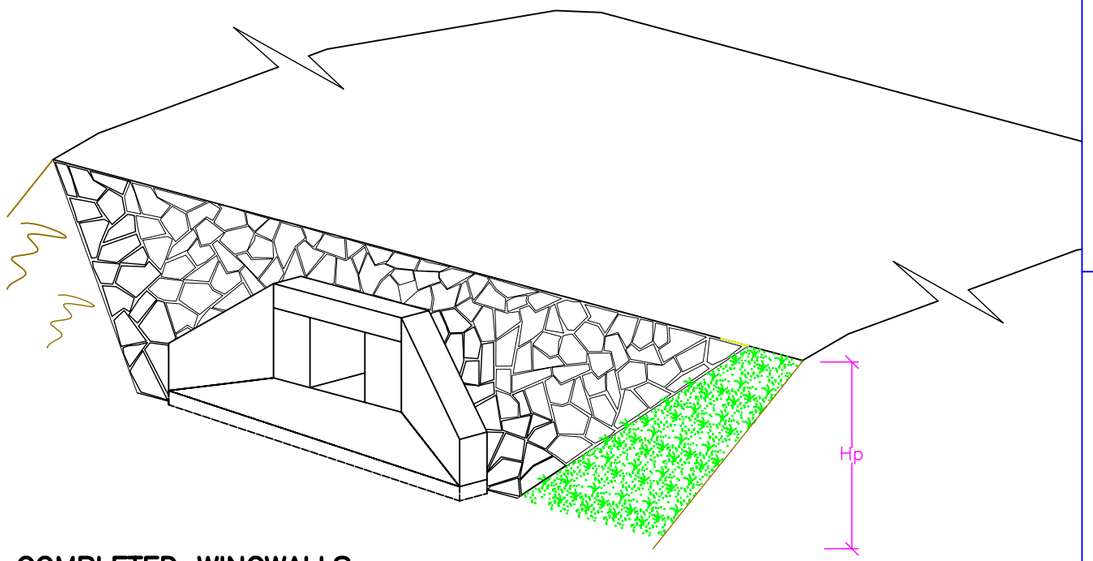
Step 1: Excavation, shaping and compacting
Step 2: Bedding
Step 3: Apron and toe
Step 4: Wingwalls
Step 5: Stone Pitching
Step 6: Backfilling and compacting
Step 7: Grassing



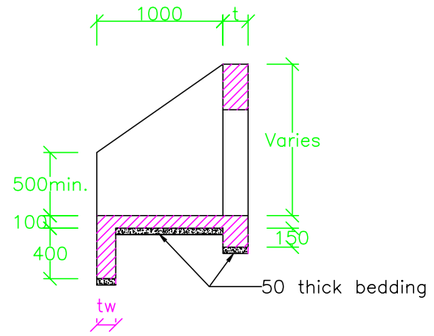
WING WALL ELEVATION Scale: NTS



WING WALL PLAN Scale: NTS



COMPLETED WINGWALLS



SECTION X–X Scale: 1:50

Notes:

1. All structural concrete to be C20
2. Blinding concrete to be class lean concrete

TABLE: HEAD AND WINGWALL THICKNESSES

S/N	Culvert Span S (mm)	Concrete End Structure		Concrete Block End Structure		Stone Masonry End Structure	
		Wingwall Thickness t (mm)	End Thickness t (mm)	Wingwall Thickness t (mm)	End Thickness t (mm)	Wingwall Thickness t (mm)	End Thickness t (mm)
1	600	200	200	230	230	300	300
2	900	200	200	230	230	300	300
3	1000	200	200	230	230	300	300
4	1200	200	200	230	230	300	300
5	1500	200	200	230	230	300	300

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: BCEP 001

BOX CULVERT END PROTECTION
Wingwalls and Stone Pitching/Grassing

Scale 1:50, NTS

Dimension mm

File Name: P/Roads and Highways/50999A/Data/Drawings /Box Culvert End Protection

Date June 2001

Drawn by	Designed by	Checked by	Approved by
JAU	JAU	FCO	MMK

Sheet: 2/4

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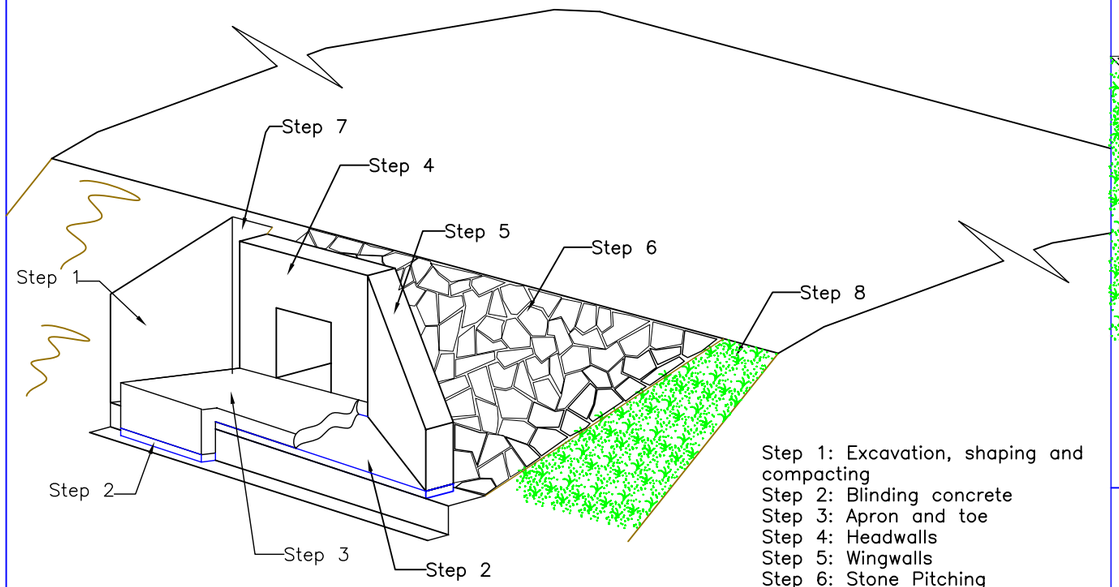
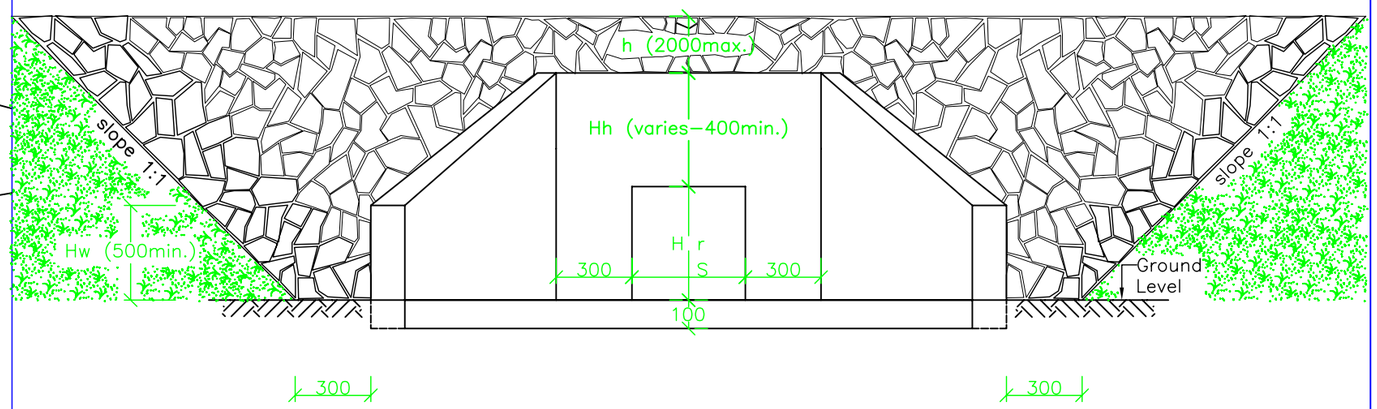
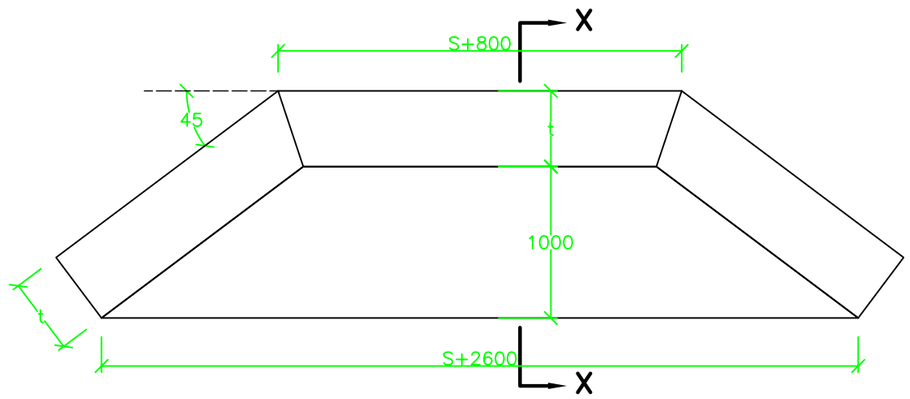


HEAD AND WINGWALLS UNDER CONSTRUCTION

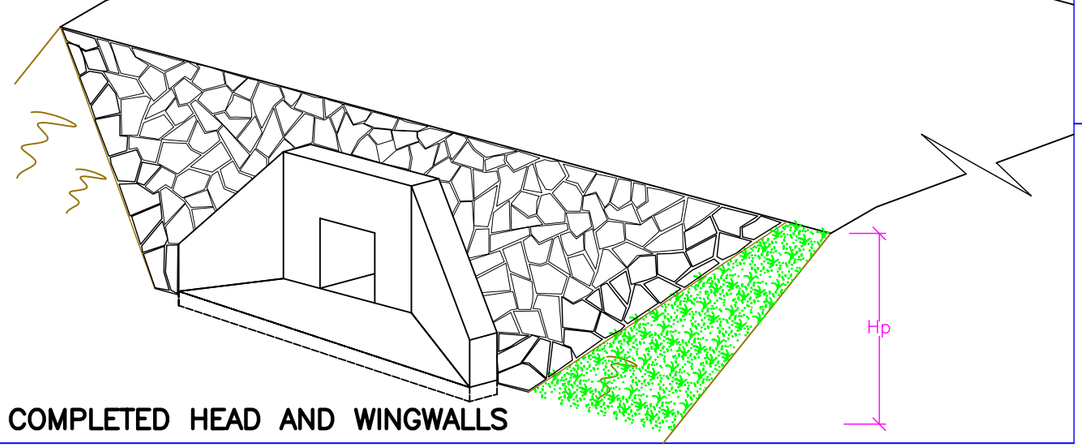
Step 1: Excavation, shaping and compacting
Step 2: Blinding concrete
Step 3: Apron and toe
Step 4: Headwalls
Step 5: Wingwalls
Step 6: Stone Pitching
Step 7: Backfilling and compacting
Step 8: Grassing



HEAD AND WING WALL ELEVATION Scale: NTS



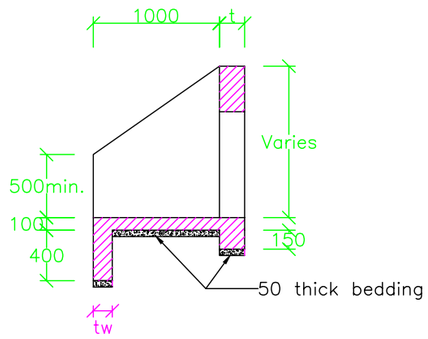
HEAD AND WING WALL PLAN Scale: NTS



COMPLETED HEAD AND WINGWALLS

TABLE: HEAD AND WINGWALL THICKNESSES

S/N	Culvert Span S (mm)	Concrete End Structure		Concrete Block End Structure		Stone Masonry End Structure	
		Wingwall Thickness t (mm)	End Thickness t (mm)	Wingwall Thickness t (mm)	End Thickness t (mm)	Wingwall Thickness t (mm)	End Thickness t (mm)
1	600	200	200	230	230	300	300
2	900	200	200	230	230	300	300
3	1000	200	200	230	230	300	300
4	1200	200	200	230	230	300	300
5	1500	200	200	230	230	300	300



SECTION X–X Scale: 1:50

Notes:

1. All structural concrete to be C20
2. Blinding concrete to be Class Lean concrete

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: BCEP 001

BOX CULVERT END PROTECTION
Headwalls, Wingwalls and Stone Pitching/Grassing

Scale 1:50, NTS

Dimension mm

File Name: P/Roads and Highways/50999A/Data/Drawings /Box Culvert End Protection

Date June 2001

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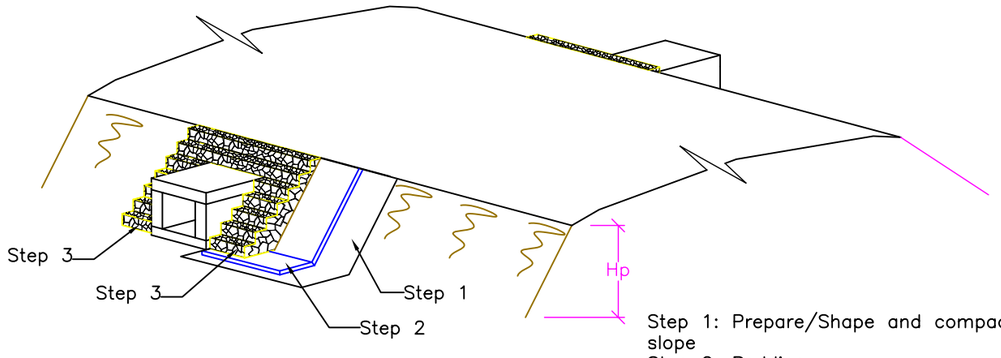
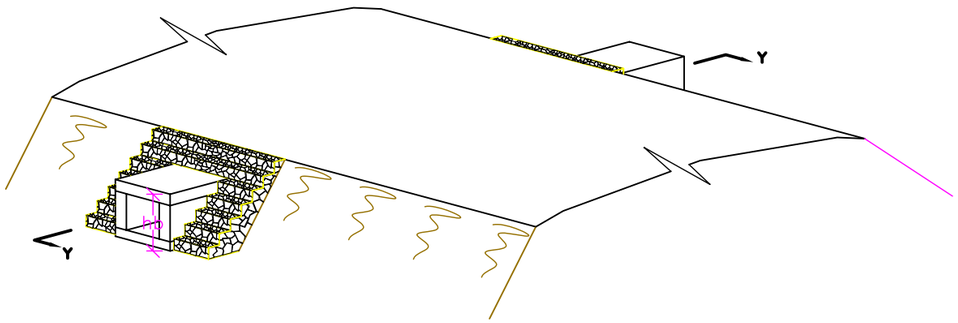
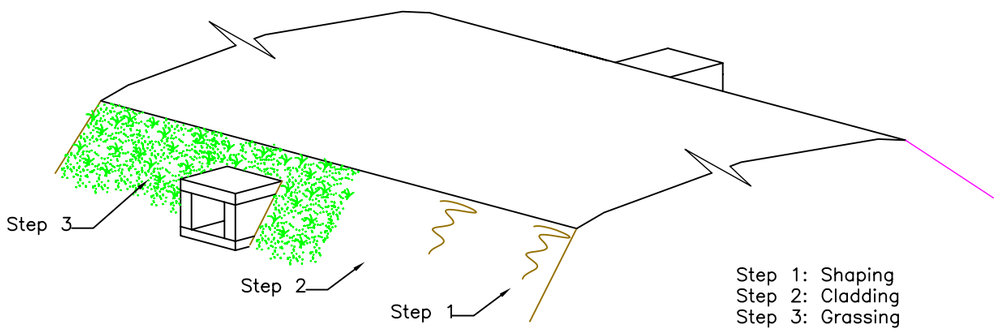


Step 1: Prepare/Shape and compact slope
Step 2: Bedding
Step 3: Stone masonry steps

STONE MASONRY STEPS UNDER CONSTRUCTION

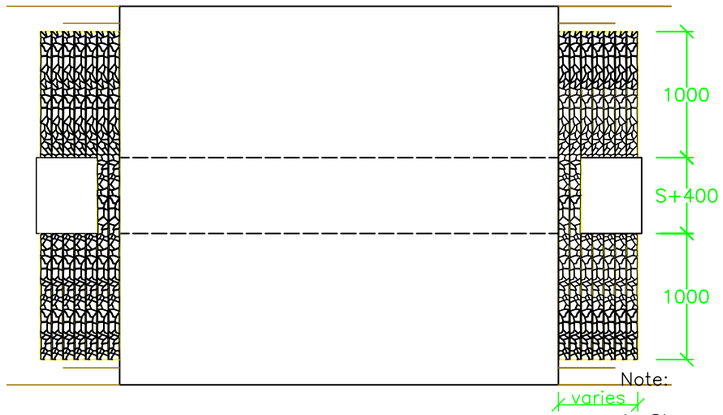


COMPLETED STONE MASONRY STEPS



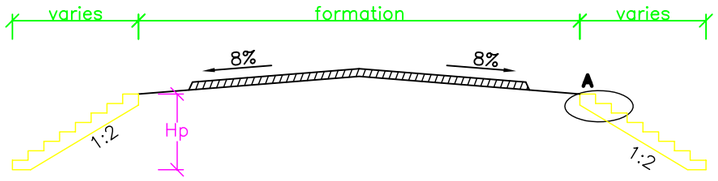
Step 1: Shaping
Step 2: Cladding
Step 3: Grassing

ALTERNATIVE: GRASSING

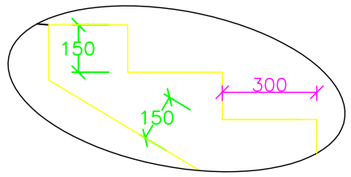


Note:
1. Stones to be of minimum thickness = 150mm

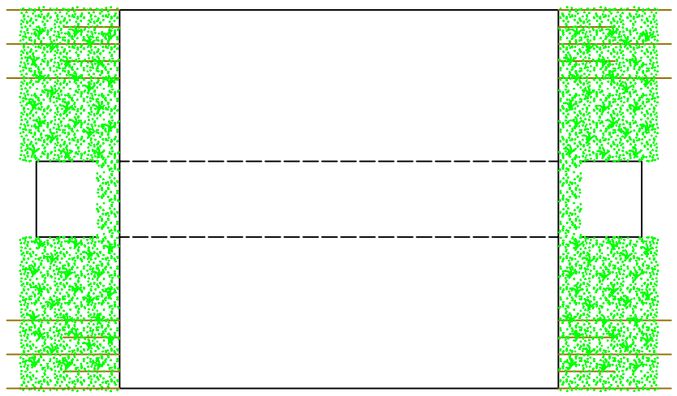
PLAN – STONE MASONRY STEPS Scale: 1:50



SECTION Y–Y THROUGH STONE MASONRY STEPS Scale: 1:100



DETAIL A Scale: 1:20



PLAN – GRASSING SLOPE Scale: NTS

Project: SUPPORT TO DISTRICT ROAD NETWORKS

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BOX CULVERT END PROTECTION
Either: Stone Masonry Steps
Or alternative: Grassing

Scale: 1:100, 1:50, 1:20

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Box Culvert End Protection

Date: June 2001

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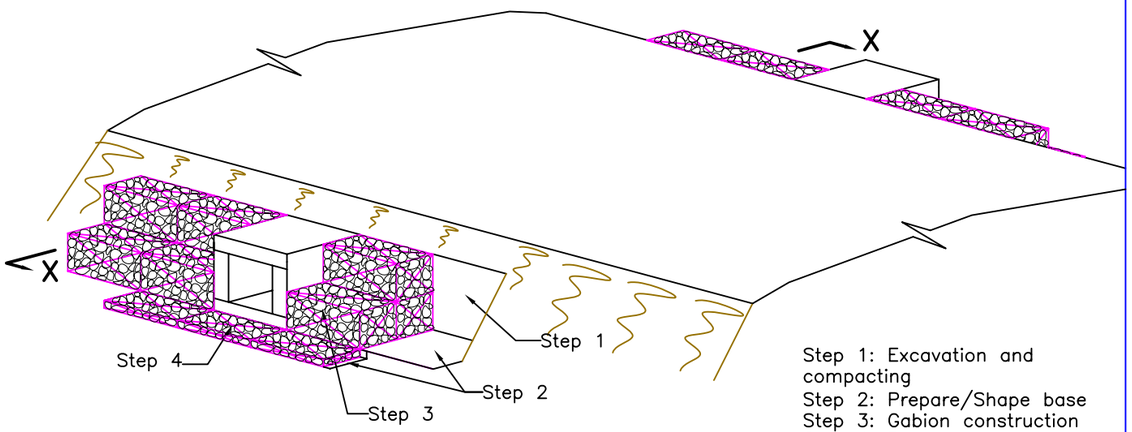
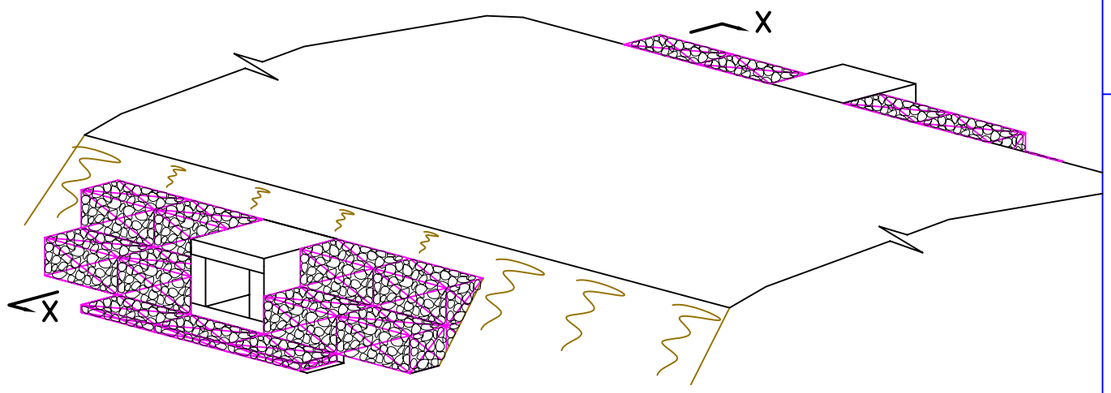


Step 1: Excavation and compacting
Step 2: Prepare/Shape base
Step 3: Gabion construction
Step 4: Reno construction

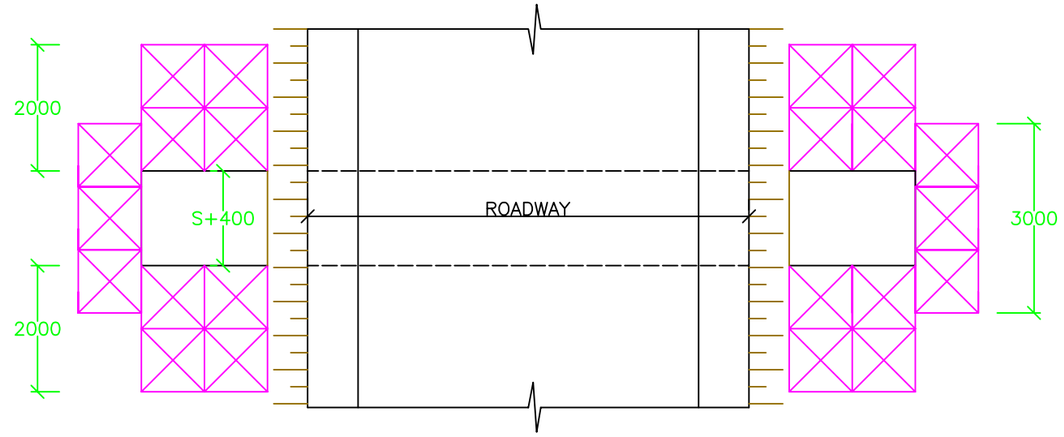
INSTALLATION PROCEDURE – GABION BOXES AND RENO MATTRESS APRONS



COMPLETED GABION BOXES AND RENO MATTRESS APRONS INSTALLATION

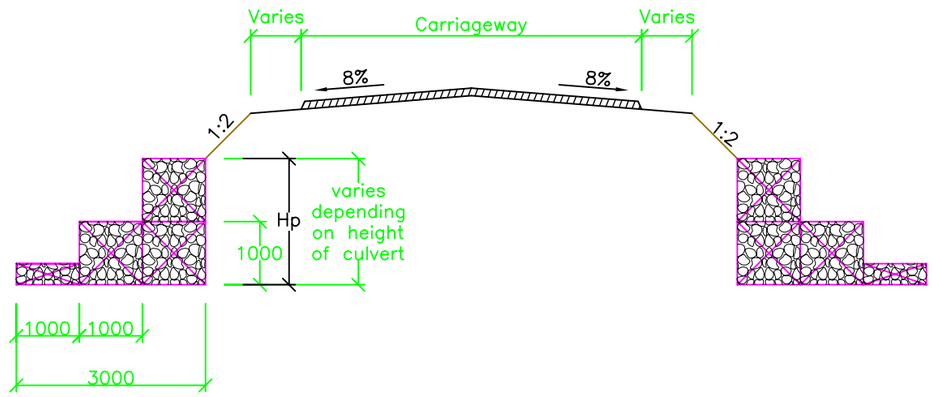
STANDARD GABIONS

Length m	Width m	Height m	Volume m^3
1	1	0.5	0.5
1	1	1	1



PLAN Scale:1:100

S: Span of Box Culvert



SECTION X–X Scale:1:100

Project: SUPPORT TO DISTRICT ROAD NETWORK PROGRAMME

Title: STANDARD STRUCTURES MANUAL

Drawing Number: BCEP 002

BOX CULVERT END PROTECTION
Gabion Boxes

Scale 1:100

Dimension mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Gabions (BC)

Date June 2001

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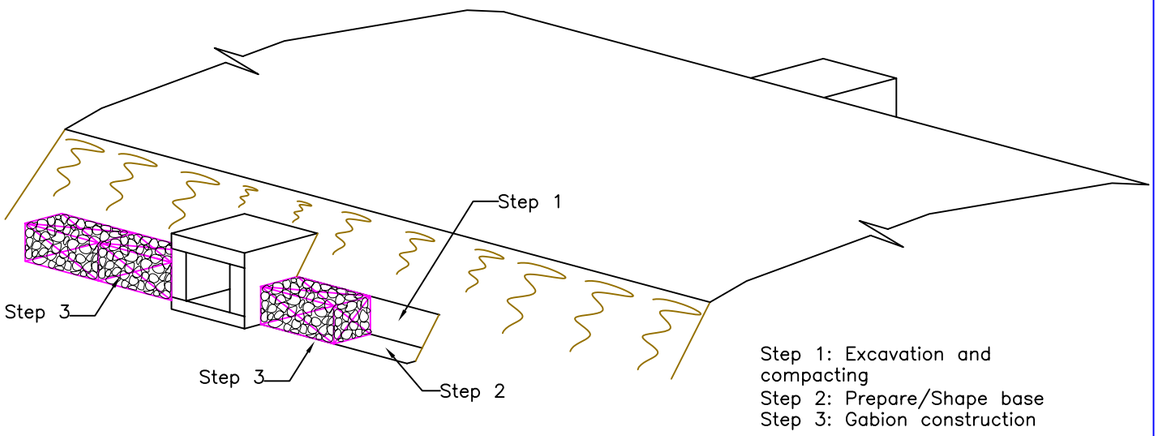
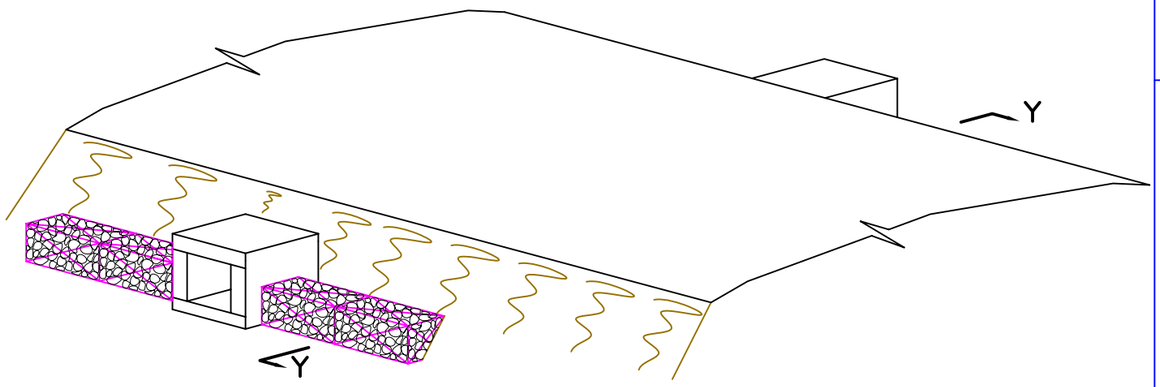


Step 1: Excavation and compacting
Step 2: Prepare/Shape base
Step 3: Gabion construction

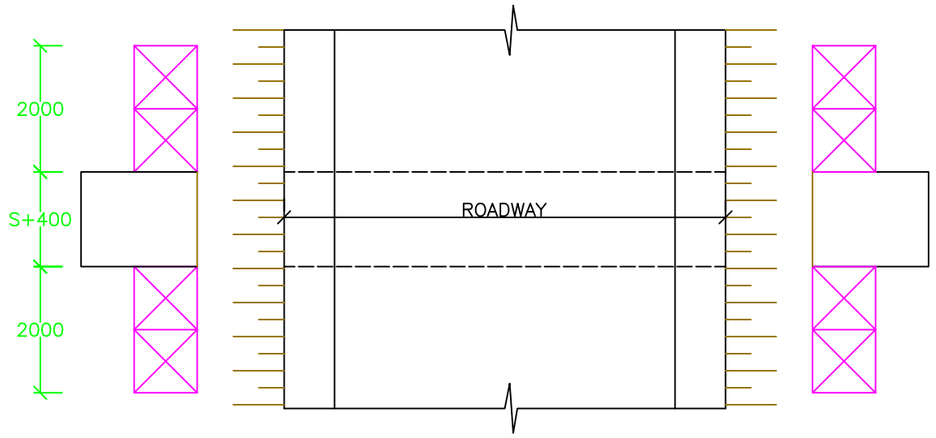
INSTALLATION PROCEDURE – GABION BOXES (TOE WALL)



COMPLETED GABION BOXES (TOE WALL) INSTALLATION

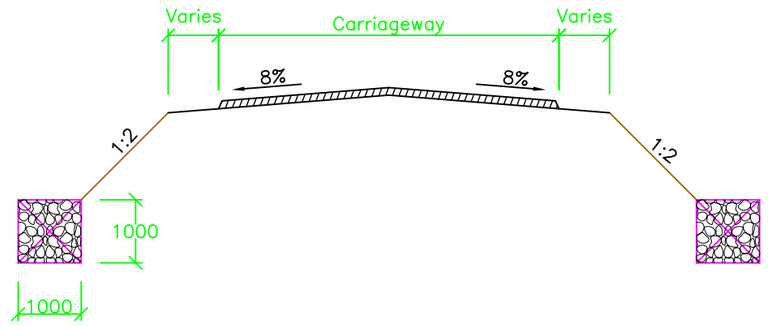
STANDARD GABIONS

Length m	Width m	Height m	Volume m^3
1	1	0.5	0.5
1	1	1	1



PLAN Scale:1:100

S: Span of Box Culvert



SECTION Y–Y Scale:1:100

Project: SUPPORT TO DISTRICT ROAD NETWORK PROGRAMME

Drawing Number: BCEP 002

Title: STANDARD STRUCTURES MANUAL

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BOX CULVERT END PROTECTION
Gabion Boxes (Toe Wall)

Scale 1:100

Dimension mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Gabions (BC)

Date June 2001

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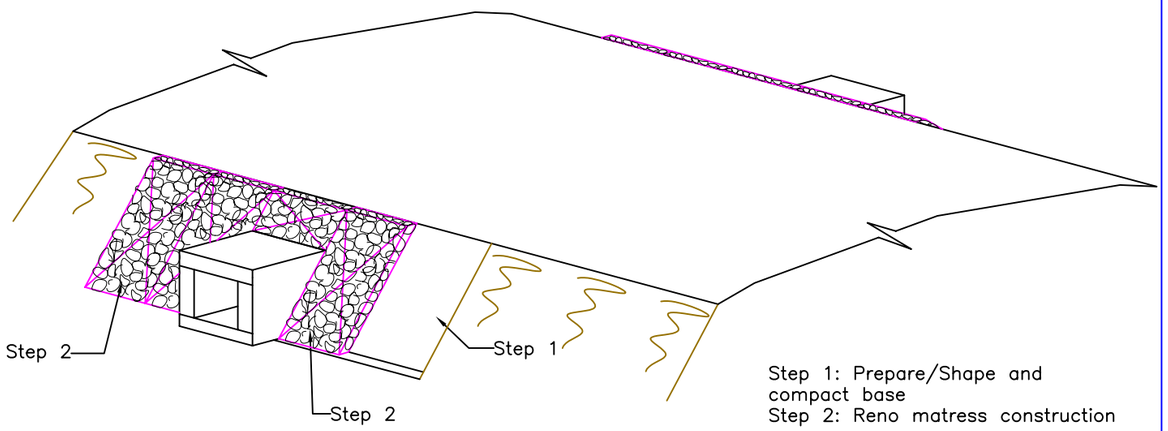
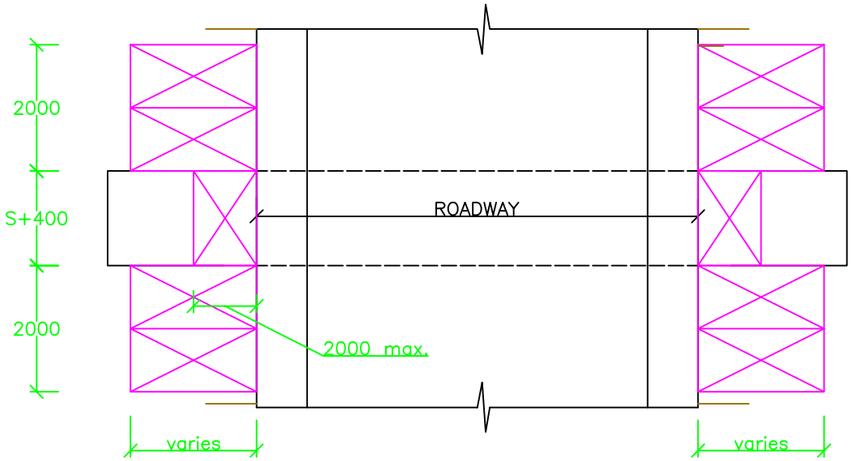


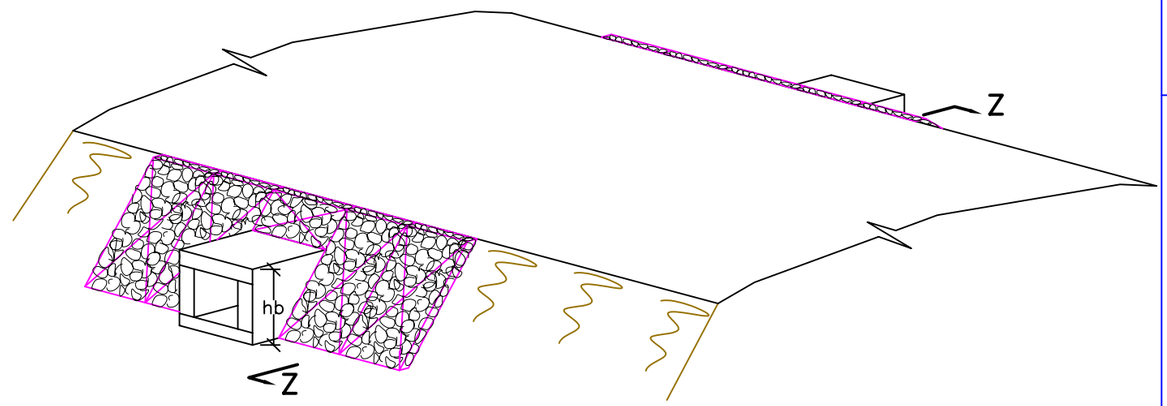
Step 1: Prepare/Shape and compact base
Step 2: Reno matress construction

INSTALLATION PROCEDURE – RENO MATTRESSES

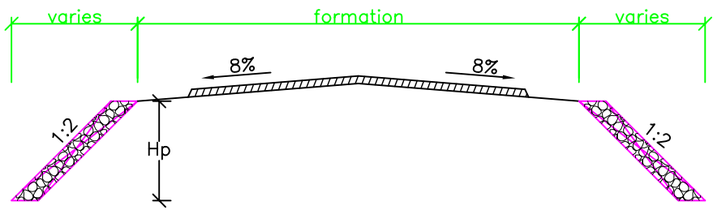


PLAN Scale:1:100

S: Span of Box Culvert



COMPLETED RENO MATTRESS INSTALLATION



SECTION Z–Z Scale:1:100

RENO MATTRESSES (FOOTING GABIONS)

Length m	Width m	Height t	Volume m^3
1	1	0.23	0.23
1	1	0.3	0.3

Project: SUPPORT TO DISTRICT ROAD NETWORK PROGRAMME

Title: STANDARD STRUCTURES MANUAL

Drawing Number: BCEP 002

BOX CULVERT END PROTECTION
Reno Mattresses

Scale: 1:100
Dimension: mm
Date: June 2001
Sheet: 3/3

File Name: P/Roads and Highways/50999A/Data/Drawings/Gabions (BC)

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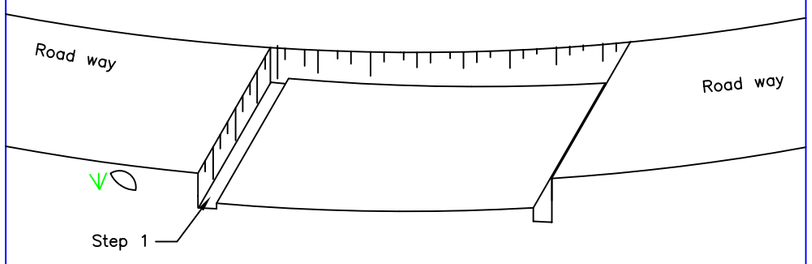
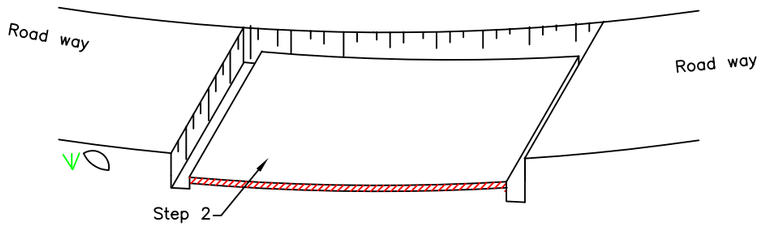
Section B-6
Drifts

Section B-6
Drifts



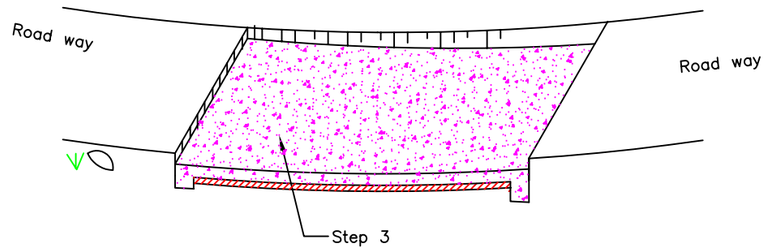
Step 1: Excavation (to wall width) and compaction

Drift under construction



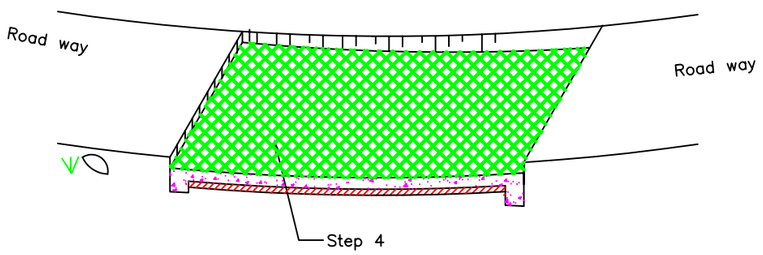
Step 2: Compacted layer of selected gravel material or lean concrete

Drift under construction



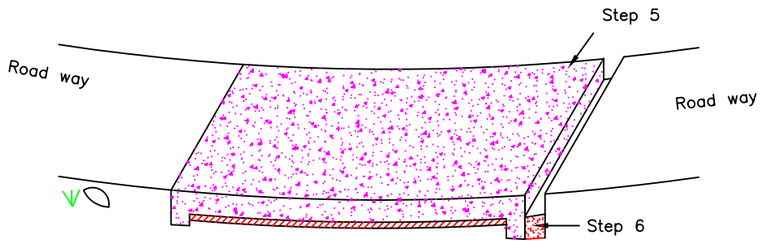
Step 3: First layer of C20 concrete (incase of reinforced deck slab)

Drift under construction



Step 4: R6 mesh laid on the first 100mm concrete layer

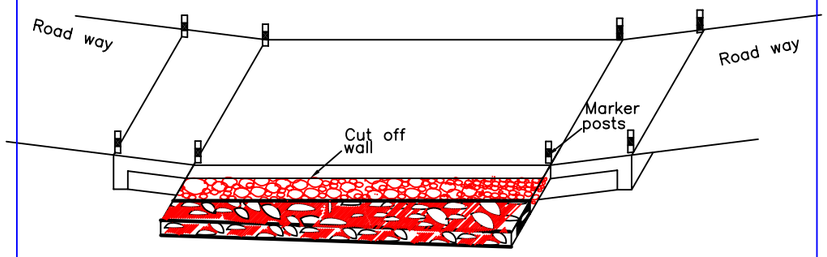
Drift under construction



Step 5: Second layer of 100mm C25 concrete top at river bed level

Step 6: Backfill as necessary

Drift under construction



Completed Drift

NOTE

1. Structure should not reduce the cross section area of the water course
2. Concrete shall be Class 20 concrete
3. Steps 3, 4 and 5 shall be carried out in one operation to avoid lamination

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

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TELEFAX: 321364, 321425

Drawing Number: DFT 001

DRIFT
Construction

Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data /Drawings/ Drift

Date: June 2001

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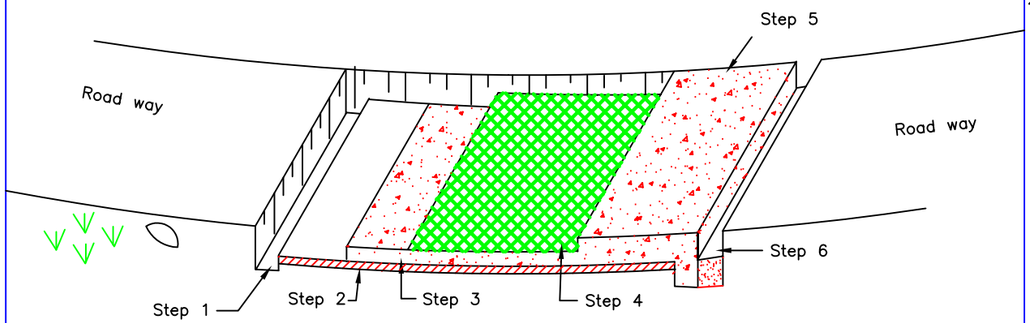


Drift under construction (NTS)

Procedures

Step 1: Excavation to wall width and compaction

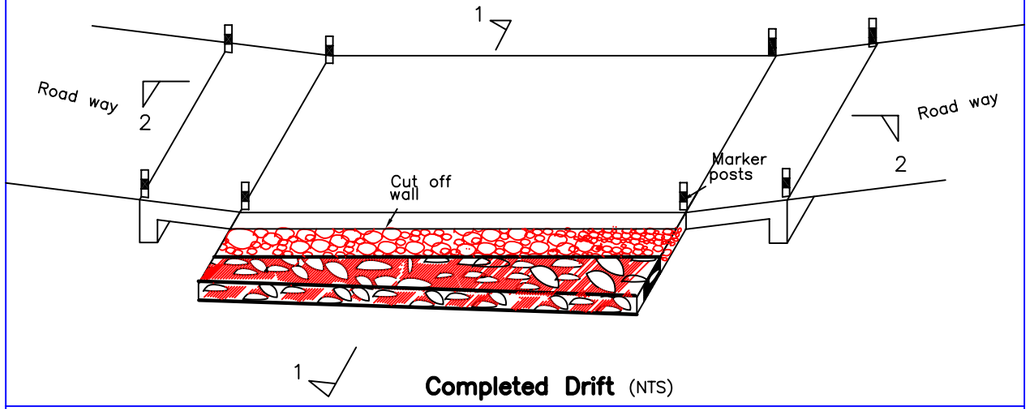
Step 2: Compacted layer of selected gravel material or lean concrete

Step 3: First layer of C20 concrete (incase of reinforced deck slab)

Step 4: R6 mesh laid on the first 100mm concrete layer

Step 5: Second layer of 100mm C20 concrete top at river bed level

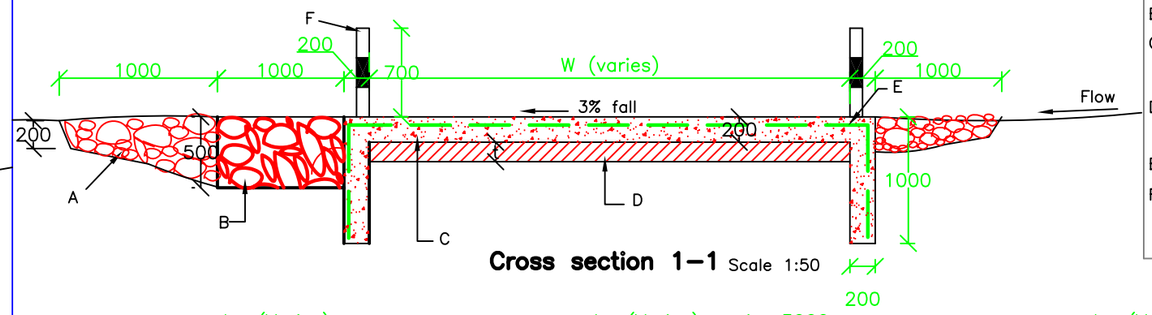
Step 6: Backfill as necessary



Completed Drift (NTS)

NOTE

1. Structure should not reduce the cross section area of the water course
2. Concrete shall be Class 20 concrete
3. Steps 3, 4 and 5 shall be carried out in one operation to avoid lamination



Cross section 1–1 Scale 1:50

A: Unbound stone apron

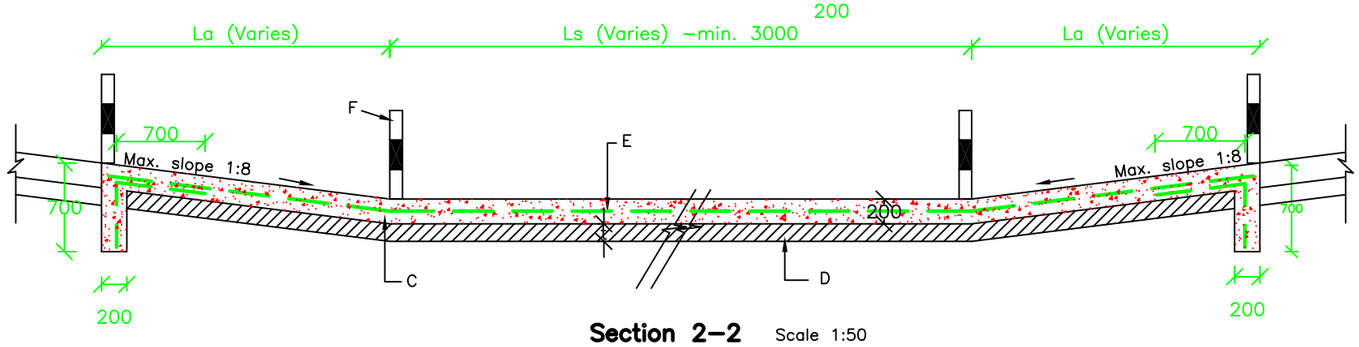
B: Gabion box

C: Reinforced concrete deck slab, 200mm min. thickness

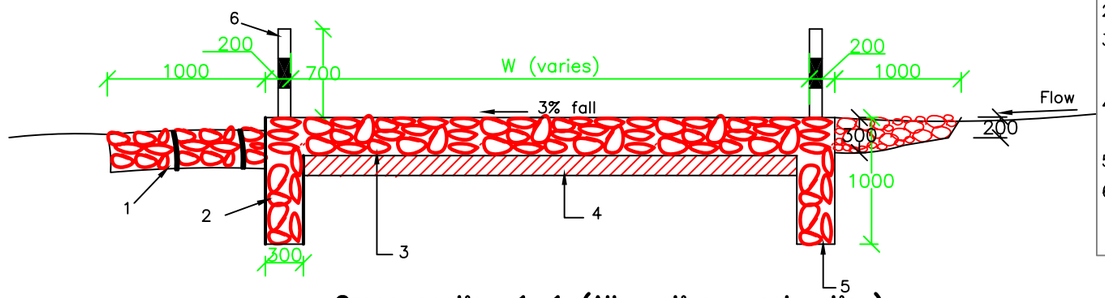
D: Compacted layer of selected gravel material or lean concrete

E: R6 200mm c/c mesh

F: Marker posts



Section 2–2 Scale 1:50



Cross section 1–1 (Alternative construction) Scale 1:50

1: Gabion mattress

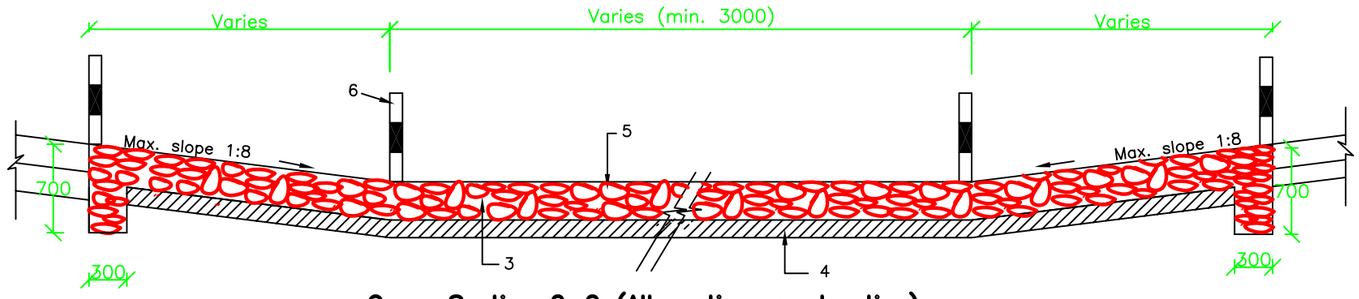
2: Down stream cutoff wall

3: Mass concrete or stone masonry or hand packed stone, min. 300mm

4: Compacted layer of selected gravel material or lean concrete

5: Up stream cutoff wall

6: Marker posts



Cross Section 2–2 (Alternative construction) Scale 1:50

Project: SUPPORT TO DISTRICT ROAD NETWORKS			**Drawing Number:** DFT 001
Title: STANDARD STRUCTURES MANUAL			**DRIFT** **Elevations and Sections** — Scale: As shown; Dimension: mm
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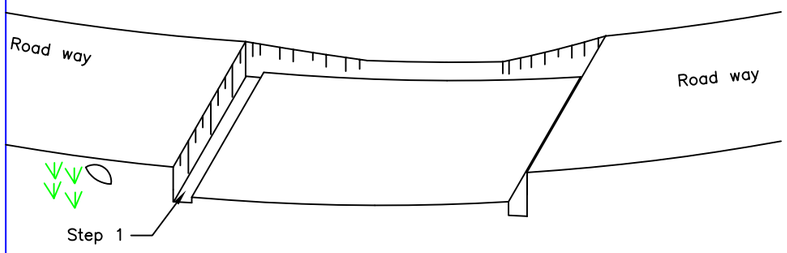
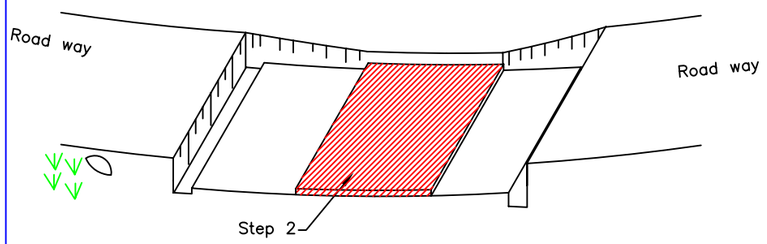
		Drawn by: JMA; Designed by: JMA; Checked by: FCO; Approved by: MMK	Sheet: 1/1

Section B-7
Vented Drifts

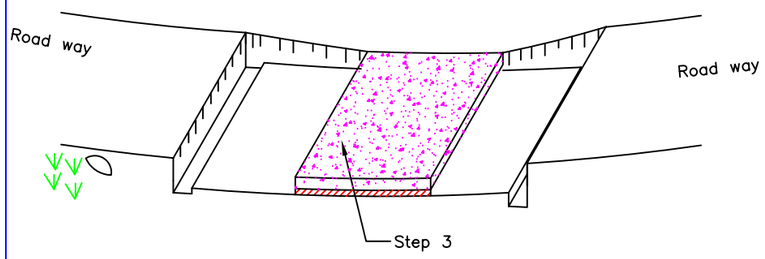
Section B-7
Vented Drifts



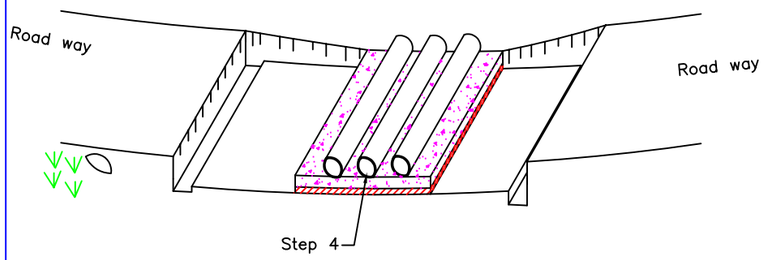
Step 1: Excavation



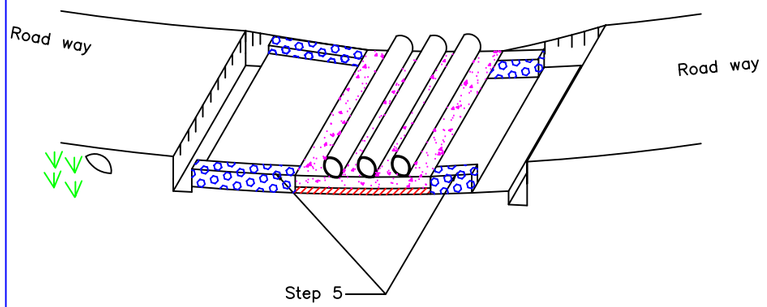
Step 2: Compacted layer of selected gravel material or lean concrete



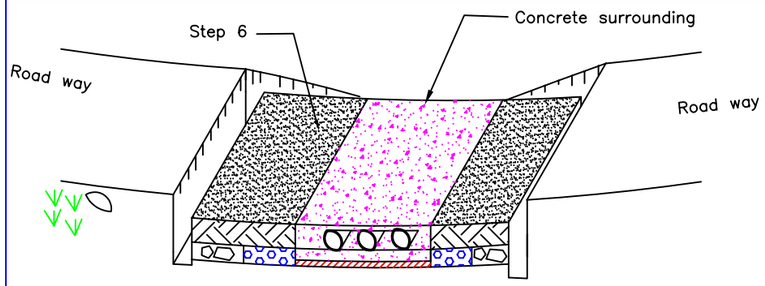
Step 3: Concrete slab, top at river bed level



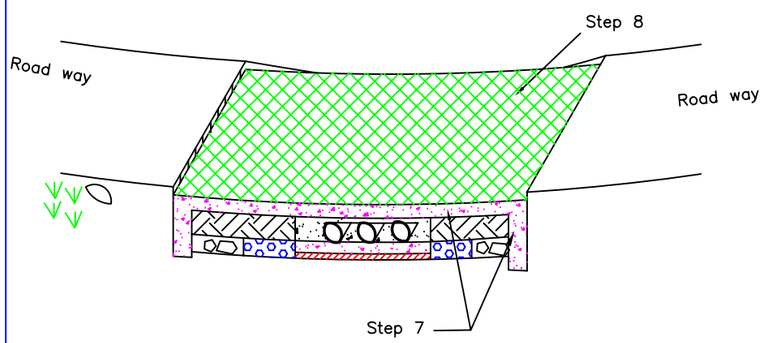
Step 4: Culvert laying at River bed



Step 5: Masonry return wall construction

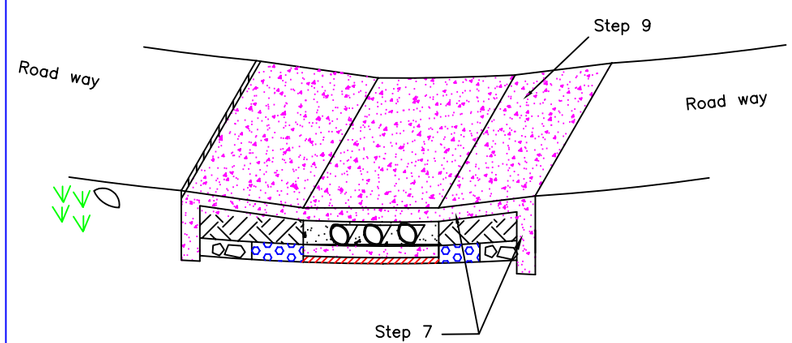


Step 6: Selected fill layer

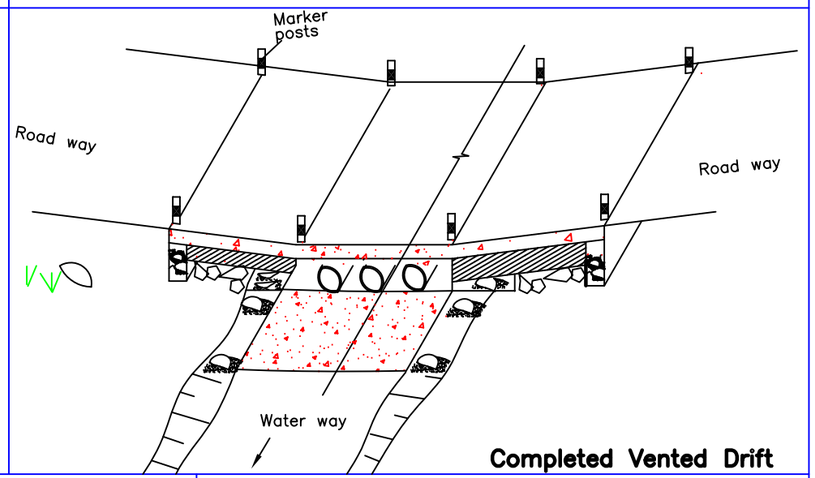


Step 7: Concrete layer 100mm thick

Step 8: R6 mesh 200 c/c laid on top of 100mm thick layer of concrete



Step 9: Second concrete layer 50mm thick



Completed Vented Drift

NOTES:

1. All concrete is Class 20.
2. All edges to have a 20mm chamfer.
3. Steps 7, 8 and 9 shall be carried out in one operation to avoid lamination

Procedures

Step 1: Excavation
Step 2: Compacted layer of selected gravel material or lean concrete
Step 3: Concrete slab, top at river bed level
Step 4: Culvert laying at River bed
Step 5: Masonry return wall construction
Step 6: Selected fill material
Step 7: Concrete layer 100mm thick
Step 8: R6 mesh 200 c/c
Step 9: Second concrete layer 50mm thick

Project: SUPPORT TO DISTRICT ROAD NETWORK

Title: STANDARD STRUCTURES MANUAL

\\Server\p\Roads & Highways 50999A\Data\Drawings\logo3.jpg

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: VDFT 001

VENTED DRIFT

Construction

Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings /Vented Drift

Date: June 2001

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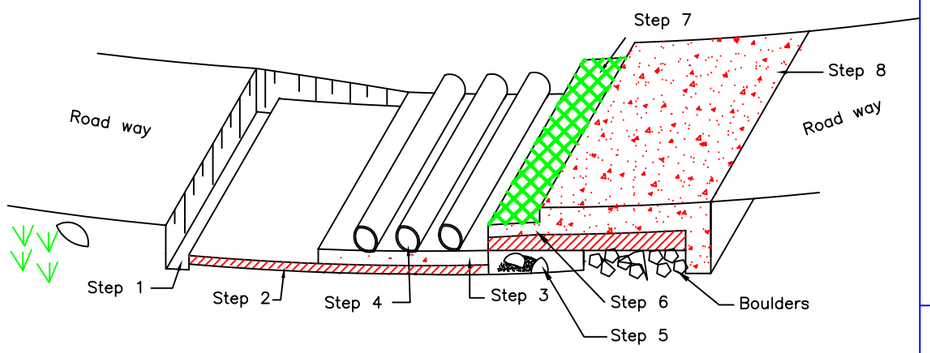
JAU	JAU	FCO	MMK	1/1



Vented Drift under construction (NTS)

Proceedures

Step 1: Excavation

Step 2: Compacted layer of selected gravel material or lean concrete

Step 3: Concrete slab, top at river bed level

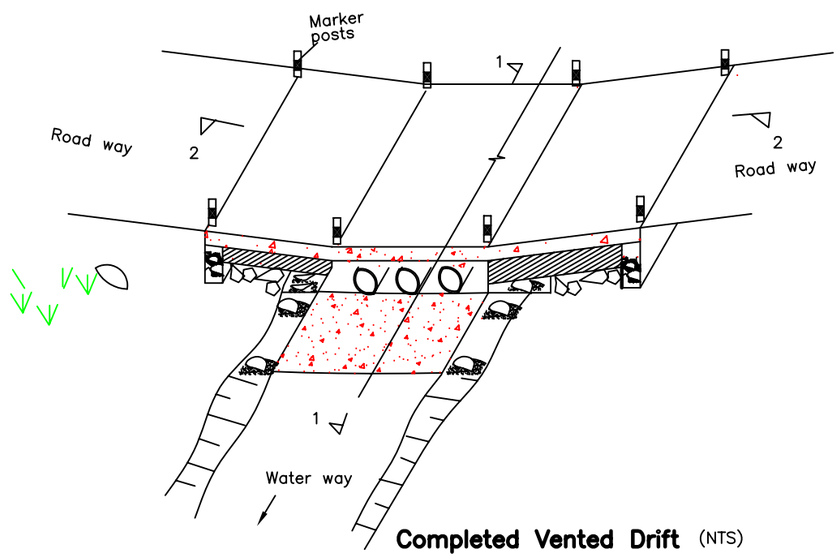
Step 4: Culvert laying at River bed

Step 5: Masonry return wall construction

Step 6: Concrete layer 100mm thick

Step 7: R6 mesh 200 c/c

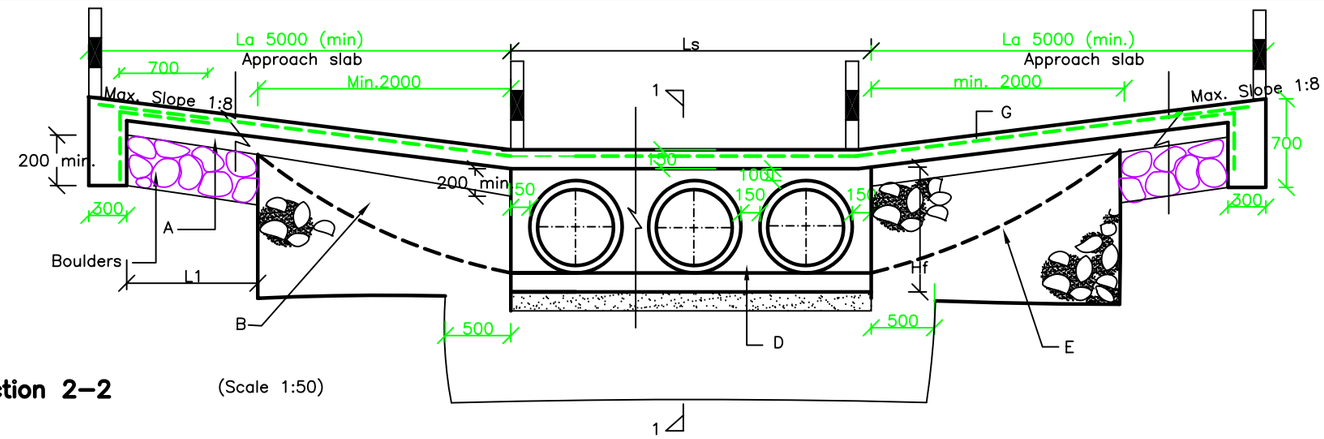
Step 8: Second concrete layer 50mm thick



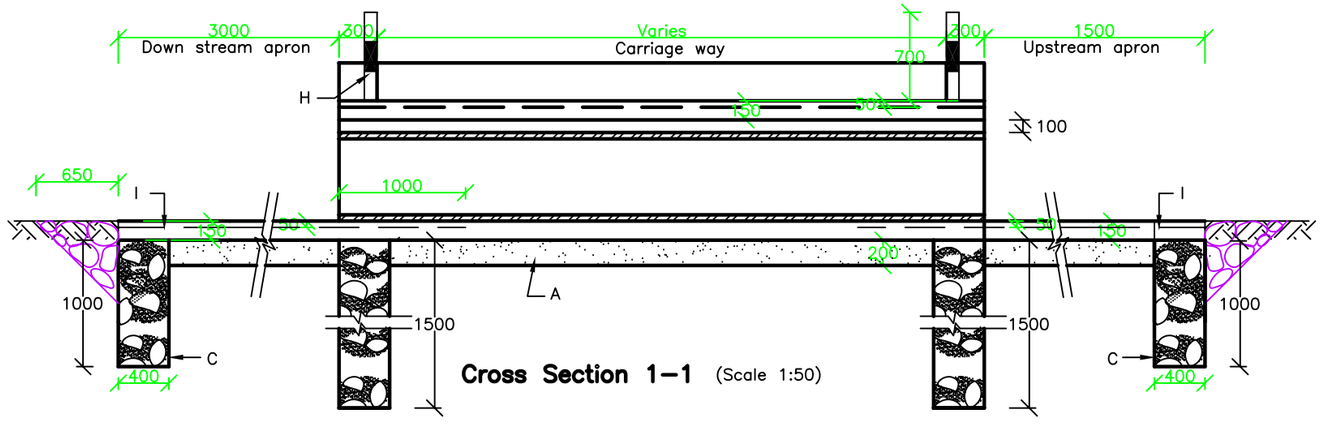
Completed Vented Drift (NTS)

NOTES

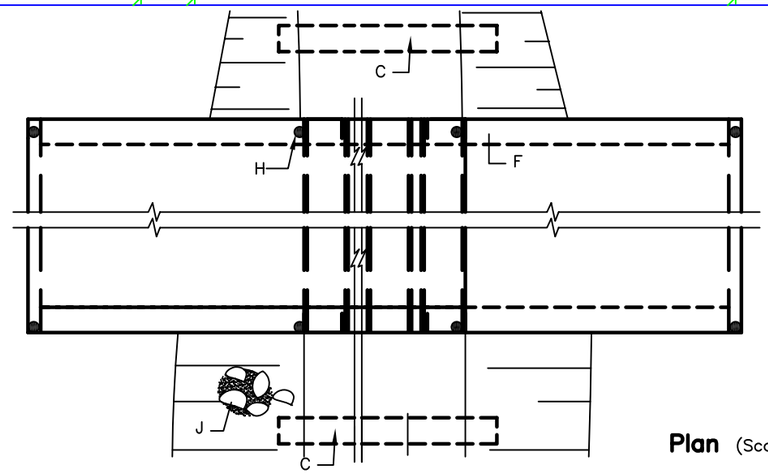
1. All concrete is Class 20
2. All edges to have a 20mm chamfer.
3. Steps 6, 7 and 8 shall be carried out in one operation to avoid lamination



Section 2–2 (Scale 1:50)



Cross Section 1–1 (Scale 1:50)



Plan (Scale 1:00)

A: Well compacted selected material

B: Selected fill

C: Masonry cutoff wall

D: Lean Concrete surrounding

E: River bed profile

F: Masonry return wall

G: R6 mesh 200mm c/c

H: Marker posts

I: Concrete slab

J: Stone pitching, as required

Project: SUPPORT TO DISTRICT ROAD NETWORK

Title: STANDARD STRUCTURES MANUAL

Drawing Number: VDFT 001

VENTED DRIFT

Plan, Elevations, and Sections

Scale: NTS, 1:50, 1:100

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings /Vented Drift

Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet No.
JMA	JMA	FCO	MMK	1/1

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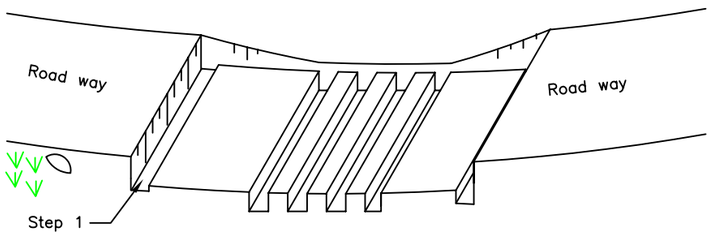
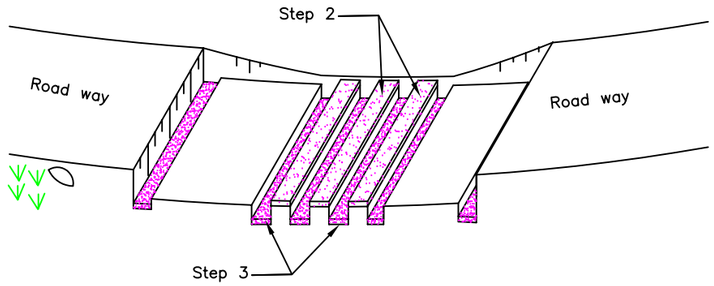
P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

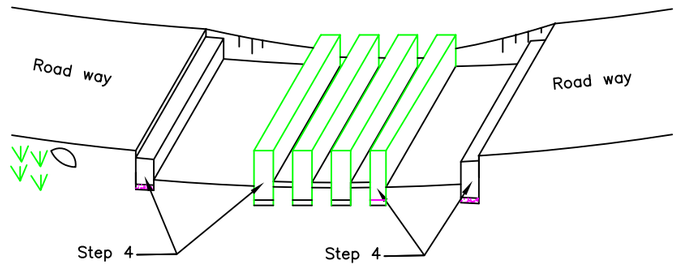


Step 1: Excavation

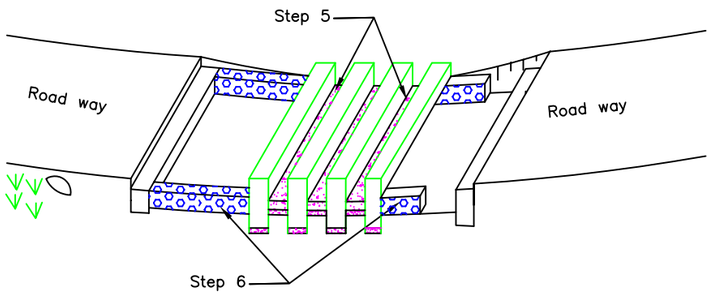


Step 2: Compacted layer of selected gravel material or lean concrete

Step 3: 50mm Lean Concrete blinding

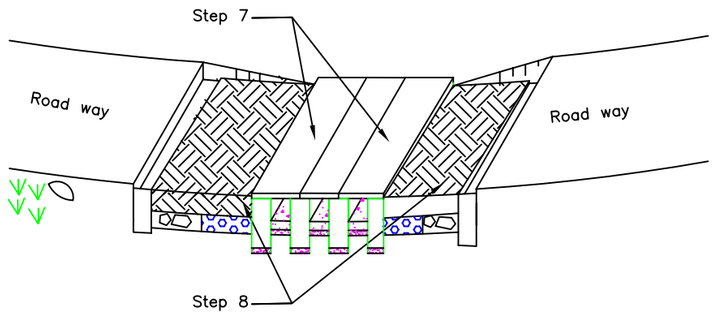


Step 4: Stone masonry walls



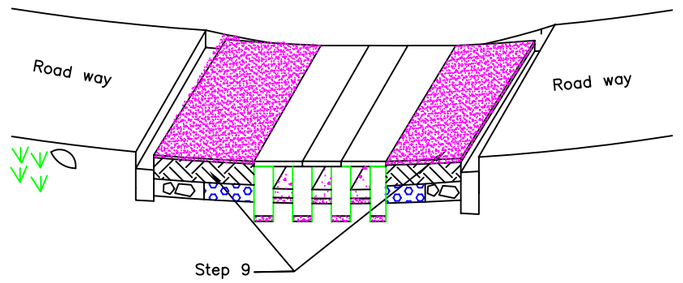
Step 5: Base slab 150mm thick, top at river bed level

Step 6: Stone masonry return wall

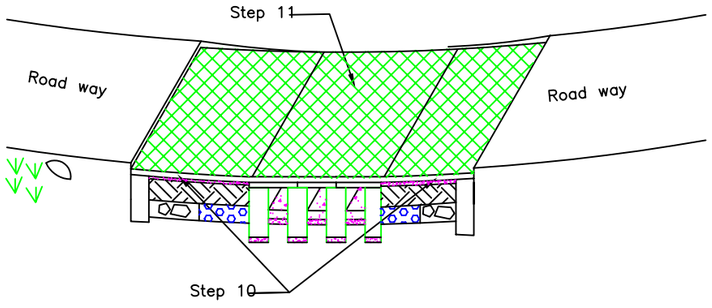


Step 7: 200mm precast RCC slab

Step 8: Compacted backfill

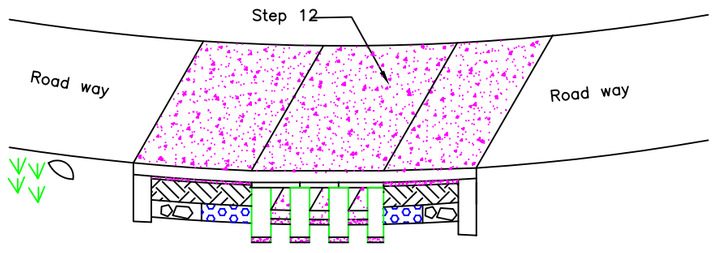


Step 9: Compacted gravel

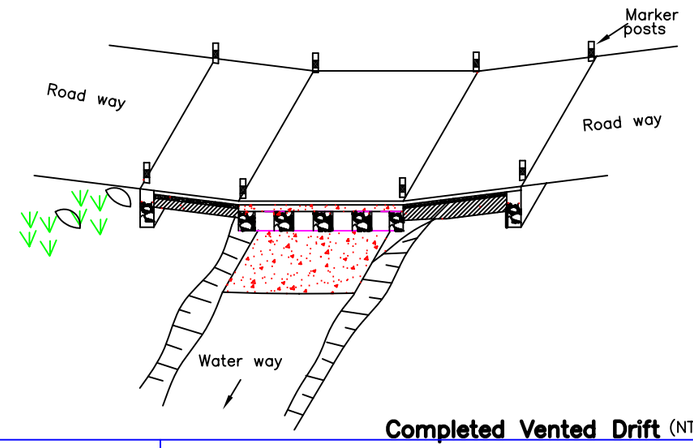


Step 10: 100mm layer of concrete

Step 11: R6 mesh 200 c/c



Step 12: 50mm concrete top layer



Completed Vented Drift (NTS)

NOTES

1. All concrete is Class 25 unless otherwise stated
2. All edges to have a 20mm chamfer.
3. Steps 10, 11 and 12 shall be carried out in one operation to avoid lamination

Procedures

Step 1: Excavation
Step 2: Compacted layer of selected gravel material or lean concrete
Step 3: 50mm Lean Concrete blinding
Step 4: Stone masonry walls
Step 5: Base slab 150mm thick, top at river bed level
Step 6: Stone masonry return wall
Step 7: 200mm precast RCC slab
Step 8: Compacted backfill
Step 9: Compacted gravel
Step 10: 100mm layer of concrete
Step 11: R6 mesh 200 c/c
Step 12: 50mm concrete top layer

Project: SUPPORT TO DISTRICT ROAD NETWORK

Title: STANDARD STRUCTURES MANUAL

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: VDFT 002

VENTED DRIFT
Construction

Scale: NTS

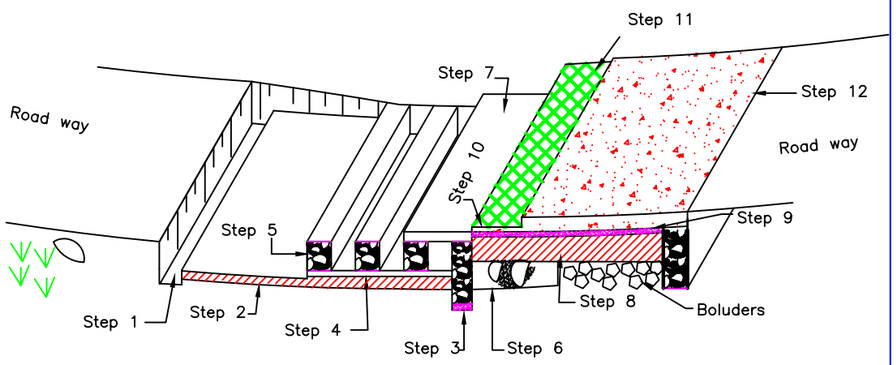
Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Vented Drift

Date: June 2001

Drawn by	Designed by	Checked by	Approved by
JAU	JAU	FCO	MMK

Sheet No. 1/1



Vented Drift under construction (NTS)

Procedures

Step 1: Excavation

Step 2: Compacted layer of selected gravel material or lean concrete

Step 3: 50mm Lean Concrete blinding

Step 4: Base slab 150mm thick, top at river bed level

Step 5: Stone masonry wall

Step 6: Stone masonry return wall

Step 7: 200mm precast RCC slab

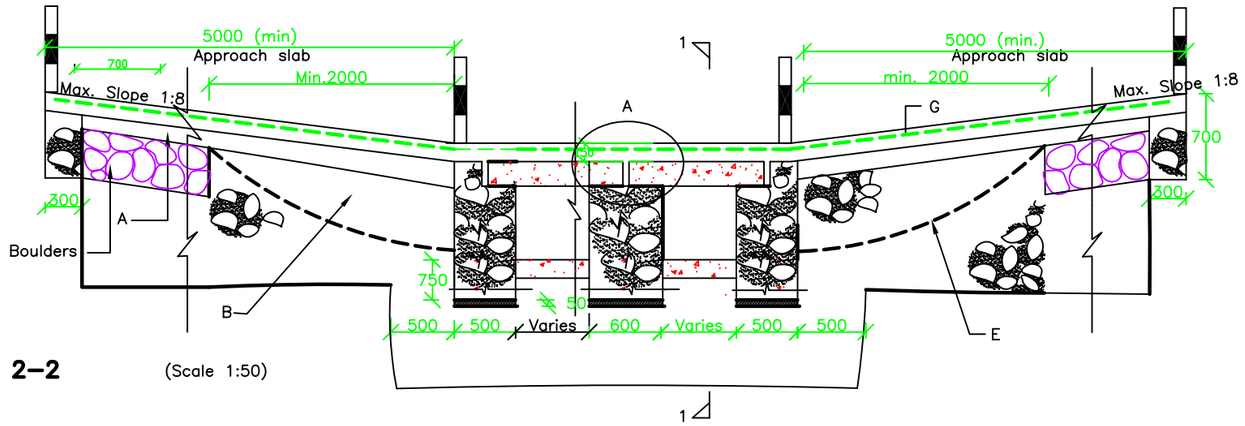
Step 8: Compacted backfill

Step 9: Compacted gravel

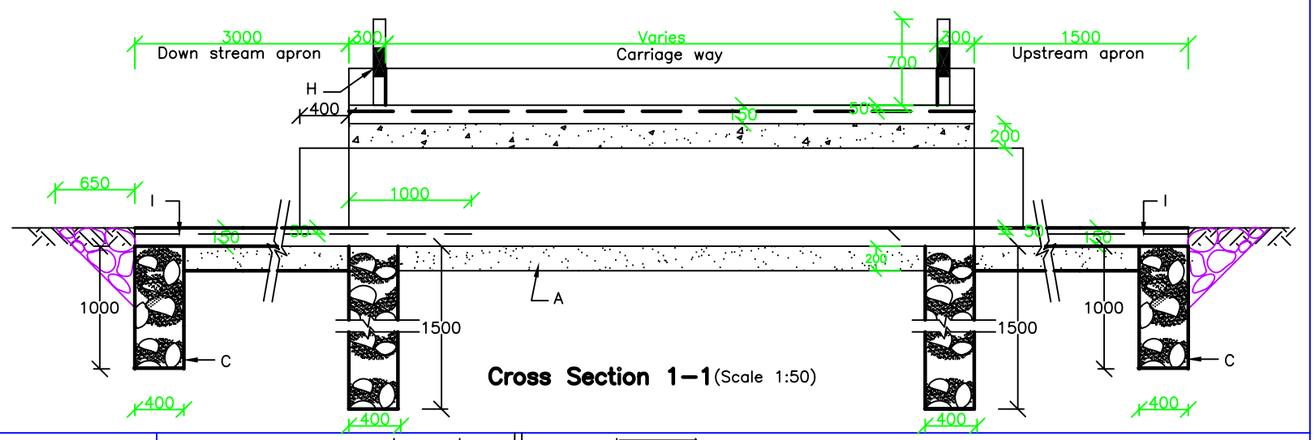
Step 10: 100mm layer of concrete

Step 11: R6 mesh 200 c/c

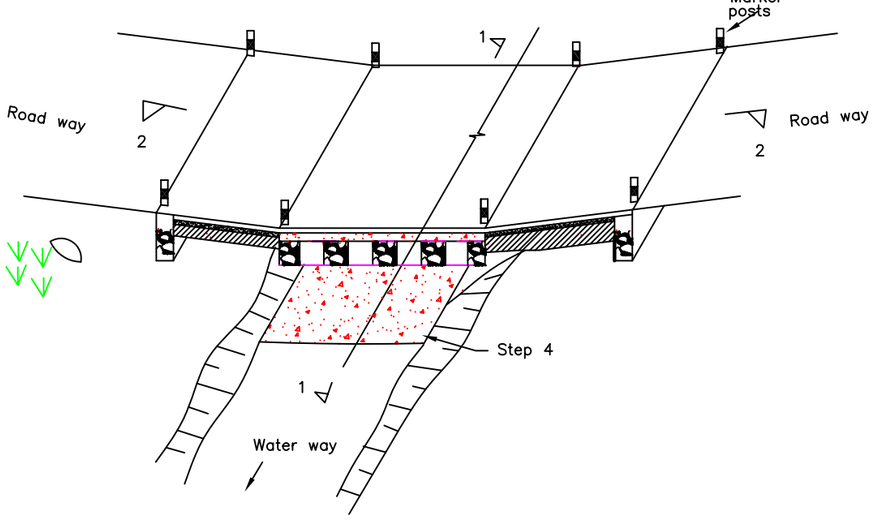
Step 12: 50mm concrete top layer



Section 2–2 (Scale 1:50)



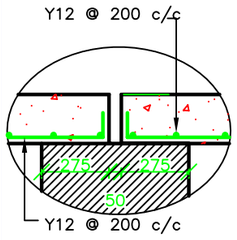
Cross Section 1–1 (Scale 1:50)



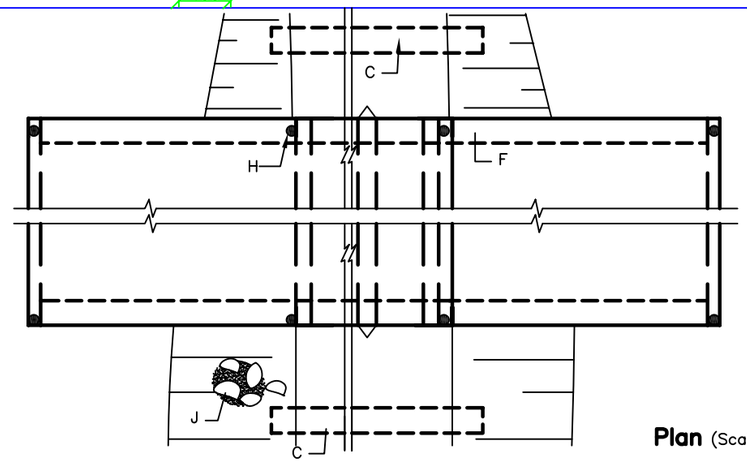
Completed Vented Drift (NTS)

NOTES

1. All concrete is Class 20 unless otherwise stated
2. All edges to have a 20mm chamfer.
3. Steps 10, 11 and 12 shall be carried out in one operation to avoid lamination
4. Tapering to ends of middle walls



Detail A (Scale 1:25)



Plan (Scale 1:00)

A: Well compacted selected material
B: Selected fill
C: Masonry cutoff wall
E: River bed profile
F: Masonry return wall
G: R6 mesh 200mm c/c
H: Marker posts
I: Concrete slab
J: Stone pitching, as required

Project: SUPPORT TO DISTRICT ROAD NETWORK

Title: STANDARD STRUCTURES MANUAL

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: VDFT 002

VENTED DRIFT
Plan, Elevations, Sections & Details

Scale: 1:20, 1:50, 1:100

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings /Vented Drift

Date: June 2001

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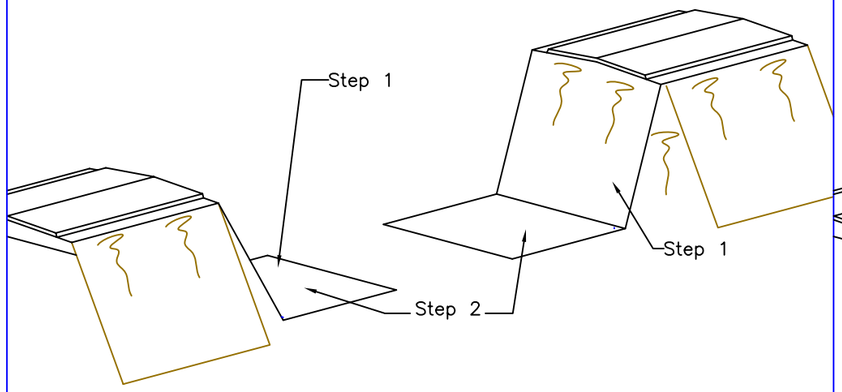
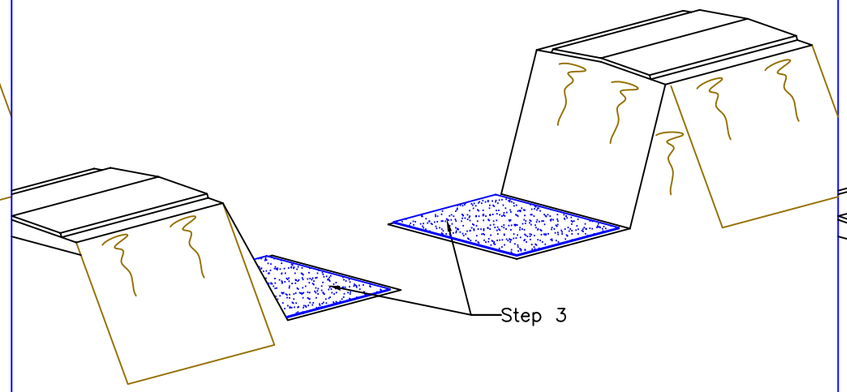
JMA	JMA	FCO	MMK	1/1

Section B-8
Bridge

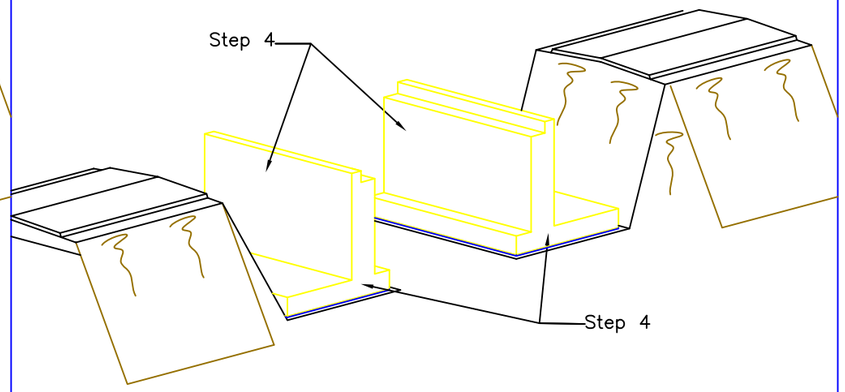
Section B-8
Bridge



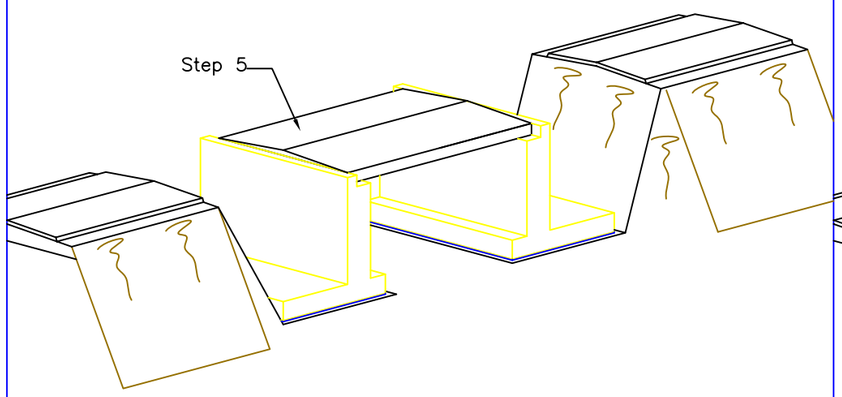
Step 1: Excavation and shaping
Step 2: Prepare and compact foundation



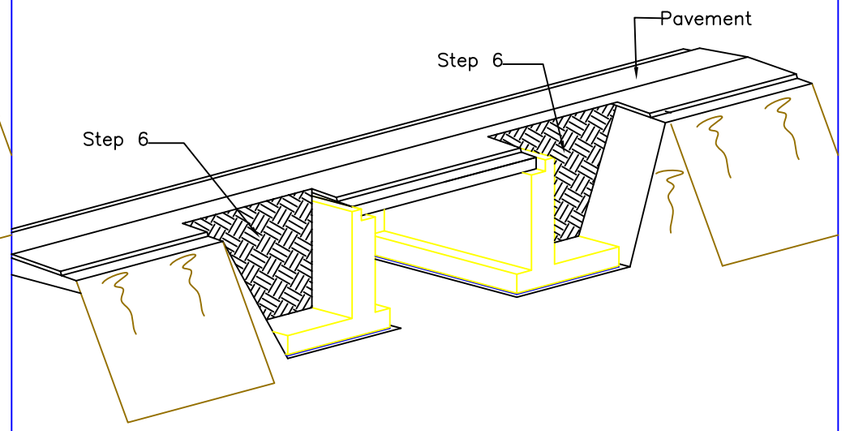
Step 3: Concrete blinding



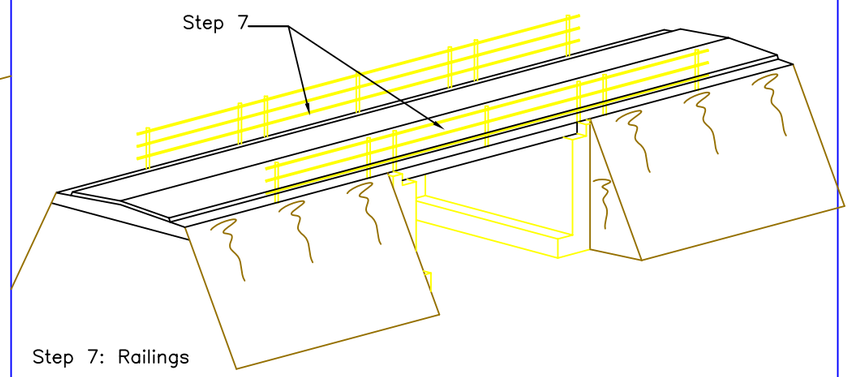
Step 4: Abutment



Step 5: Bridge deck



Step 6: Backfilling and compacting behind abutment



Step 7: Railings

COMPLETED SINGLE SPAN BRIDGE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES (mm).
2. MIN. COVER TO REINFORCEMENT – 50mm
3. CHARACTERISTIC CONCRETE CUBE STRENGTH AT 28 DAYS – 30 N/mm2

Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete blinding
Step 4: Abutment
Step 5: Bridge deck
Step 6: Backfilling and compacting behind abutment

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

\\Server\pRoads & Highways\50999A\Data\Drawings\logo3.jpg

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

Drawing Number: BRG 001

SINGLE SPAN BRIDGE Construction

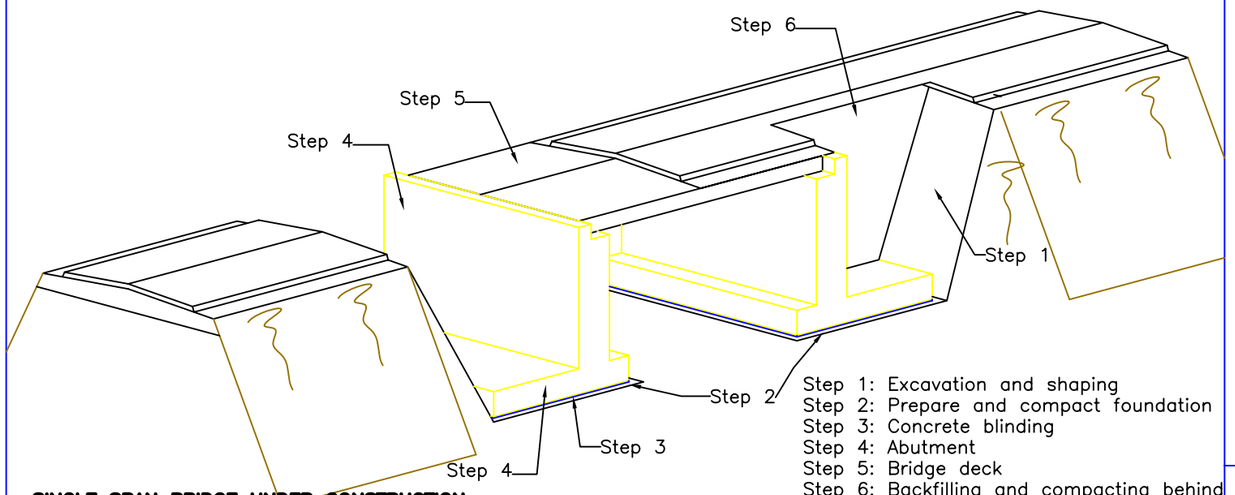
Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings /Bridge

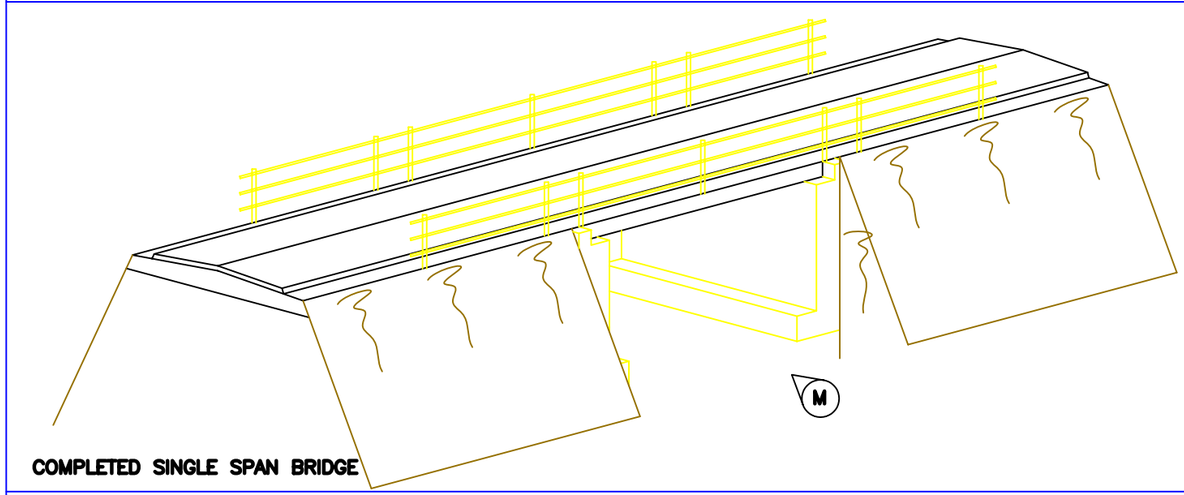
Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	1/7

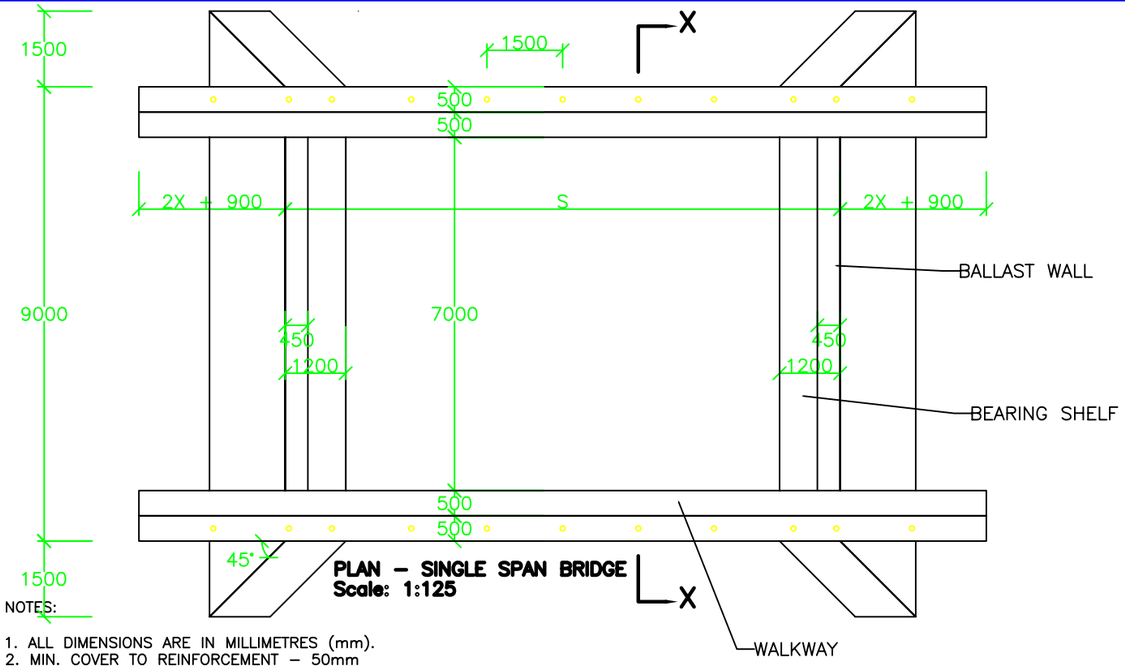


Step 1: Excavation and shaping
Step 2: Prepare and compact foundation
Step 3: Concrete blinding
Step 4: Abutment
Step 5: Bridge deck
Step 6: Backfilling and compacting behind abutment

SINGLE SPAN BRIDGE UNDER CONSTRUCTION

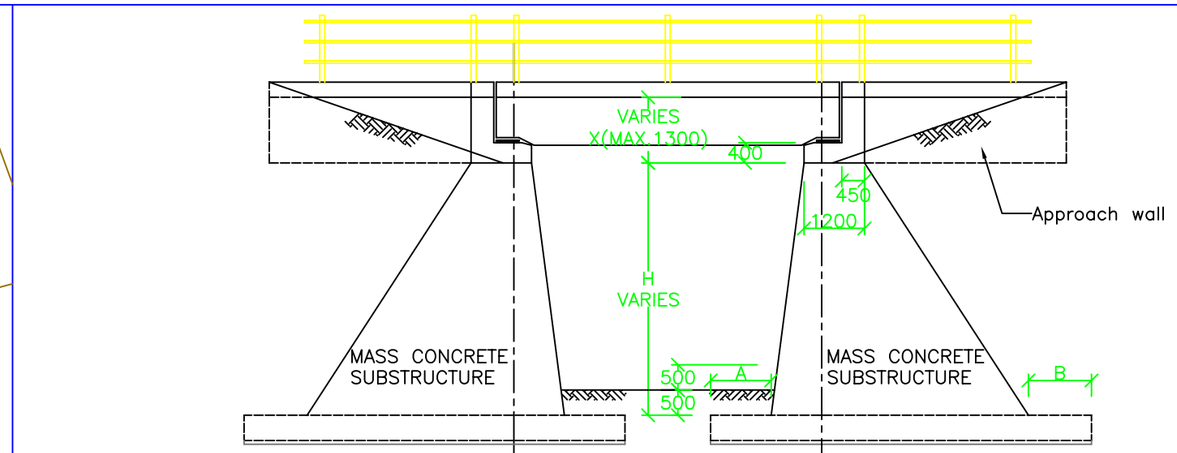


COMPLETED SINGLE SPAN BRIDGE

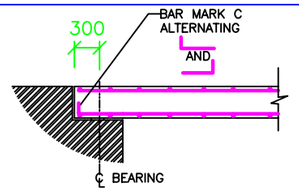


PLAN – SINGLE SPAN BRIDGE
Scale: 1:125

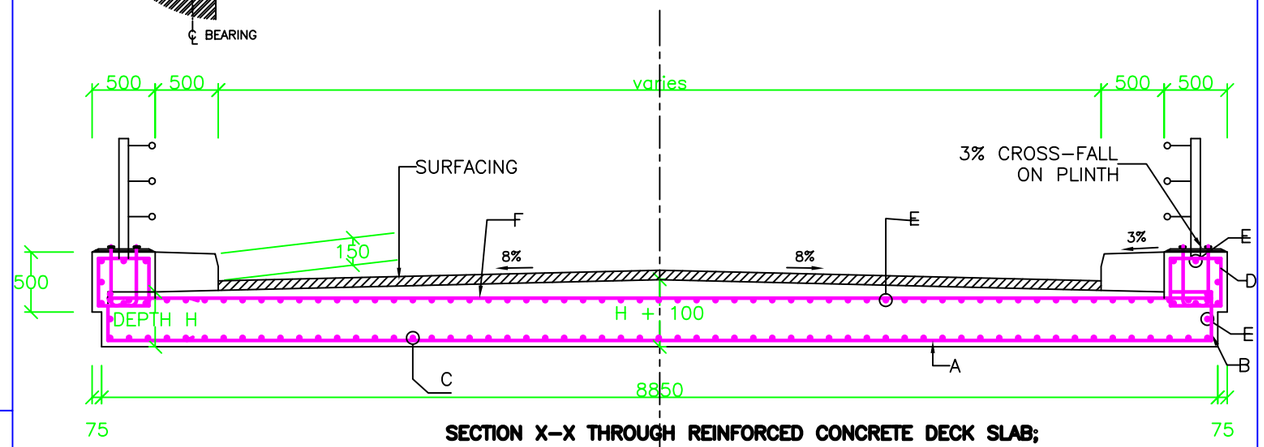
NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES (mm).
2. MIN. COVER TO REINFORCEMENT – 50mm
3. CHARACTERISTIC CONCRETE CUBE STRENGTH AT 28 DAYS – 30 N/mm2



TYPICAL ELEVATION "M" OF A SINGLE SPAN BRIDGE **Scale: 1:125**



DETAIL AT SUPPORT **Scale: 1:75**



SECTION X–X THROUGH REINFORCED CONCRETE DECK SLAB;
BS.HA.LOAD; 2 LANES **Scale: 1:50**

MILD STEEL REINFORCEMENT – REINFORCED CONCRETE DECK SLAB

	STRAIGHT	500 / H−100	SPAN+500 / H/2 / 400 / 350		STRAIGHT SPAN+500	STRAIGHT	DEPTH H (mm)
BAR / SPAN(m)	A	B	C	D	E	F	
5	16 @ 100	12 @ 200	32 @ 150	16 @ 200	12 @ 200	12 @ 200	400
10	16 @ 100	16 @ 200	32 @ 100	16 @ 200	16 @ 200	16 @ 200	650
15	16 @ 100	16 @ 200	32 @ 90	16 @ 200	16 @ 200	16 @ 200	700
20	16 @ 100	16 @ 200	32 @ 90	16 @ 200	16 @ 200	16 @ 200	750

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: BRG 001

Title: STANDARD STRUCTURES MANUAL

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

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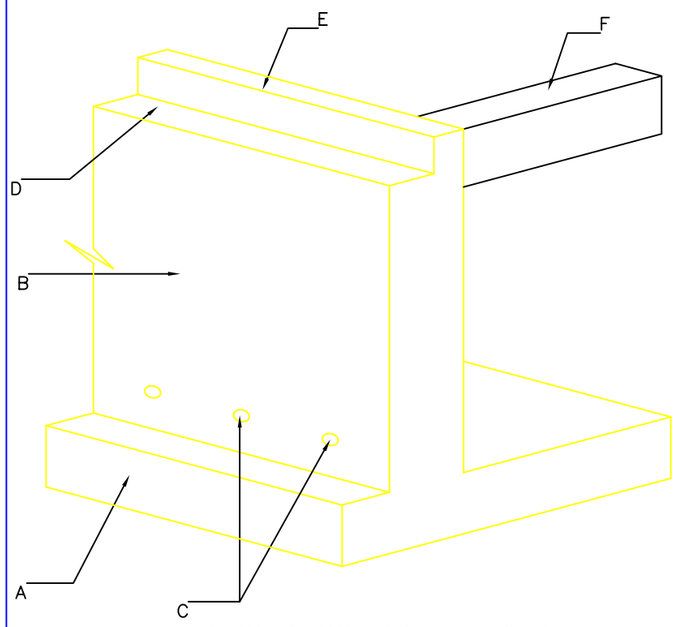
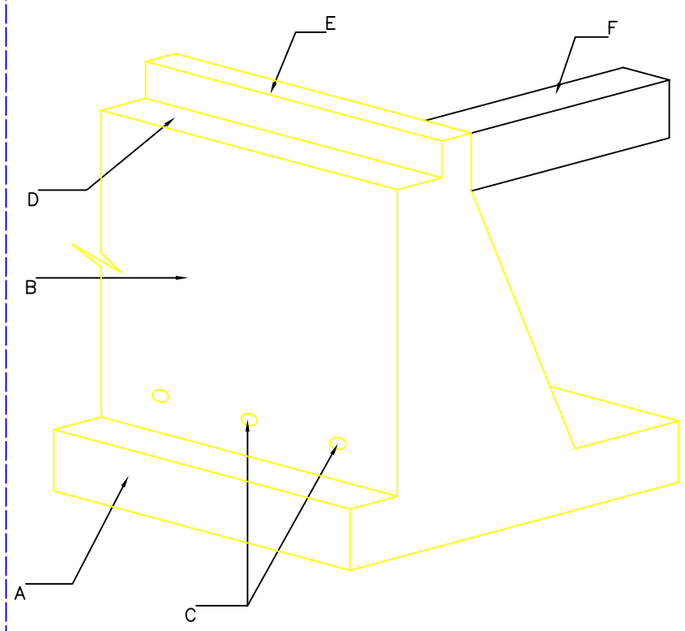
BRIDGE AND BRIDGE DECK
Installation, Plan, Elevation
Vertical Section and Reinforcement Detail

Scale: 1:250
Dimension: mm
File Name: P/Roads and Highways/50999A/Data/Drawings/Bridge
Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	2/7



REINFORCED CONCRETE ABUTMENT

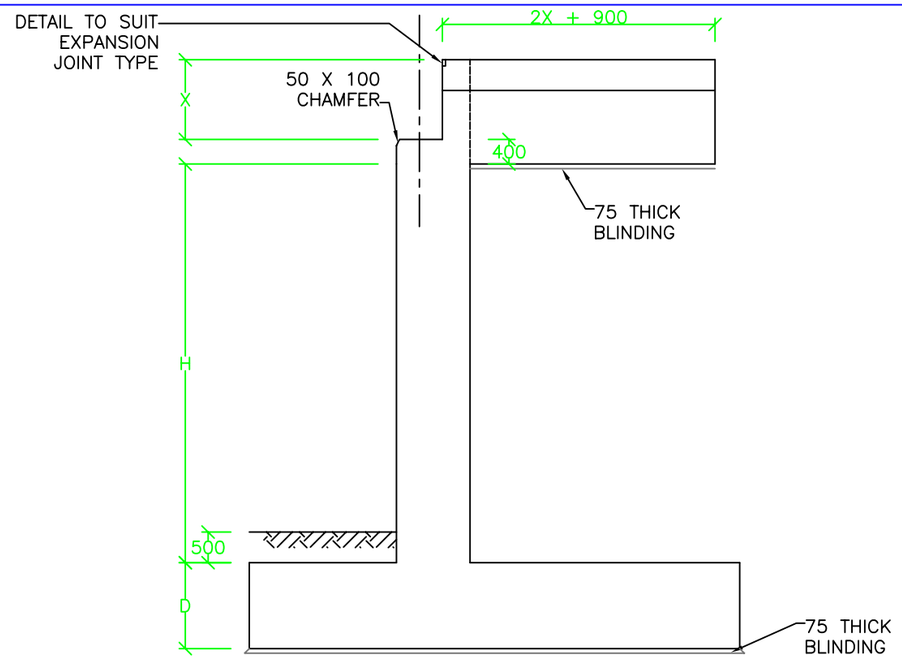


MASS CONCRETE ABUTMENT

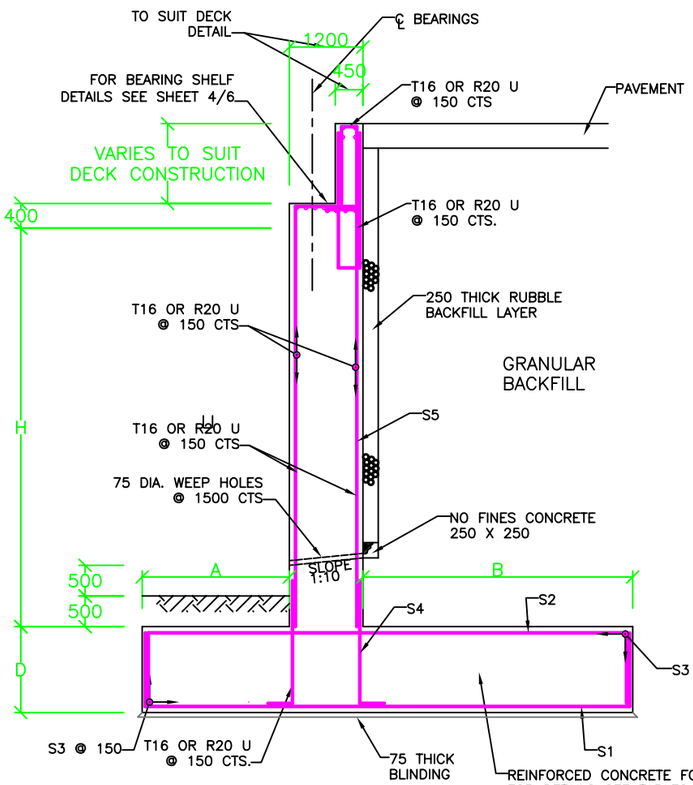
A. Foundation slab
B. Front/Stem wall
C. Weep holes
D. Bearing Shelf
E. Ballast wall
F. Approach Wall

MAIN ELEMENTS OF AN ABUTMENT

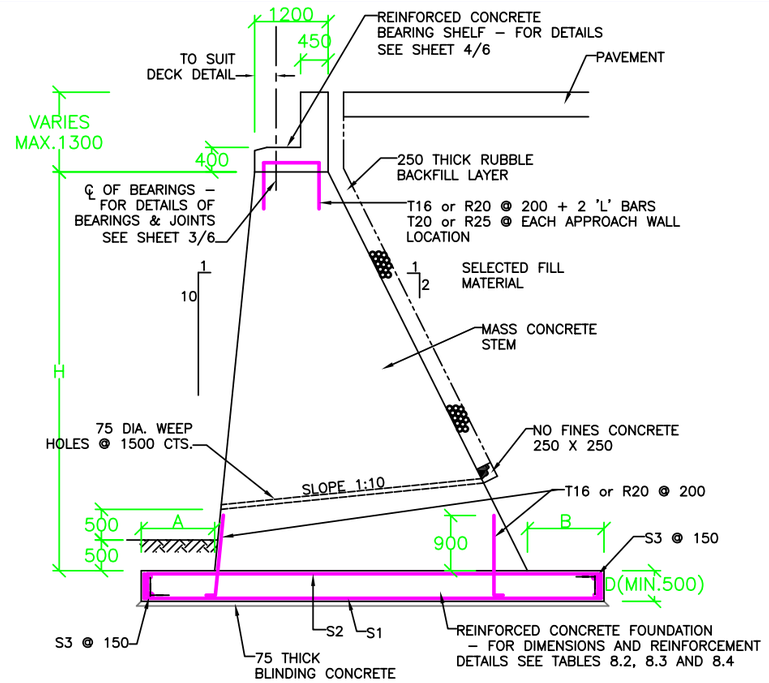
A. Foundation slab
B. Front/Stem wall
C. Weep holes
D. Bearing Shelf
E. Ballast wall
F. Approach wall



REINFORCED CONCRETE ABUTMENT – SIDE ELEVATION



REINFORCED CONCRETE ABUTMENT – VERTICAL SECTION



MASS CONCRETE ABUTMENT – VERTICAL SECTION

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: BRG 001

BRIDGE ABUTMENT
Sections, Elevations and Plan
Vertical Sections

Scale: 1:100
Dimension: mm
File Name: P/Roads and Highways/50999A/Data/Drawings /Bridge
Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	3/7

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

P. O. BOX 10, ENTEBBE, UGANDA

TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

TABLE 8.2 Abutment, mass concrete – foundation sizes

Span S mm	Height H mm	400			300			200			150			100		
		A	B	D	A	B	D	A	B	D	A	B	D	A	B	D
5000	2000	600	800	500	600	800	500	600	800	500	900	800	500	1400	800	600
	3000	600	600	500	600	600	500	600	600	500	1100	600	600	1700	600	700
	4000	500	500	500	500	500	500	800	500	500	1300	500	700	–	–	–
	5000	500	500	500	500	500	500	1200	600	600	1700	500	900	–	–	–
10000	2000	500	1200	500	500	1200	500	800	1200	500	1200	1200	600	1800	1200	700
	3000	500	1000	500	500	1000	500	1000	1000	500	1400	1000	700	–	–	–
	4000	500	900	500	500	900	500	1200	900	600	1800	1000	900	–	–	–
	5000	500	800	500	700	800	500	1600	900	800	2000	1000	1000	–	–	–
15000	2000															
	3000															
	4000															
	5000															
20000	2000															
	3000															
	4000															
	5000															

TABLE 8.15: Pier Stem Reinforcement (mm)

Height H mm	HIGH YIELD STEEL REINFORCEMENT						MILD STEEL REINFORCEMENT					
	S1	S2	S3	S4	S5	S6	S1	S2	S3	S4	S5	S6
2000	20@150	16@175	16@175	16@150	16@150	20	20@150	16@150	16@150	20@150	20@150	20
3000	20@150	16@175	16@175	16@150	16@150	20	25@150	16@150	16@150	20@150	20@150	25
4000	20@150	16@175	16@175	16@150	16@150	20	25@150	16@150	16@150	20@150	20@150	25
5000	25@150	16@175	16@175	16@150	16@150	25	32@200	16@150	16@150	20@200	20@200	32

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: BRG 001

Title: STANDARD STRUCTURES MANUAL

TABLES: MASS CONCRETE ABUTMENT
Foundations sizes
Pier Stem Reinforcement

Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Bridge

Date: June 2001

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Sheet: 4/7

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TABLE 8.3 Abutment, mass concrete – high yield steel reinforcement in the foundation (mm)

Span S mm	Height H mm	ALLOWABLE BEARING PRESSURE VALUES (kN/m²)														
		400			300			200			150			100		
		S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3
5000	2000	16@200	16@200	12	20@200	16@200	12	20@200	16@200	12	16@200	16@200	12	16@200	16@200	12
	3000	16@200	16@200	12	20@200	16@200	12	20@200	16@200	12	16@200	16@200	12	16@200	16@200	16
	4000	16@200	16@200	12	20@200	16@200	12	20@200	16@200	12	16@200	16@200	12	–	–	–
	5000	16@200	16@200	12	20@200	16@200	12	20@200	16@200	12	–	–	–	–	–	–
10000	2000	16@200	16@200	12	20@200	16@200	12	20@200	16@200	12	16@150	16@150	12	16@150	16@150	16
	3000	16@200	16@200	12	20@200	16@200	12	20@200	16@200	12	16@150	16@150	12	–	–	–
	4000	16@200	16@200	12	20@200	16@200	12	20@150	16@150	16	20@150	16@150	12	–	–	–
	5000	16@200	16@200	12	20@200	16@200	12	25@200	16@200	16	20@150	16@150	12	–	–	–
15000	2000	16@200	16@200	12	20@200	16@200	12	20@150	16@150	12	20@200	16@200	12	20@200	20@200	16
	3000	16@200	16@200	12	20@200	16@200	12	25@200	16@200	16	20@150	16@150	12	–	–	–
	4000	16@200	16@200	12	20@200	16@200	12	25@150	16@150	16	20@150	16@150	12	–	–	–
	5000	16@200	16@200	12	20@200	16@200	12	25@150	16@150	16	25@200	16@200	12	–	–	–
20000	2000	16@200	16@200	12	20@150	16@150	12	25@150	16@150	16	25@200	16@200	12	20@150	20@150	16
	3000	16@200	16@200	12	25@200	16@200	16	25@150	16@100	16	25@200	16@200	12	–	–	–
	4000	16@200	16@200	12	25@150	16@150	16	32@150	20@200	16	25@150	16@150	16	–	–	–
	5000	16@200	16@200	12	25@150	16@150	16	32@150	20@150	16	25@150	16@150	16	–	–	–

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: BRG 001

Title: STANDARD STRUCTURES MANUAL

TABLES: MASS CONCRETE ABUTMENT High Yield Steel Reinforcement in the Foundation

Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Bridge

Date: June 2001

Drawn by: JAU | Designed by: JAU | Checked by: FCO | Approved by: MMK

Sheet: 5/12

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MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

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TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

TABLE 8.4 Abutment, mass concrete – mild steel reinforcement in the foundation (mm)

Span S mm	Height H mm	ALLOWABLE BEARING PRESSURE VALUES (kN/m²)														
		400			300			200			150			100		
		S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3
5000	2000	20@150	20@150	12	20@150	20@150	12	20@150	20@150	12	20@200	20@200	12	20@200	20@200	12
	3000	20@150	20@150	12	20@150	20@150	12	20@150	20@150	12	20@200	20@200	12	20@150	20@150	12
	4000	20@150	20@150	12	20@150	20@150	12	20@150	20@150	12	20@175	20@175	12	–	–	–
	5000	20@150	20@150	12	20@150	20@150	12	25@150	20@150	12	–	–	–	–	–	–
10000	2000	20@150	20@150	12	20@150	20@150	12	20@150	20@150	12	20@150	20@150	12	20@150	20@150	12
	3000	20@150	20@150	12	20@150	20@150	12	20@150	20@150	12	20@150	20@150	12	–	–	–
	4000	20@150	20@150	12	20@150	20@150	12	25@200	20@200	12	25@200	20@200	12	–	–	–
	5000	20@150	20@150	12	20@150	20@150	12	25@150	20@150	12	25@175	25@175	12	–	–	–
15000	2000	20@150	20@150	12	20@150	20@150	12	25@200	20@200	12	25@200	20@200	12	25@175	20@150	12
	3000	20@150	20@150	12	20@150	20@150	12	25@175	20@175	12	25@200	20@200	12	–	–	–
	4000	20@150	20@150	12	20@150	20@150	12	25@150	20@150	12	25@175	20@175	12	–	–	–
	5000	20@150	20@150	12	25@200	20@200	12	25@125	16@125	12	25@125	16@125	12	–	–	–
20000	2000	20@150	20@150	12	20@150	20@150	12	25@175	20@175	12	25@200	20@200	12	25@150	20@150	12
	3000	20@150	20@150	12	20@150	20@150	12	25@150	20@150	12	25@175	20@175	12	–	–	–
	4000	20@150	20@150	12	25@200	20@200	12	25@125	16@125	12	25@125	16@125	12	–	–	–
	5000	20@150	20@150	12	25@175	20@175	12	25@125	16@125	12	25@125	16@125	12	–	–	–

Project: SUPPORT TO DISTRICT ROAD NETWORKS			**Drawing Number: BRG 001**	
Title: STANDARD STRUCTURES MANUAL			**TABLES: MASS CONCRETE ABUTMENT Mild Steel Reinforcement in the Foundation**	Scale NTS
\\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425			Dimension mm
			File Name: P/Roads and Highways/50999A/Data/Drawings /Bridge	Date June 2001
			Drawn by JAU / Designed by JAU / Checked by FCO / Approved by MMK	Sheet: 6/12

TABLE 8.7 Abutment, reinforced concrete – foundation sizes

Span S mm	Height H mm	ALLOWABLE BEARING PRESSURE VALUES (KN/M2)														
		400			300			200			150			100		
		A	B	D	A	B	D	A	B	D	A	B	D	A	B	D
4000	2000	600	1800	500	600	1800	500	600	1800	500	800	1800	500	1400	1800	600
	3000	600	2200	500	600	2200	500	800	2200	500	1200	2200	600	1800	2200	700
	4000	600	2900	800	600	2900	800	1100	2800	800	1600	2800	800	–	–	–
	5000	600	3500	1000	800	3500	1000	1500	3400	1000	–	–	–	–	–	–
6000	2000	600	1800	500	600	1800	500	600	1800	500	1200	1800	500	1600	1800	700
	3000	600	2200	500	600	2200	500	800	2200	500	1400	2200	700	2000	2200	800
	4000	600	2900	800	600	2900	800	1200	2800	800	1800	2800	900	–	–	–
	5000	800	3500	1000	800	3500	1000	1600	3400	1000	2000	3400	1000	–	–	–
8000	2000	600	2200	500	600	2200	500	800	2200	500	1200	2200	600	1800	2200	700
	3000	600	2600	600	600	2600	600	1000	2600	600	1400	2600	700	2200	2600	700
	4000	600	3400	900	600	3400	900	1400	3200	900	2000	3200	1000	–	–	–
	5000	800	4000	1100	1000	4000	1100	2000	3800	1100	2600	3800	1200	–	–	–
10000	2000	600	2200	500	600	2200	500	1000	2200	500	1400	2200	700	2000	2200	800
	3000	800	2600	600	800	2600	600	1200	2600	600	1700	2600	800	–	–	–
	4000	800	3400	900	800	3400	900	1600	3200	900	2200	3200	1000	–	–	–
	5000	800	4000	1100	1200	3800	1100	2000	3800	1100	2900	3800	1300	–	–	–
12000	2000	600	2200	500	600	2200	500	1000	2200	500	1600	2200	800	2200	2200	800
	3000	800	2600	600	800	2600	600	1400	2600	700	2000	2600	900	–	–	–
	4000	1000	3200	900	1000	3200	900	1800	3200	900	2400	3200	1000	–	–	–
	5000	1200	3800	1100	1400	3800	1100	2200	3800	1100	3200	3800	1400	–	–	–

Project: SUPPORT TO DISTRICT ROAD NETWORKS			**Drawing Number: BRG 001**
Title: STANDARD STRUCTURES MANUAL			**TABLES: REINFORCED CONCRETE ABUTMENT Foundations sizes**
\\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425		Scale NTS Dimension mm File Name: P/Roads and Highways/50999A/Data/Drawings/Bridge Date June 2001
		Drawn by JAU / Designed by JAU / Checked by FCO / Approved by MMK	Sheet: 7/12

TABLE 8.8 Abutment, reinforced concrete – high yield steel reinforcement in foundation (mm)

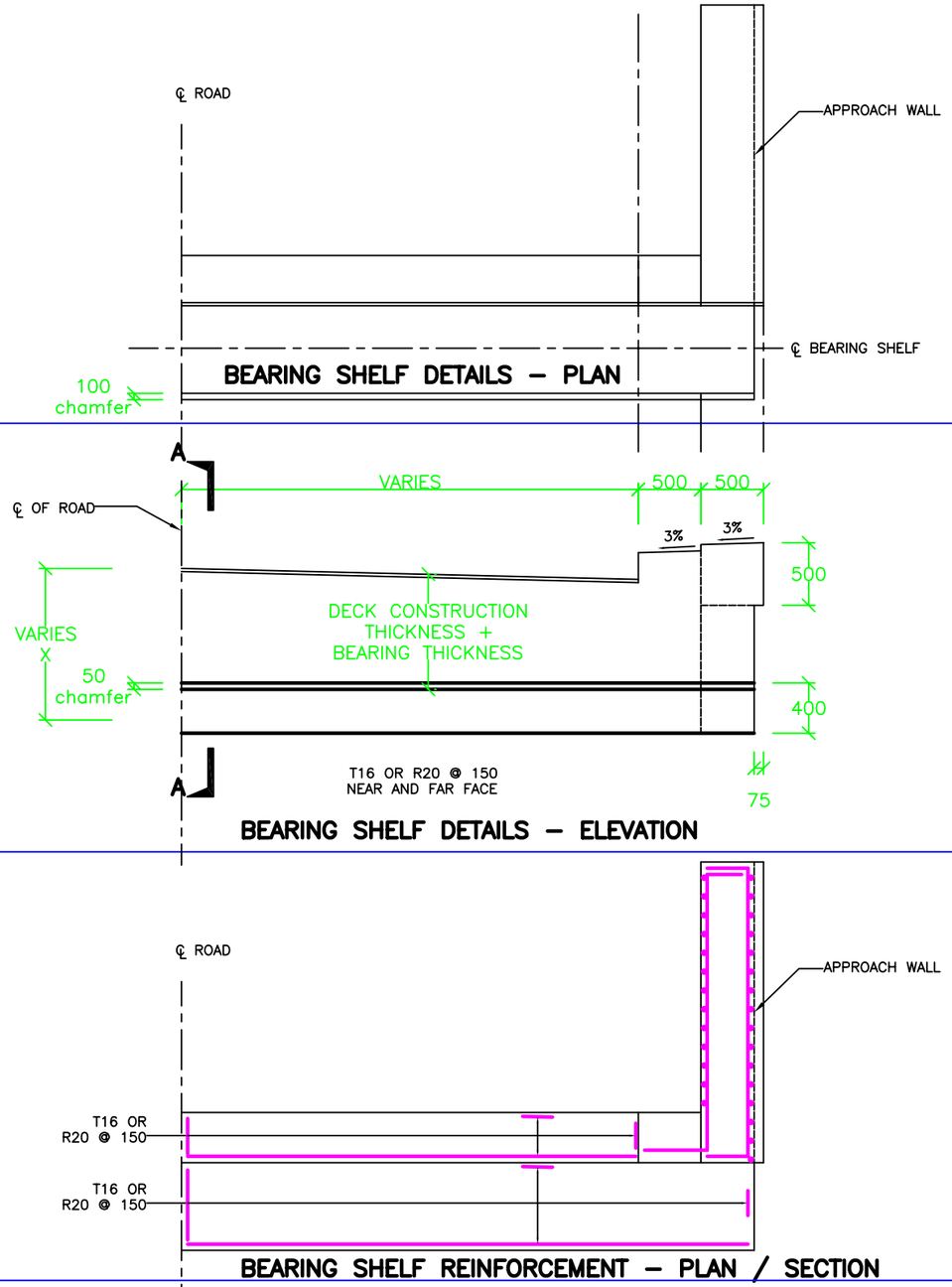
Span S mm	Height H mm	ALLOWABLE BEARING PRESSURE VALUES (kN/m²)														
		400			300			200			150			100		
		S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3
4000	2000	16@200	20@200	12	16@200	20@200	12	16@200	20@200	12	16@200	20@200	12	16@200	20@200	12
	3000	16@150	25@150	12	16@150	25@150	12	16@200	25@200	12	16@200	25@200	12	16@150	20@150	12
	4000	16@200	32@200	16	16@200	32@200	16	16@200	32@200	16	16@200	32@200	16	–	–	–
	5000	20@200	40@200	16	20@200	40@200	16	16@150	32@150	16	–	–	–	–	–	–
6000	2000	16@200	20@200	12	16@200	20@200	12	20@200	20@200	12	16@200	20@200	12	16@150	20@150	16
	3000	16@150	25@150	12	16@150	25@150	12	16@150	25@150	12	20@150	20@150	12	16@150	20@150	16
	4000	20@200	32@200	16	20@200	32@200	16	20@150	32@200	16	20@150	25@150	16	–	–	–
	5000	20@200	40@200	16	20@200	40@200	16	20@150	32@150	16	20@150	32@150	16	–	–	–
8000	2000	16@200	25@200	12	16@150	20@150	12	16@150	20@150	12	16@175	20@175	12	20@200	20@200	16
	3000	16@200	32@200	12	20@200	32@200	12	20@200	32@200	12	20@175	25@175	12	25@175	25@175	16
	4000	16@150	32@150	16	20@200	32@150	16	20@200	32@200	16	20@200	32@200	16	–	–	–
	5000	16@150	40@150	16	16@125	40@125	16	20@175	40@175	16	20@150	32@150	16	–	–	–
10000	2000	16@150	20@150	12	16@150	20@150	12	20@200	20@200	12	20@200	20@200	16	16@150	20@150	16
	3000	20@200	32@200	12	20@200	32@200	12	20@200	32@200	12	20@200	25@200	16	–	–	–
	4000	20@150	32@150	16	16@150	32@150	16	20@200	32@200	16	25@200	32@200	16	–	–	–
	5000	20@150	40@150	16	20@175	40@175	16	20@175	40@175	16	25@150	32@150	20	–	–	–
12000	2000	16@150	20@150	12	16@150	20@150	12	16@150	20@150	12	16@150	20@150	16	25@200	25@200	16
	3000	20@200	32@200	12	20@200	32@200	12	20@175	25@175	12	25@150	20@150	16	–	–	–
	4000	20@200	32@200	16	20@200	32@200	16	25@200	32@200	16	32@200	32@200	16	–	–	–
	5000	20@175	40@175	16	20@175	40@175	16	25@175	40@175	16	32@175	32@175	20	–	–	–

Project: SUPPORT TO DISTRICT ROAD NETWORKS		**Drawing Number: BRG 001**	
Title: STANDARD STRUCTURES MANUAL		**TABLES: REINFORCED CONCRETE ABUTMENT High Yield Steel Reinforcement in the Foundation**	Scale NTS
			Dimension mm
\\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425	File Name: P/Roads and Highways/50999A/Data/Drawings /Bridge	Date June 2001
		Drawn by JAU / Designed by JAU / Checked by FCO / Approved by MMK	Sheet: 8/12

TABLE 8.9 Abutment, reinforced concrete – high yield steel reinforcement in the foundation (mm)

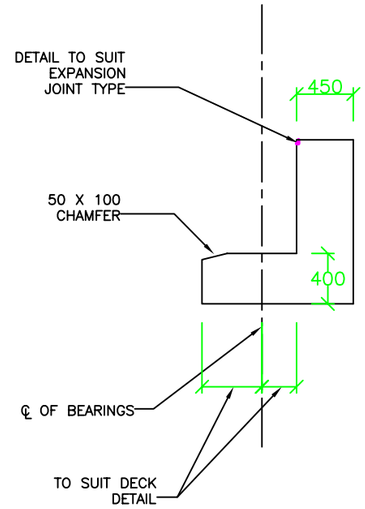
Span S mm	Height H mm	ALLOWABLE BEARING PRESSURE VALUES (kN/m²)														
		400			300			200			150			100		
		S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3
5000	2000	20@200	25@200	12	20@200	25@200	12	16@200	25@200	12	16@200	25@200	12	20@150	20@150	16
	3000	20@175	32@175	12	16@175	32@175	12	20@175	32@175	12	25@200	32@200	16	20@150	25@150	16
	4000	16@150	32@150	16	16@150	32@150	16	16@150	32@150	16	20@150	32@150	16	–	–	–
	5000	20@175	40@175	20	20@175	40@175	20	25@200	40@200	20	–	–	–	–	–	–
10000	2000	20@150	25@150	12	16@150	25@150	12	20@150	25@150	12	25@200	25@200	16	25@200	25@200	16
	3000	20@150	32@150	16	20@150	32@150	16	20@150	32@150	16	25@150	25@150	16	–	–	–
	4000	16@125	32@125	16	16@125	32@125	16	25@200	40@200	16	25@150	32@150	20	–	–	–
	5000	20@150	40@150	20	20@150	40@150	20	25@150	40@150	20	32@200	40@200	20	–	–	–
15000	2000	25@200	40@200	16	20@200	40@200	16	32&25@200	40@200	16	32&20@150	32@150	20	25@200	32@200	16
	3000	20@150	40@150	20	20@150	40@150	20	32&25@150	40@150	20	32&25@200	40@200	20	–	–	–
	4000	20@125	40@125	20	25@125	40@125	20	32&25@125	40@125	20	32@150	40@150	25	–	–	–
	5000	20@125	40@125	25	20@125	40@125	25	32&25@125	40@125	25	40&20@125	40@125	25	–	–	–
20000	2000	20@150	40@150	20	20@150	40@150	20	32&25@150	40@150	20	32&25@200	40@200	20	32@200	32@150	16
	3000	20@125	40@125	20	25@125	40@125	20	32&25@125	40@125	20	32@150	40@150	25	–	–	–
	4000	20@125	40@125	25	20@125	40@125	25	32&25@125	40@125	25	40&20@125	40@125	25	–	–	–
	5000	16@125	40@125	25	20@125	40@125	25	32&25@125	40@125	25	40&20@125	40@125	25	–	–	–

Project: SUPPORT TO DISTRICT ROAD NETWORKS				**Drawing Number: BRG 001**	
Title: STANDARD STRUCTURES MANUAL				**TABLES: REINFORCED CONCRETE ABUTMENT Mild Steel Reinforcement in the Foundation**	Scale NTS
\\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425				Dimension mm
				File Name: P/Roads and Highways/50999A/Data/Drawings /Bridge	Date June 2001
				Drawn by JAU / Designed by JAU / Checked by FCO / Approved by MMK	Sheet: 9/12

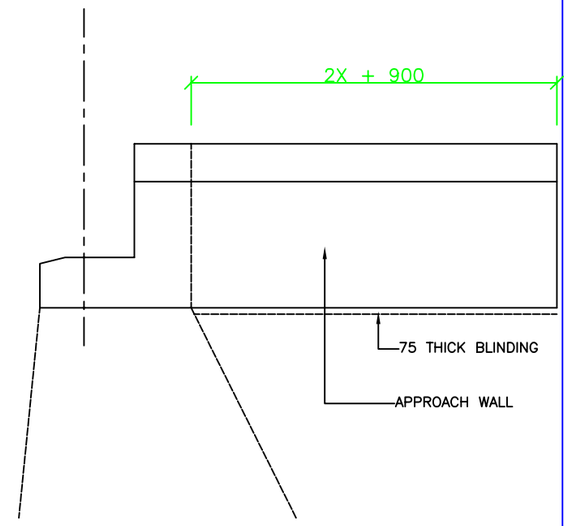


BEARING SHELF DETAILS – PLAN

BEARING SHELF DETAILS – ELEVATION



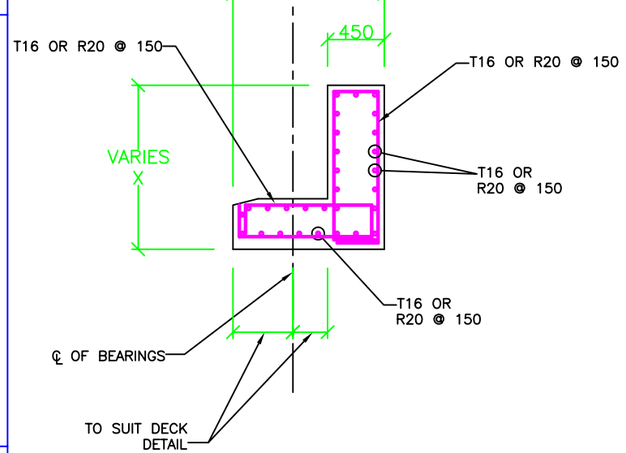
BEARING SHELF DETAILS– SECTION A–A



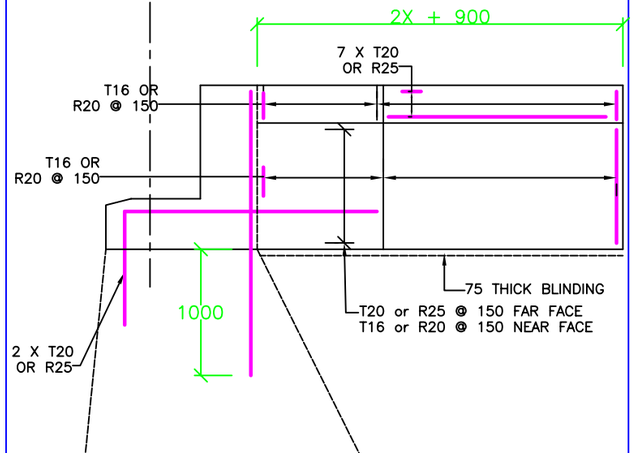
BEARING SHELF DETAILS – END ELEVATION

BEARING SHELF REINFORCEMENT – PLAN / SECTION

BEARING SHELF REINFORCEMENT – ELEVATION



BEARING SHELF REINFORCEMENT – SECTION A–A



BEARING SHELF REINFORCEMENT – END ELEVATION

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: BRG 001

BRIDGE: BEARING SHELF
Plan, Elevations and Sections
Reinforcement Details

Scale: 1:100, 1:50

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Retaining Walls

Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	5/7

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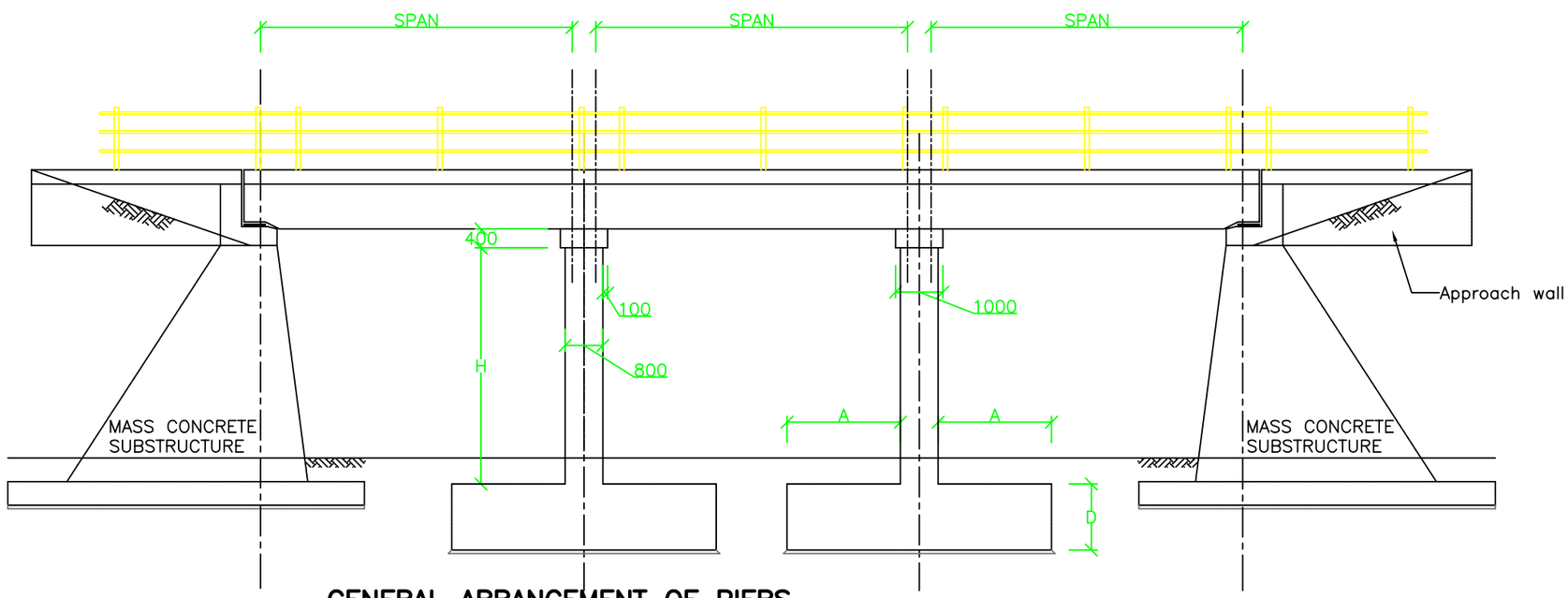
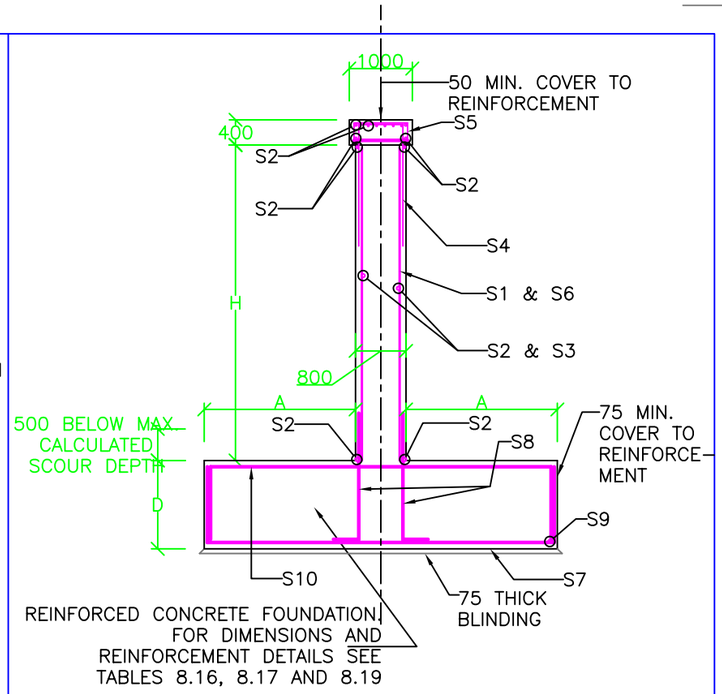
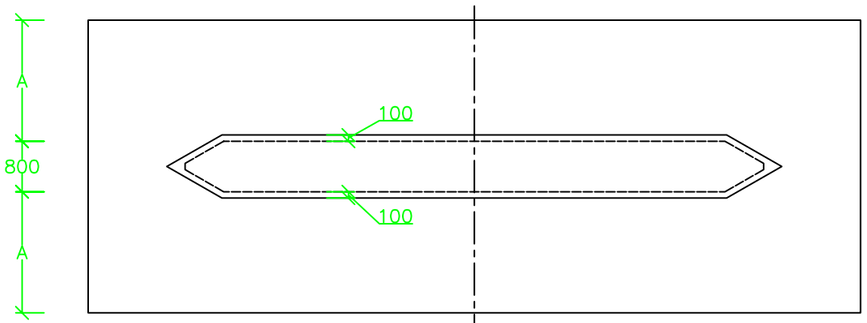
TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425



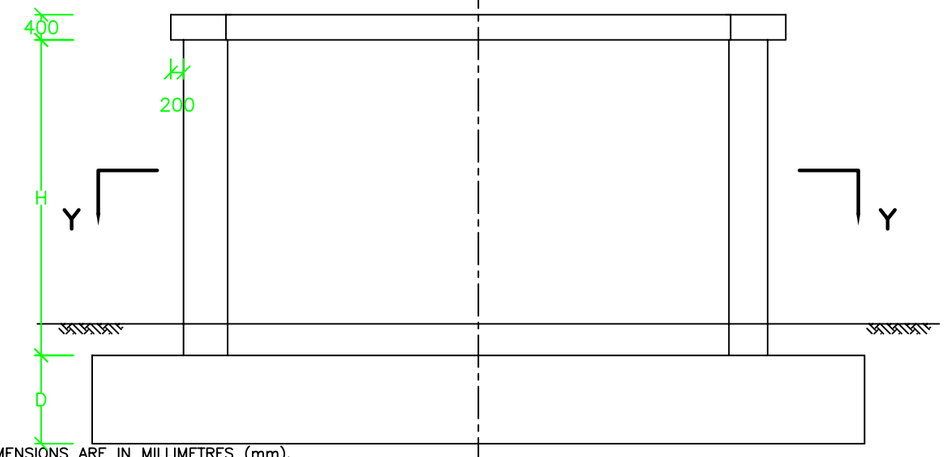
GENERAL ARRANGEMENT OF PIERS (WITH REINFORCED CONCRETE STEM AND REINFORCED CONCRETE FOUNDATION) Scale: 1:125



REINFORCED CONCRETE PIER VERTICAL SECTION Scale 1:100



PIER – PLAN Scale 1:100



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES (mm).
2. MIN. COVER TO REINFORCEMENT – 50mm
3. CHARACTERISTIC CONCRETE CUBE STRENGTH AT 28 DAYS – 30 N/mm2
4. ALL BLINDING CONCRETE TO BE CLASS LEAN CONCRETE

PIER – ELEVATION Scale 1:100

FOR DETAILS OF STEM REINFORCEMENT SEE TABLE 8.15

REINFORCED CONCRETE PIER HORIZONTAL SECTION Y–Y Scale 1:100

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: BRG 001

REINFORCED CONCRETE PIER
Plan, Elevations and Sections
Reinforcement Details

Scale: 1:125, 1:100

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Bridge

Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
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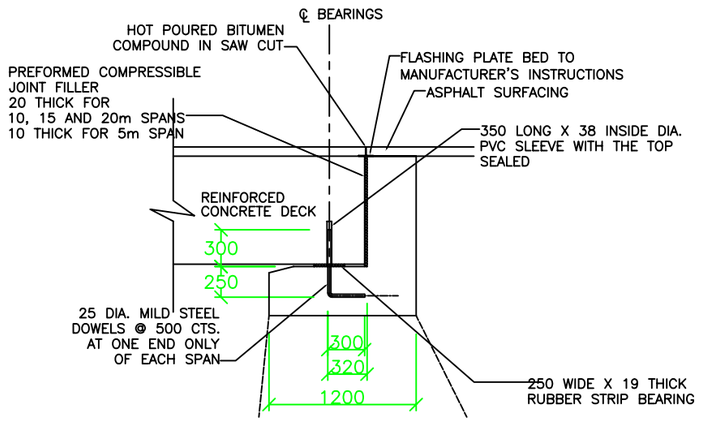
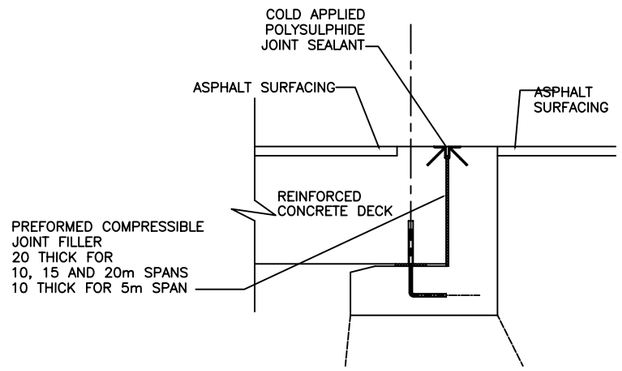
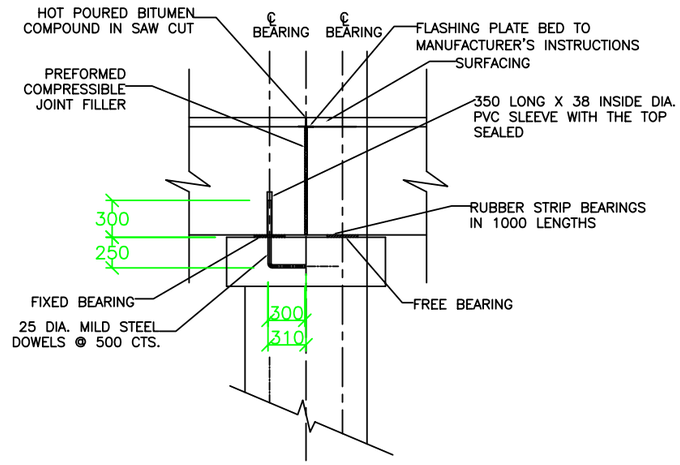


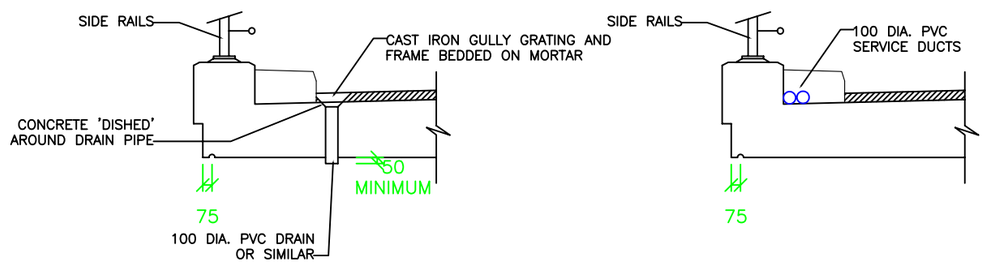
ABUTMENT EXPANSION JOINT AND BEARING DETAILS SCALE 1:50



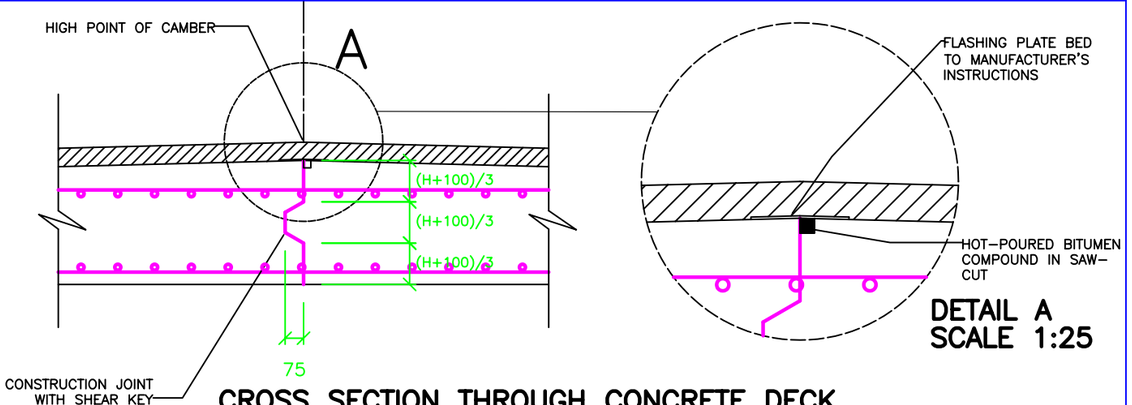
ABUTMENT EXPANSION JOINT AND BEARING DETAILS SCALE 1:50



PIER EXPANSION JOINT AND BEARING DETAILS SCALE 1:50



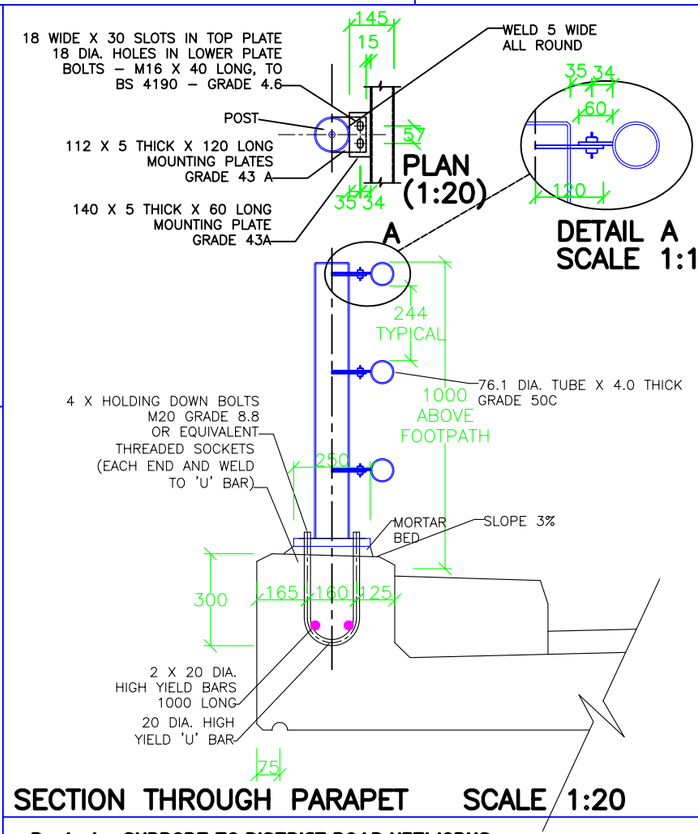
CROSS SECTION THROUGH CONCRETE DECK SHOWING DUCTS AND DRAINAGE SCALE 1:100



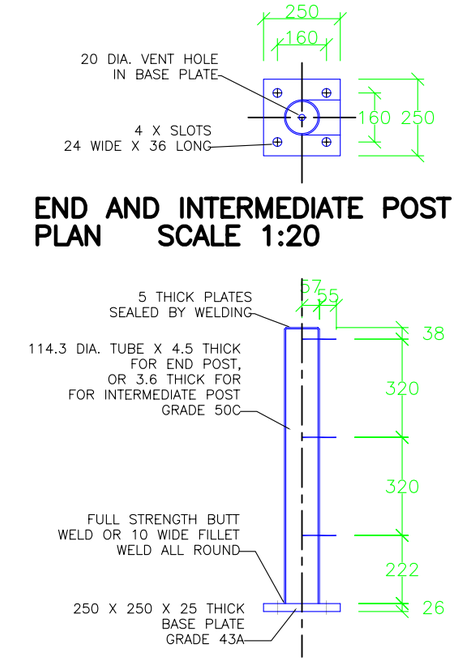
CROSS SECTION THROUGH CONCRETE DECK SHOWING CONSTRUCTION JOINT AT MID SPAN SCALE 1:50

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES (mm).
2. EACH SPAN TO HAVE ONE FIXED BEARING AND ONE FREE BEARING.
3. THE 25 DIA. DOWELS SHOWN, APPLY TO BRIDGES WITH 3 OR MORE SPANS. 2 SPAN BRIDGES USUALLY HAVE FIXED BEARINGS ON THE ABUTMENTS.



SECTION THROUGH PARAPET SCALE 1:20



END AND INTERMEDIATE POST PLAN SCALE 1:20

END AND INTERMEDIATE POST SECTION SCALE 1:20

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: BRG 001

ABUTMENT AND PIER:
Expansion Joint and Bearing Details
DUCTS, DRAINAGE & CONSTRUCTION JOINT
PARAPETS: Section, Posts

Scale	1:50, 1:25 1:20, 1:10
Dimension	mm
File Name:	P/Roads and Highways/50999A/Data/Drawings /Bridge
Date	June 2001
Drawn by	JAU
Designed by	JAU
Checked by	FCO
Approved by	MMK
Sheet:	7/7

\\Server\p Roads & Highways 50999A\Data\Drawings logo3.jpg

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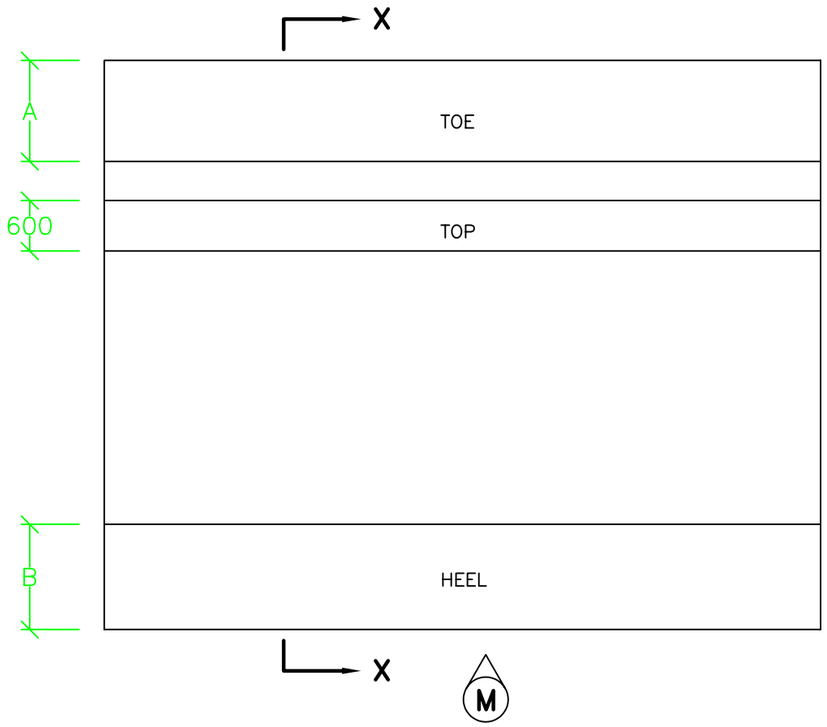
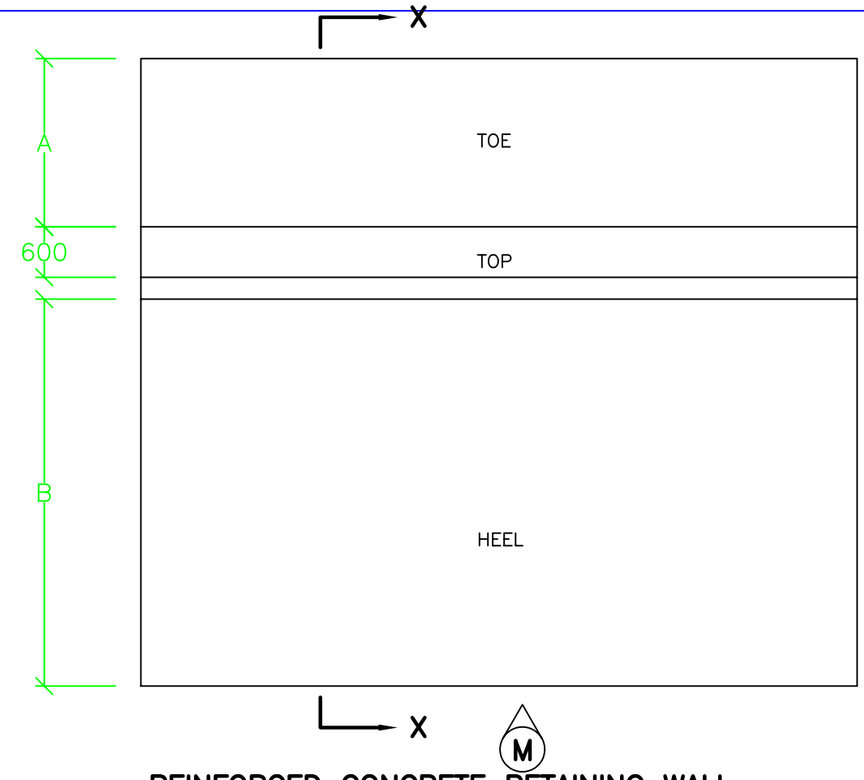
Section B-9
Retaining Walls to 5m Height

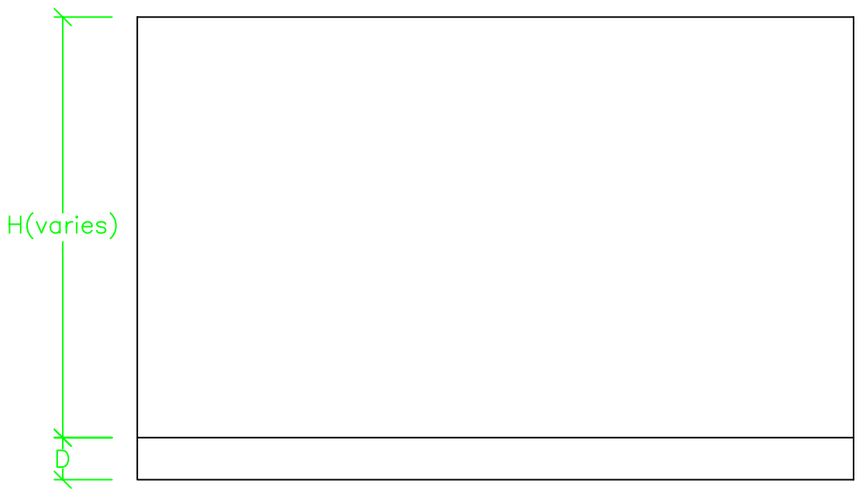
Section B-9
Retaining Walls to 5m Height



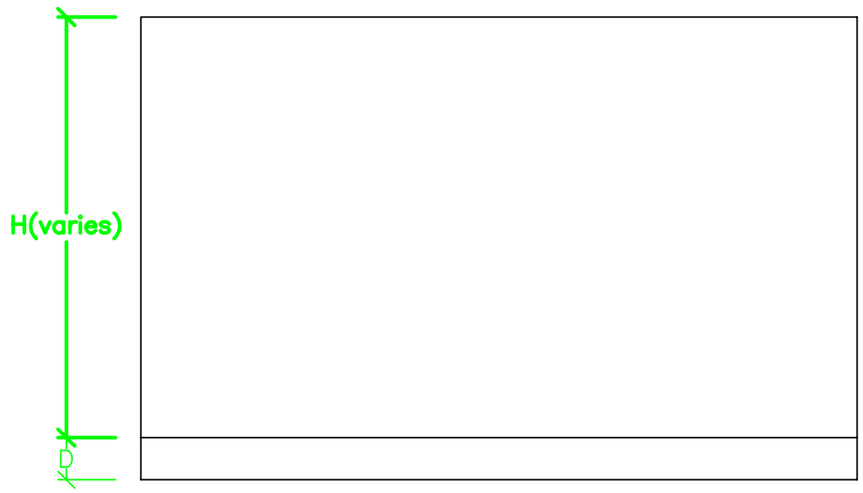
MASS CONCRETE RETAINING WALL
PLAN



REINFORCED CONCRETE RETAINING WALL
PLAN



MASS CONCRETE RETAINING WALL
ELEVATION M



REINFORCED CONCRETE RETAINING WALL
ELEVATION M

NOTES:

1. TO BE READ TOGETHER WITH DRAWING NUMBER RTW 001, SHEET 2/4
2. ALL DIMENSIONS ARE IN MILLIMETRES (mm).
3. ALL STRUCTURAL CONCRETE TO BE C20
4. ALL BLINDING CONCRETE TO BE CLASS LEAN CONCRETE

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: RTW 001

MASS CONCRETE AND REINFORCED CONCRETE RETAINING WALLS
Plan and Elevation

Scale 1:75

Dimension mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Retaining Walls

Date June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
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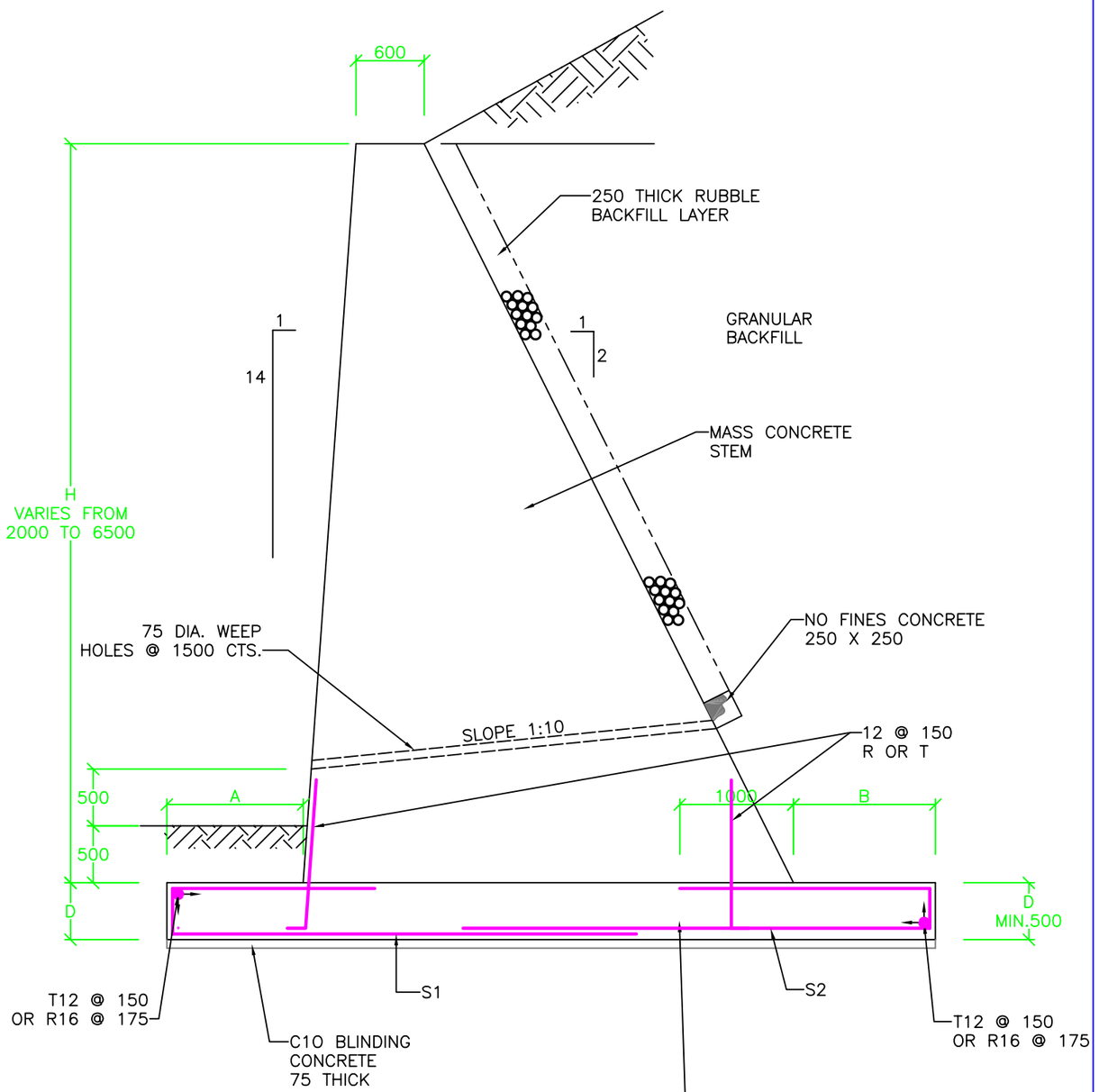
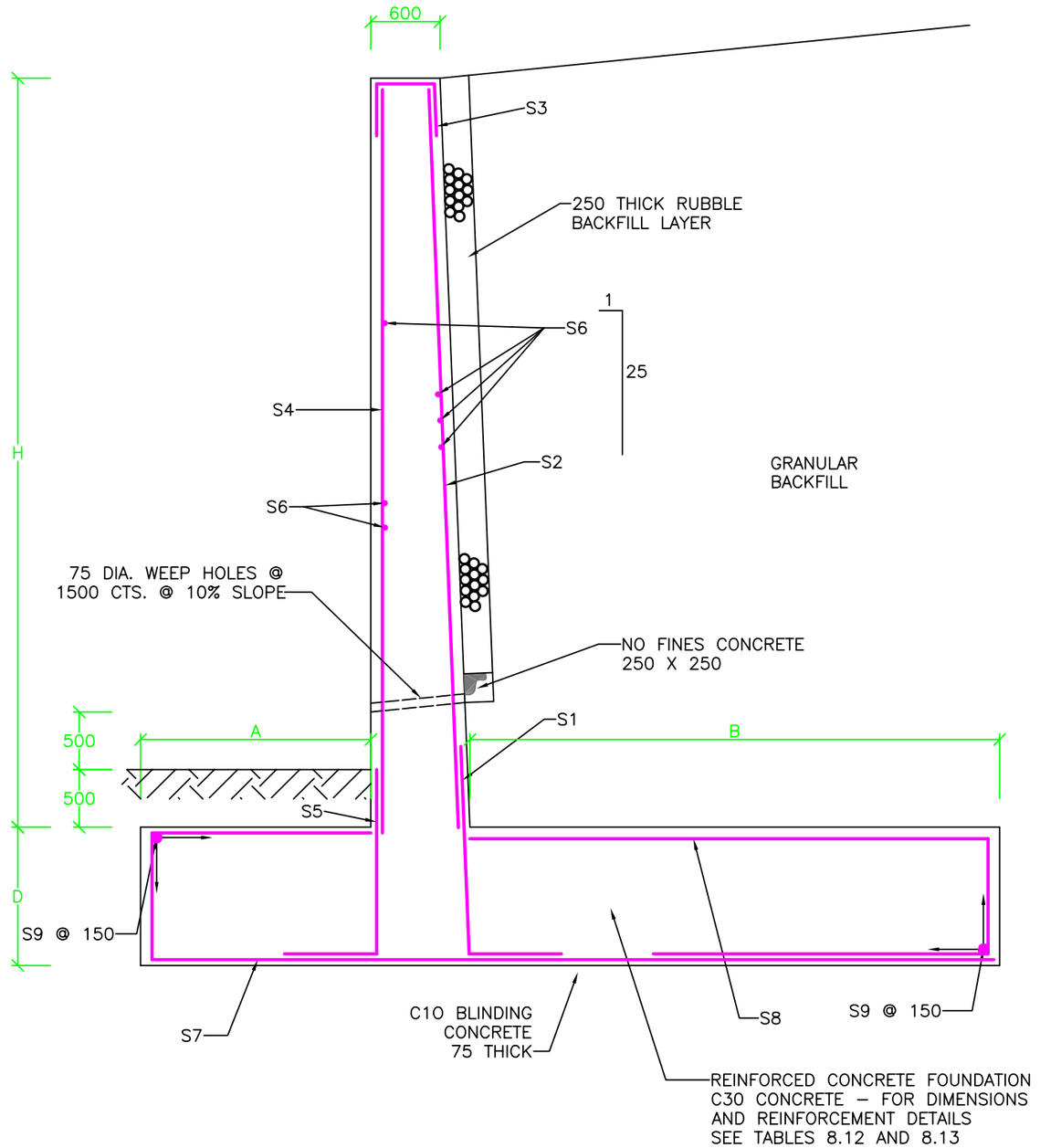


MASS CONCRETE RETAINING WALL
VERTICAL SECTION X–X



REINFORCED CONCRETE RETAINING WALL
VERTICAL SECTION X–X

NOTES:

1. TO BE READ TOGETHER WITH DRAWING NUMBER RTW 001, SHEET 1/4, SHEET 3/4, SHEET 4/4
2. ALL DIMENSIONS ARE IN MILLIMETRES (mm).
3. ALL STRUCTURAL CONCRETE TO BE C20
4. ALL BLINDING CONCRETE TO BE CLASS LEAN CONCRETE

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: RTW 001

Title: STANDARD STRUCTURES MANUAL

I:\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg

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MASS CONCRETE AND REINFORCED CONCRETE RETAINING WALLS
Vertical Sections

Scale: 1:50
Dimension: mm
File Name: P/Roads and Highways/50999A/Data/Drawings/Retaining Walls
Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
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TABLE 8.5: Retaining Wall, mass concrete – Foundation sizes

Height H mm	ALLOWABLE BEARING PRESSURE VALUES (kN/m²)																	
	400			300			200			150			100			75		
	A mm	B mm	D mm	A mm	B mm	D mm	A mm	B mm	D mm	A mm	B mm	D mm	A mm	B mm	D mm	A mm	B mm	D mm
2000	300	1250	500	300	1250	500	300	1250	500	300	1250	500	300	1250	500	500	1250	500
3000	300	1250	500	300	1250	500	300	1250	500	300	1250	500	500	1250	500	700	1250	500
4000	300	1250	500	300	1250	500	300	1250	500	300	1250	500	700	1250	500	1200	1250	500
5000	300	1250	500	300	1250	500	300	1250	500	600	1250	500	1200	1250	500	–	–	–

TABLE 8.6: Retaining Wall, mass concrete – Foundation reinforcement

	Height H mm	ALLOWABLE BEARING PRESSURE VALUES (kN/m²)											
		400		300		200		150		100		75	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
HIGH YIELD STEEL (T)	2000	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200
	3000	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200
	4000	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200
	5000	16@150	16@150	20@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	–	–
MILD STEEL (R)	2000	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200
	3000	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200	16@200
	4000	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150
	5000	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	–	–

NOTES:

1. TO BE READ TOGETHER WITH DRAWING NUMBER RTW 001, SHEET 2/4.
2. ALL DIMENSIONS ARE IN MILLIMETRES (mm).

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: RTW 001

Title: STANDARD STRUCTURES MANUAL

MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS,

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MASS CONCRETE RETAINING WALLS Foundation Sizes and Reinforcement Details

Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Retaining Walls

Date: June 2001

Drawn by	Designed by	Checked by	Approved by
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Sheet: 3/4

TABLE 8.11: Retaining Wall, reinforced concrete – Stem Reinforcement

Height H mm	HIGH YIELD STEEL REINFORCEMENT						MILD STEEL REINFORCEMENT					
	S1	S2	S3	S4	S5	S6	S1	S2	S3	S4	S5	S6
2000	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150
3000	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150	16@150
4000	16@150	16@150	16@150	16@150	16@150	16@150	20@150	20@150	16@150	16@150	16@150	16@150
5000	20@150	20@150	16@150	16@150	16@150	16@150	25@150	25@150	16@150	16@150	16@150	16@150

TABLE 8.12: Retaining Wall, reinforced concrete – Foundation sizes

Height H mm	ALLOWABLE BEARING PRESSURE VALUES (kN/m²)																	
	400			300			200			150			100			75		
	A mm	B mm	D mm	A mm	B mm	D mm	A mm	B mm	D mm	A mm	B mm	D mm	A mm	B mm	D mm	A mm	B mm	D mm
1000	500	2200	500	500	2200	500	500	2200	500	500	2200	500	500	2200	500	500	2200	500
2000	500	2200	500	500	2200	500	500	2200	500	500	2200	500	500	2200	500	500	2200	500
3000	500	2600	600	500	2600	600	500	2600	600	500	2600	600	800	2600	600	1200	2600	600
4000	600	3200	800	600	3200	800	600	3200	800	800	3200	800	1200	3200	800	1800	2900	800
5000	500	3700	1000	500	3700	1000	600	3700	1000	1100	3700	1000	–	–	–	–	–	–

TABLE 8.13: Retaining Wall, reinforced concrete – Foundation reinforcement

	Height H mm	ALLOWABLE BEARING PRESSURE VALUES (kN/m²)																	
		400			300			200			150			100			75		
		S7	S8	S9	S7	S8	S9	S7	S8	S9	S7	S8	S9	S7	S8	S9	S7	S8	S9
HIGH YIELD STEEL (T)	2000	16@150	16@150	12	16@150	16@150	12	16@150	16@150	12	16@150	16@150	12	16@150	16@150	12	16@150	16@150	12
	3000	16@150	20@150	12	16@150	20@150	12	16@150	20@150	12	16@150	20@150	12	16@150	20@150	12	16@150	20@150	12
	4000	16@150	25@150	16	16@150	25@150	16	16@150	25@150	16	16@150	25@150	16	16@150	25@150	16	16@150	25@150	16
	5000	20@200	32@200	16	20@200	32@200	16	20@200	32@200	16	20@200	32@200	16				–	–	–
MILD STEEL (R)	2000	20@150	20@150	12	20@150	20@150	12	16@150	20@150	12	16@150	20@150	12	16@150	20@150	12	16@150	20@150	12
	3000	20@150	25@150	16	20@150	25@150	16	16@150	25@150	16	16@150	25@150	16	16@150	25@150	16	16@150	25@150	16
	4000	16@175	32@175	16	16@175	32@175	16	16@175	32@175	16	16@175	32@175	16	16@150	32@175	16	20@175	32@175	16
	5000	20@200	40@200	20	20@200	40@200	20	20@200	40@200	20	20@200	40@200	20				–	–	–

NOTES:

1. TO BE READ TOGETHER WITH DRAWING NUMBER RTW 001, SHEET 2/4.
2. ALL DIMENSIONS ARE IN MILLIMETRES (mm).

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: RTW 001

Title: STANDARD STRUCTURES MANUAL

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TELEFAX: 321364, 321425

REINFORCED CONCRETE RETAINING WALLS
Foundation Sizes and Reinforcement Details

Scale: NTS

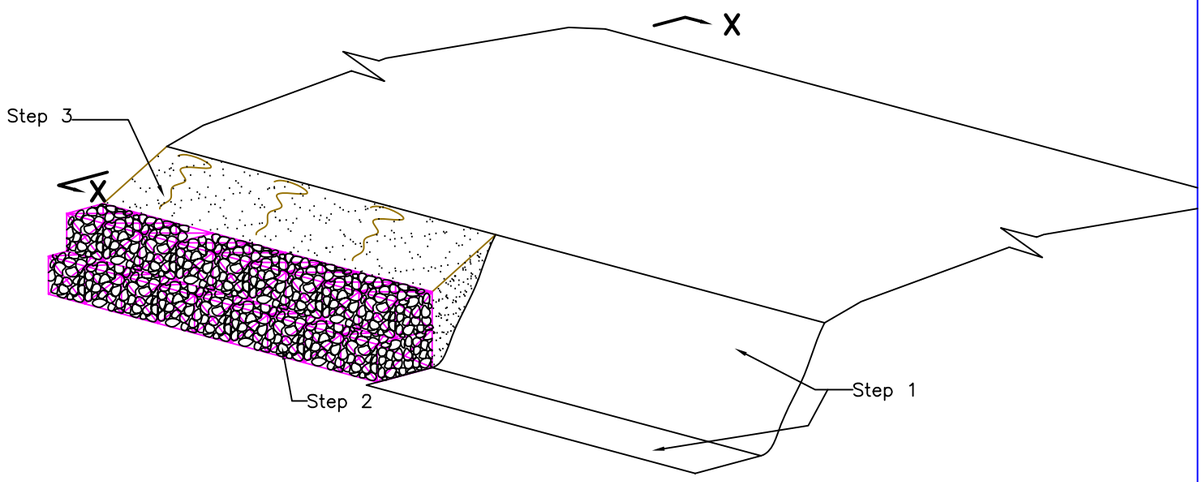
Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Retaining Walls

Date: June 2001

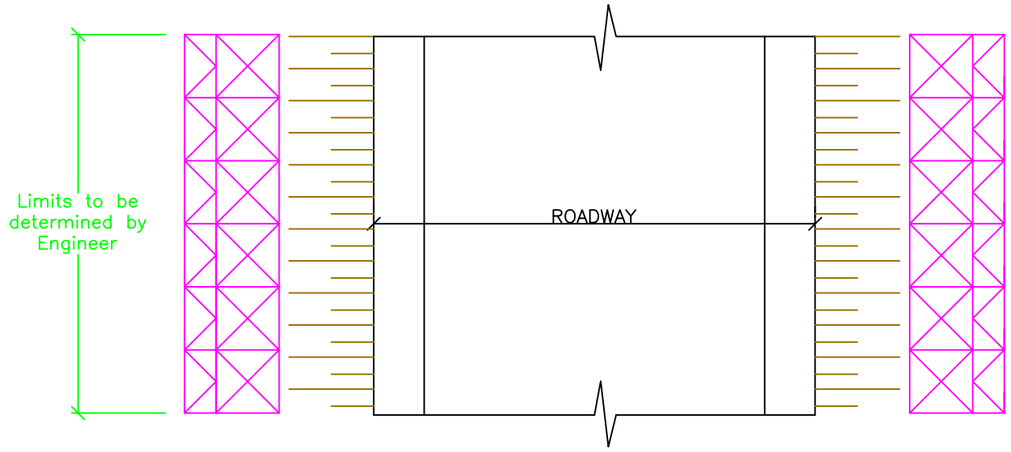
Drawn by	Designed by	Checked by	Approved by
JAU	JAU	FCO	MMK

Sheet: 4/4

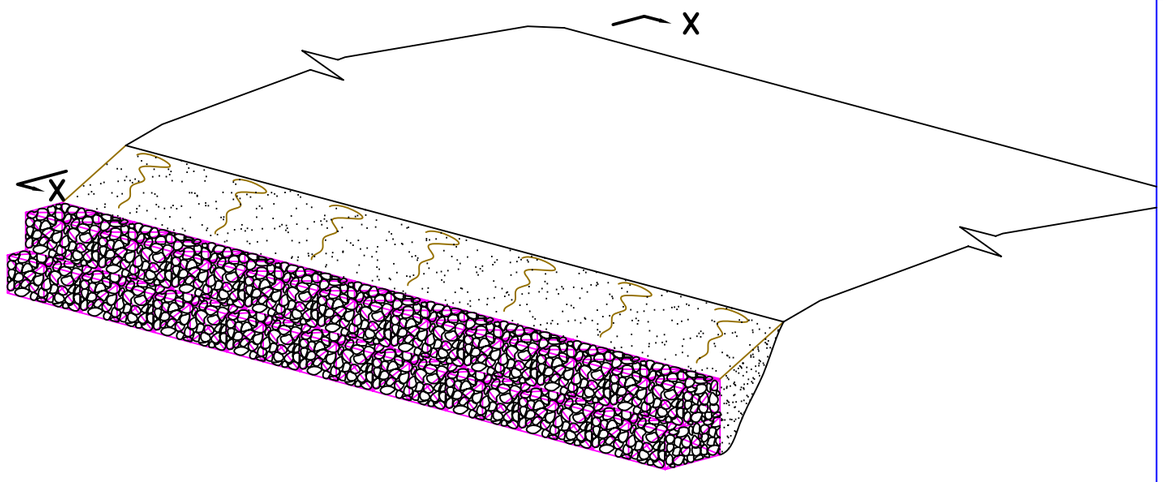


Step 1: Excavation and compaction/Prepare slope and base
Step 2: Gabion construction
Step 3: Backfilling/Compaction

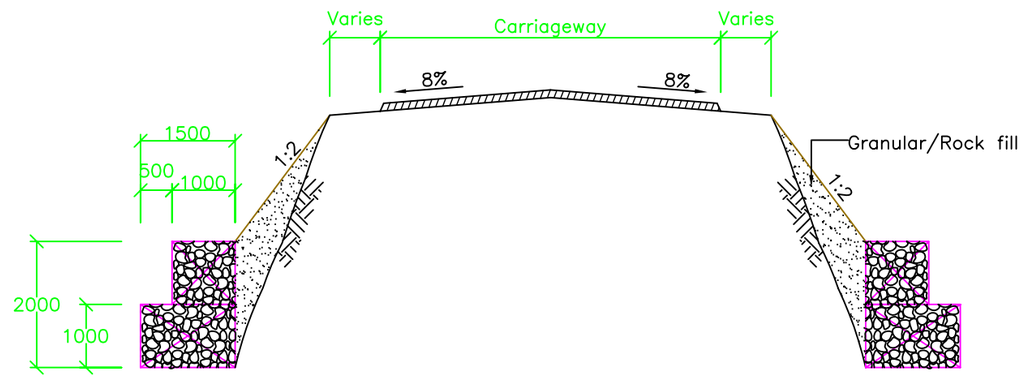
GABION RETAINING WALL UNDER CONSTRUCTION



PLAN Scale:1:100



COMPLETED GABION RETAINING WALL



SECTION X–X Scale:1:100

STANDARD GABIONS

Length m	Width m	Height m	Volume m^3
1	1	0.5	0.5
1	1	1	1

Project: SUPPORT TO DISTRICT ROAD NETWORK PROGRAMME

Drawing Number: RTW 002

Title: STANDARD STRUCTURES MANUAL

GABION RETAINING WALLS
Installation, Plan and Section

Scale 1:100

Dimension mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Gabions Retaining Walls

Date June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	1/3

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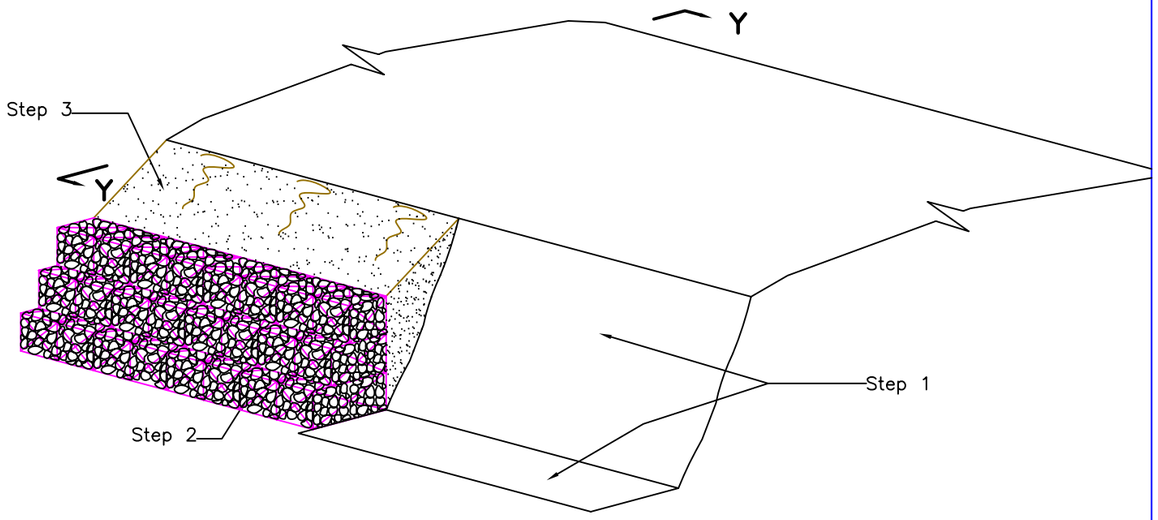
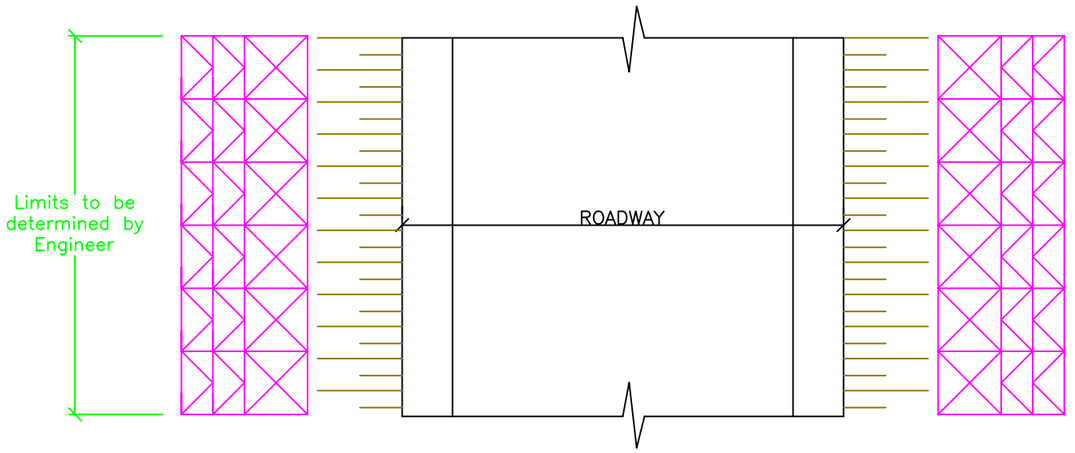
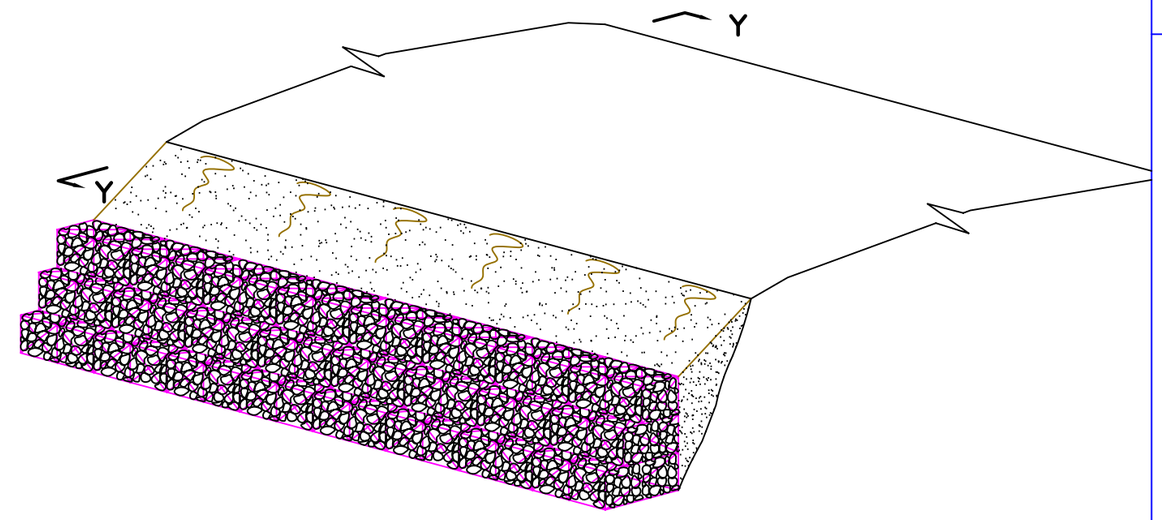


Step 1: Excavation and compaction/Prepare slope and base
Step 2: Gabion construction
Step 3: Backfilling/Compaction

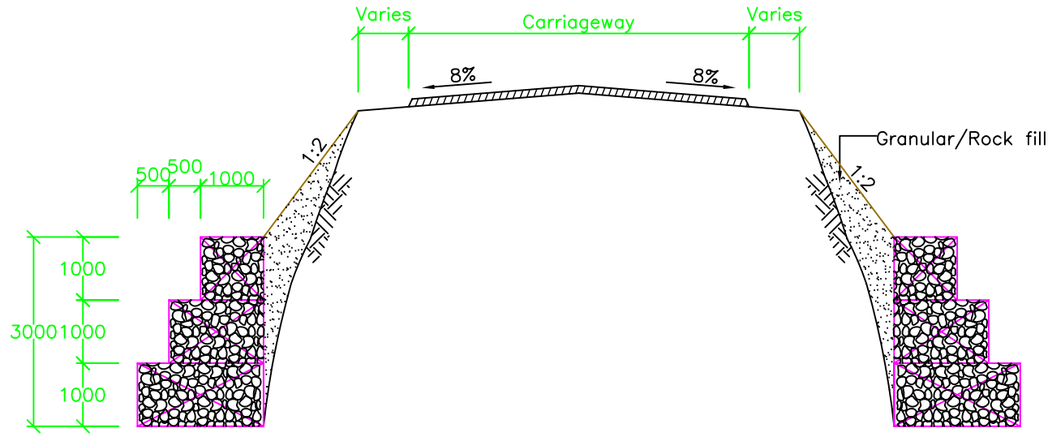
GABION RETAINING WALL UNDER CONSTRUCTION



PLAN Scale:1:100



COMPLETED GABION RETAINING WALL



SECTION Y–Y Scale:1:100

STANDARD GABIONS

Length m	Width m	Height m	Volume m^3
1	1	0.5	0.5
1	1	1	1

Project: SUPPORT TO DISTRICT ROAD NETWORK PROGRAMME

Drawing Number: RTW 002

Title: STANDARD STRUCTURES MANUAL

GABION RETAINING WALLS
Installation, Plan and Section

Scale 1:100

Dimension mm

File Name: P/Roads and Highways/50999A/Data/Drawings /Gabions Retaining Walls

Date June 2001

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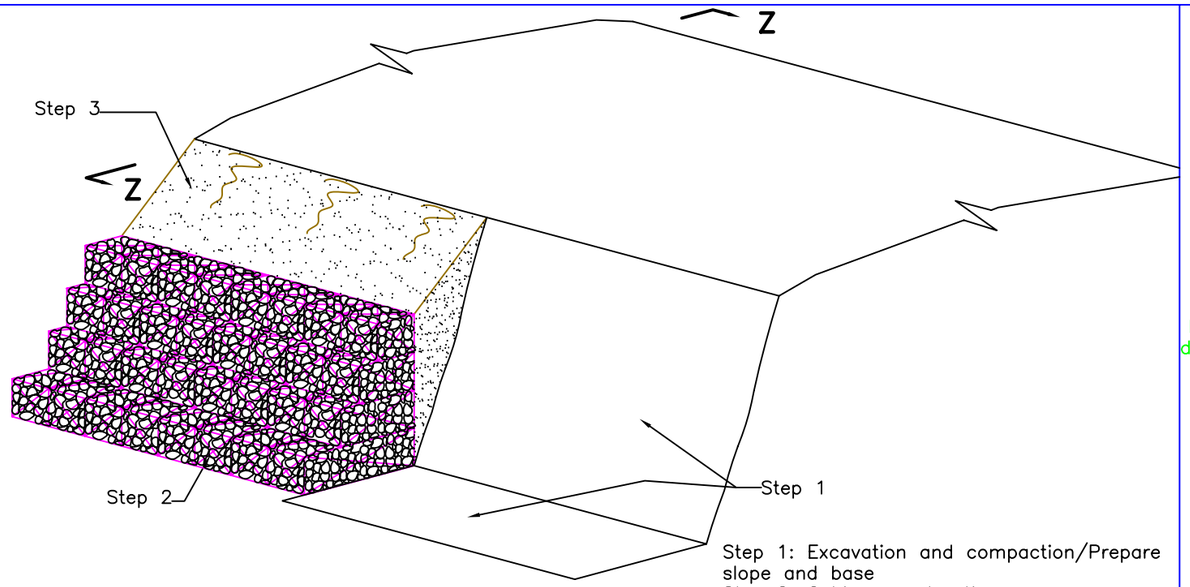
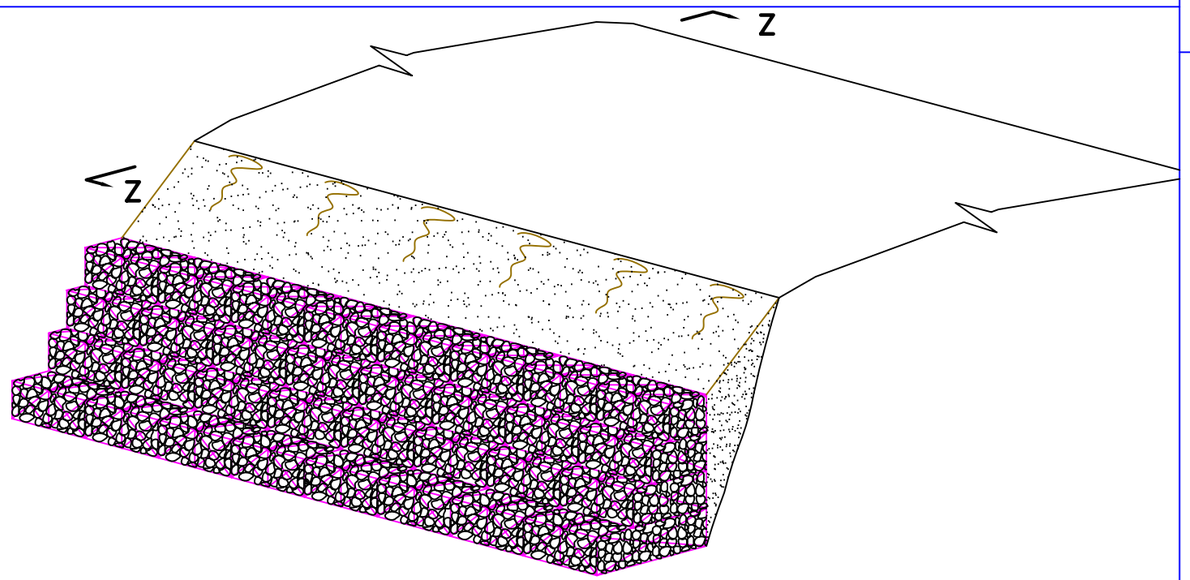
TELEPHONE: 320101, 320909
TELEFAX: 321364, 321425

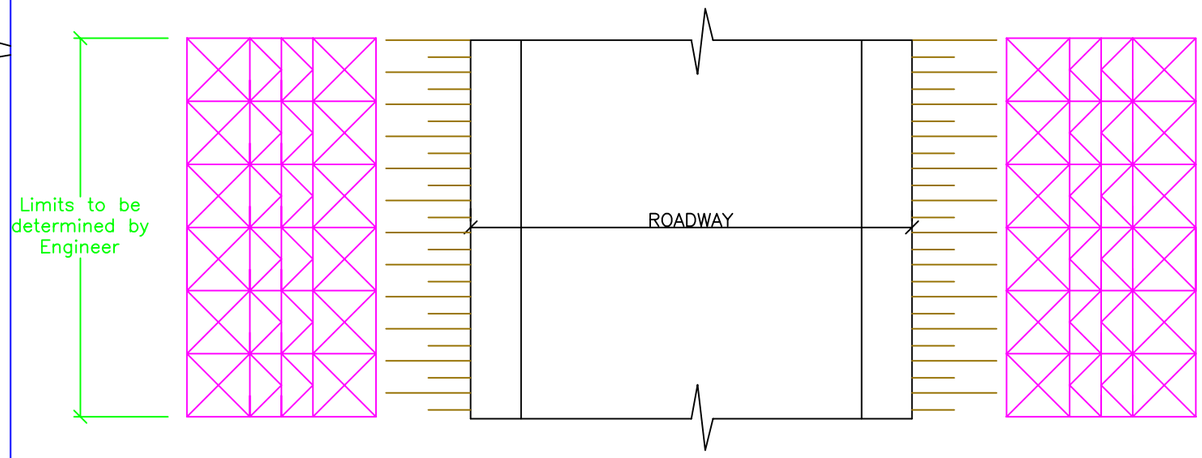


Step 1: Excavation and compaction/Prepare slope and base
Step 2: Gabion construction
Step 3: Backfilling/Compaction

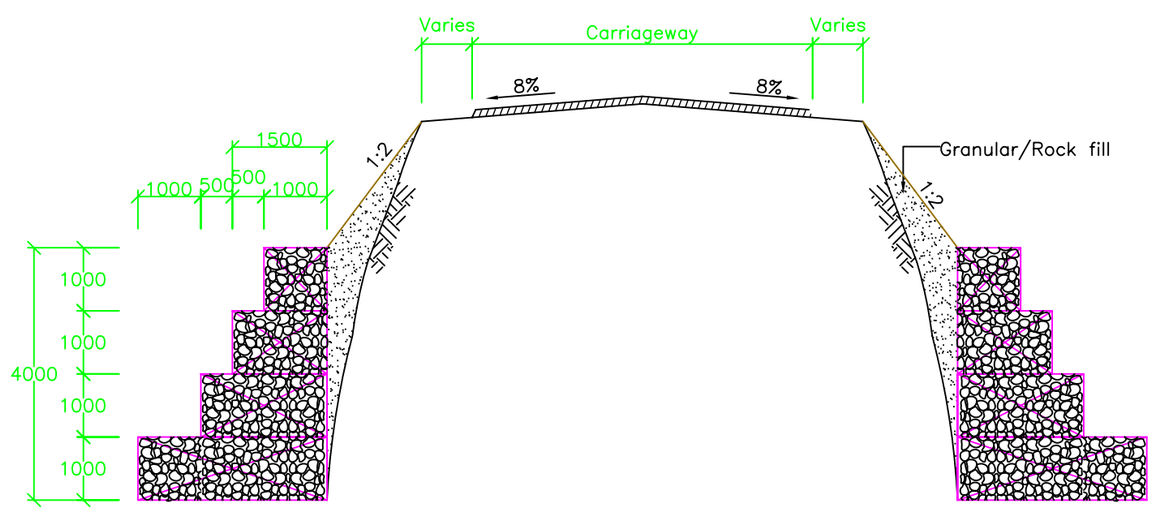
GABION RETAINING WALL UNDER CONSTRUCTION



COMPLETED GABION RETAINING WALL



PLAN Scale:1:100



SECTION Z–Z Scale:1:100

STANDARD GABIONS

Length m	Width m	Height m	Volume m^3
1	1	0.5	0.5
1	1	1	1

Project: SUPPORT TO DISTRICT ROAD NETWORK PROGRAMME

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Title: STANDARD STRUCTURES MANUAL

GABION RETAINING WALLS
Installation, Plan and Section

Scale 1:100

Dimension mm

File Name: P/Roads and Highways/50999A/Data/Drawings /Gabions Retaining Walls

Date June 2001

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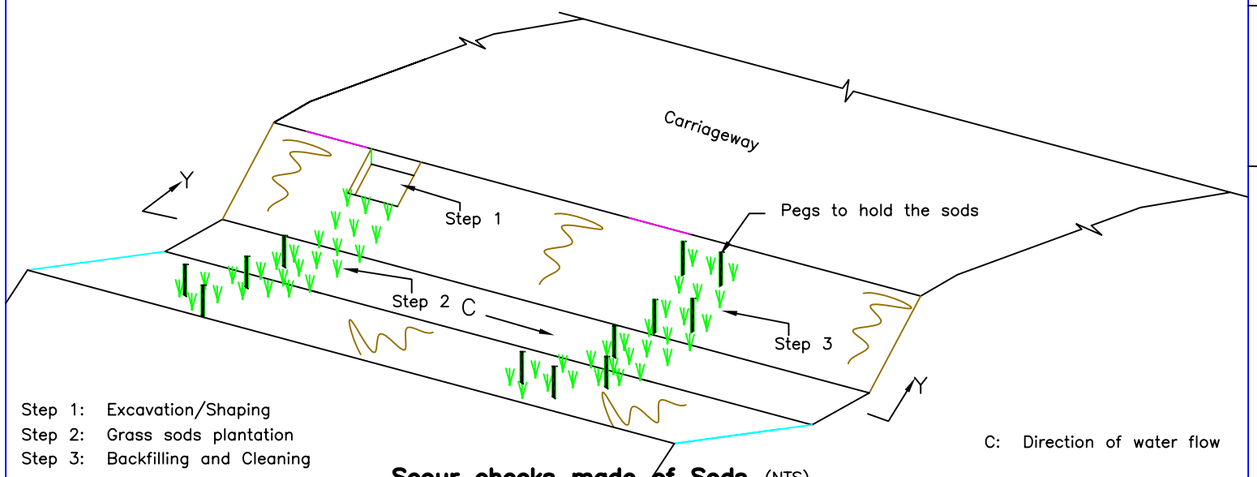
Section B-10
Environmental Protection / Stabilisation Methods
Waterway Protection Works

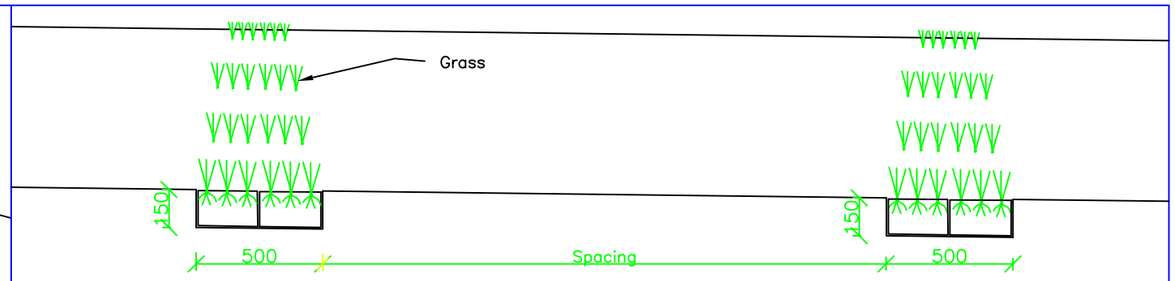
Section B-10
Waterway Protection Works



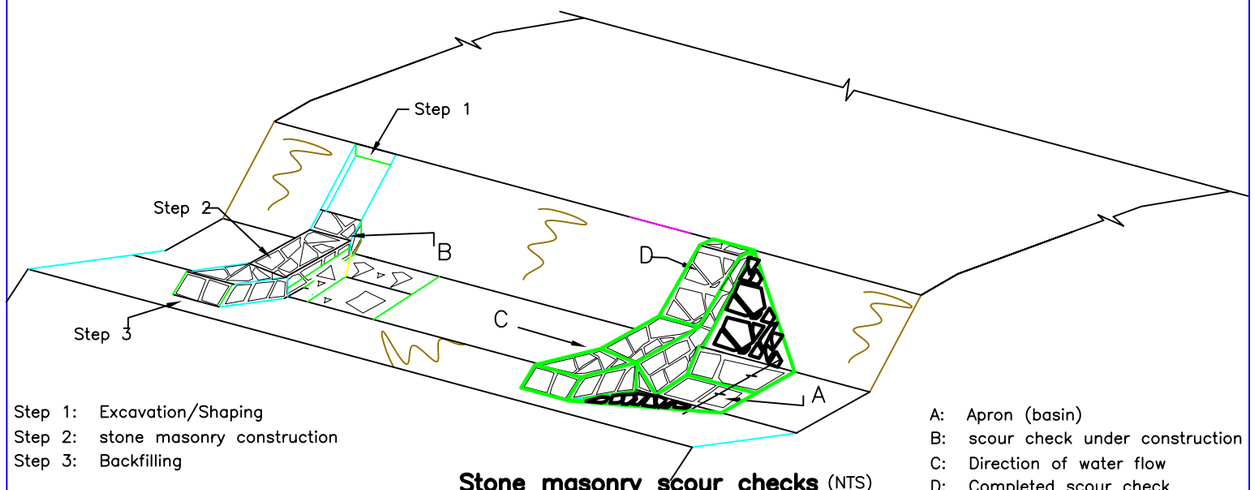
Step 1: Excavation/Shaping
Step 2: Grass sods plantation
Step 3: Backfilling and Cleaning

C: Direction of water flow

Scour checks made of Sods (NTS)



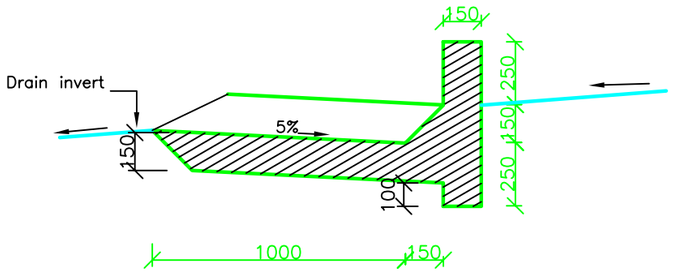
Section Y–Y (Scale 1:25)



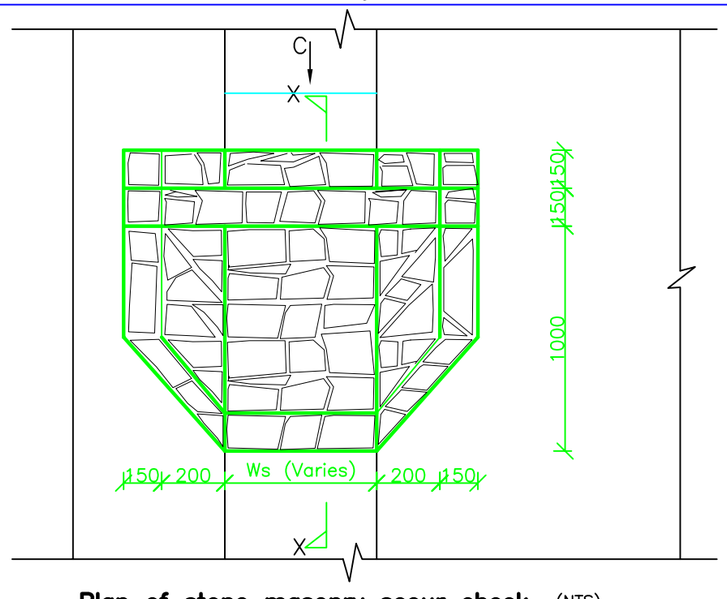
Step 1: Excavation/Shaping
Step 2: stone masonry construction
Step 3: Backfilling

A: Apron (basin)
B: scour check under construction
C: Direction of water flow
D: Completed scour check

Stone masonry scour checks (NTS)



Section X–X (Scale 1:25)



Plan of stone masonry scour check (NTS)

Gradient (%)	4 or less	5	6	7	8	9	10	>10
Maximum spacing of Scour checks (m)	Not applicable	20	15	10	7.5	6	5	4

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

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Drawing Number: WWP 001

WATER WAY PROTECTIONS (SCOUR CHECKS)

Plan, Elevations and Sections

Scale: As shown

Dimension: mm

File Name: P/Roads and Highways/50999A/Data /Drawings/ Water ways

Date: June 2001

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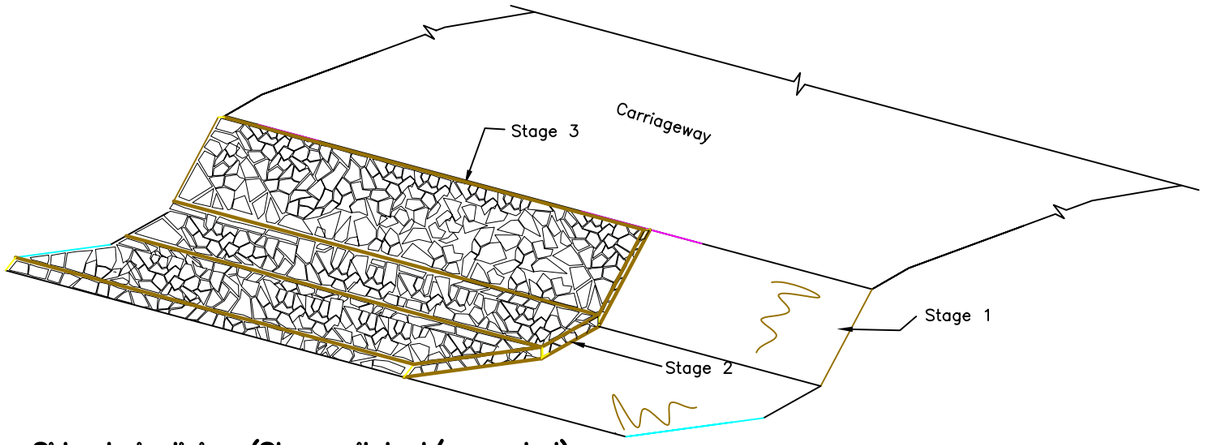
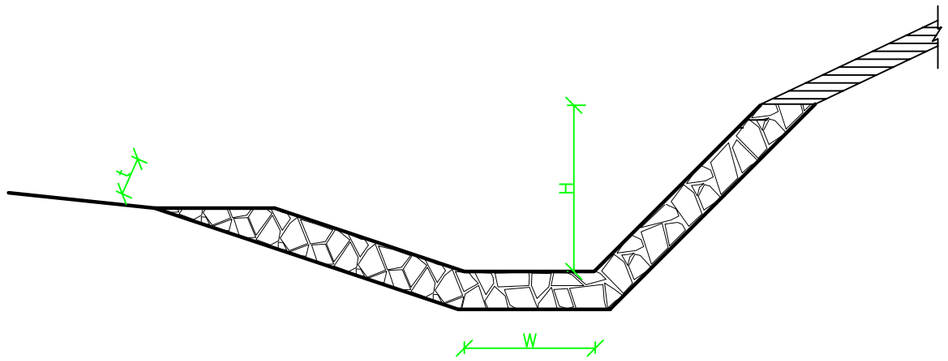


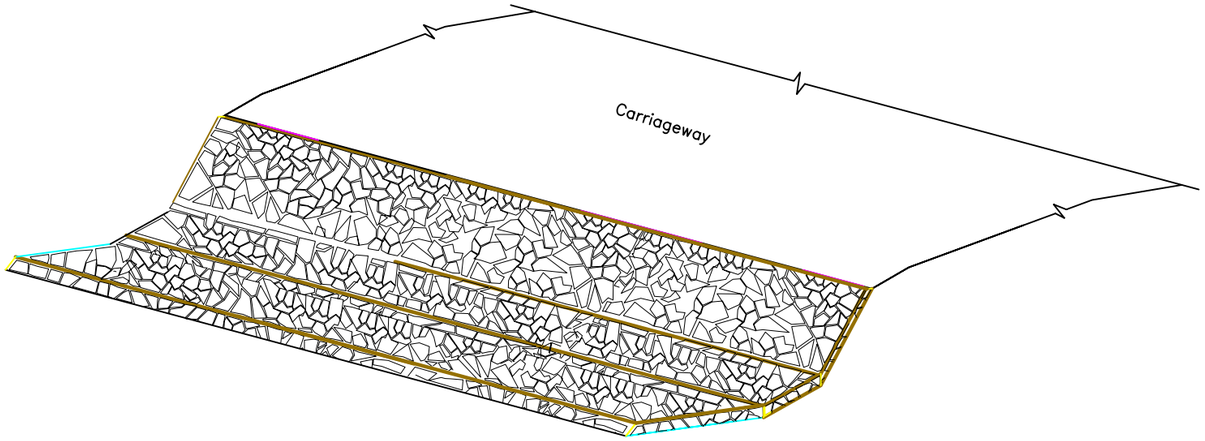
Side drain lining (Stone pitched/concreted) (NTS)

Procedures

Stage 1: Preparation/shaping
Stage 2: Stone pitch construction
Stage 3: Coping
Stage 4: Backfilling and cleaning



Section through ditch lining (Scale 1:25)



Completed side drain lining (NTS)

Type of Lining	Min. thickness, t (mm)	Width, W (mm)	Height, H (mm)	Reinforce–ment
Concrete	100	Varies	Varies	A142
Stone pitching	150	Varies	Varies	Not required

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

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Drawing Number: WWP 002

WATER WAY PROTECTIONS (DITCH LINING) Plan, Elevations and Section

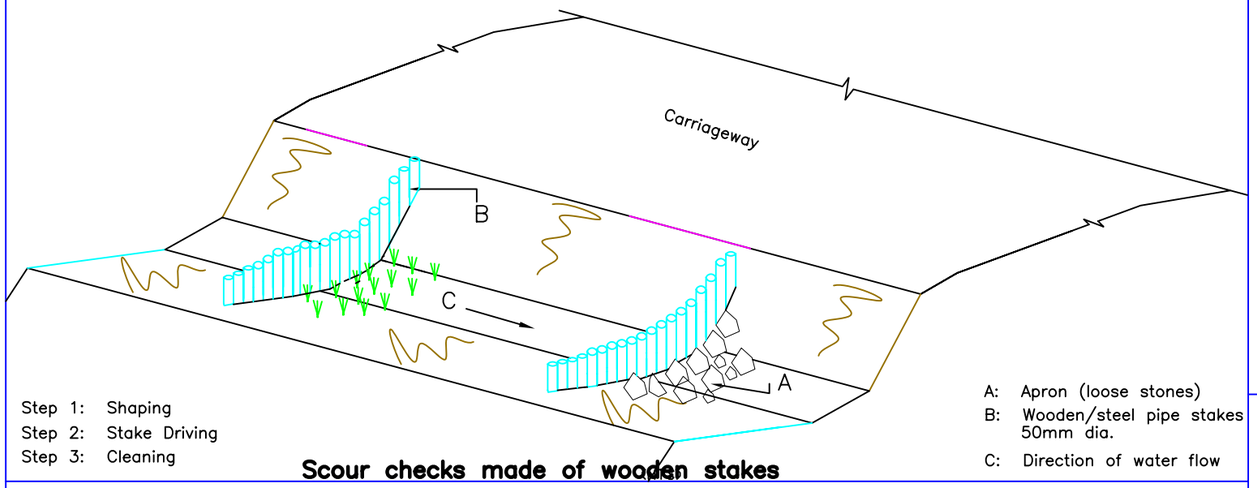
Scale: As shown

Dimension: mm

File Name: P/Roads and Highways/50999A/Data /Drawings/ Waterway protection

Date: June 2001

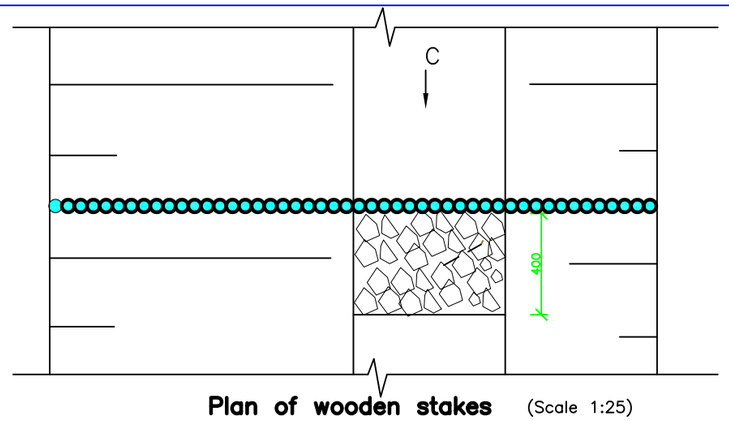
Drawn by	Designed by	Checked by	Approved by	Sheet:
JMA	JMA	FCO	MMK	1/1



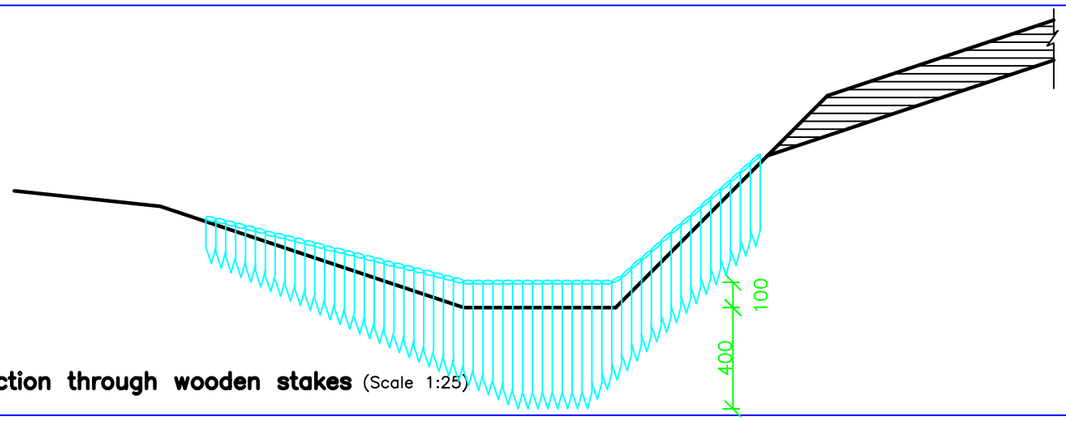
Step 1: Shaping
Step 2: Stake Driving
Step 3: Cleaning

A: Apron (loose stones)
B: Wooden/steel pipe stakes 50mm dia.
C: Direction of water flow

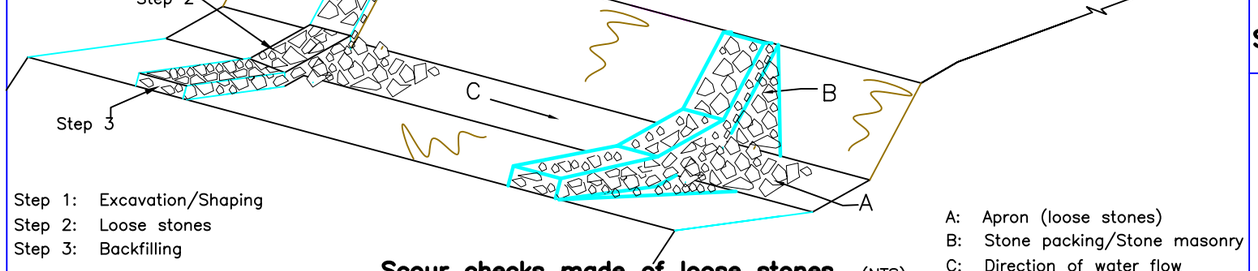
Scour checks made of wooden stakes



Plan of wooden stakes (Scale 1:25)



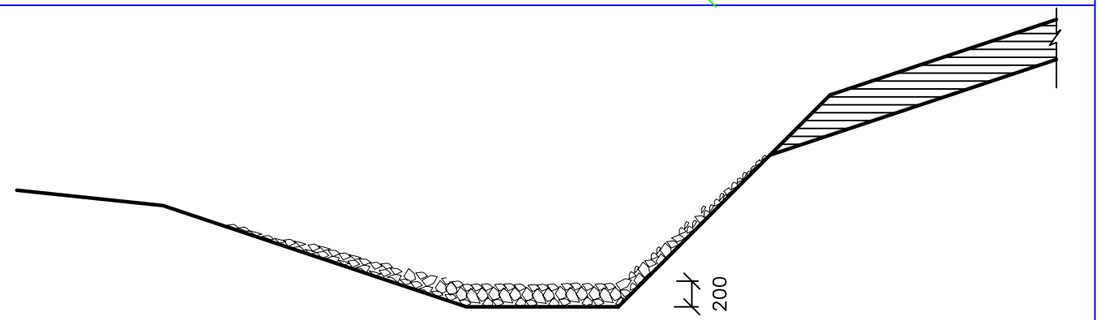
Section through wooden stakes (Scale 1:25)



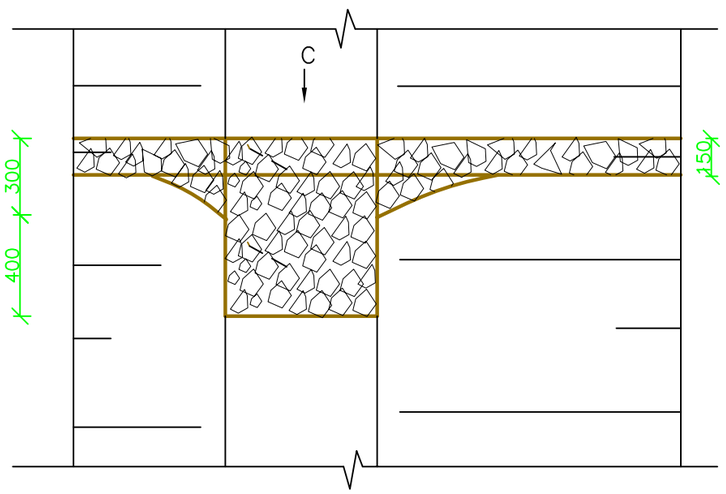
Step 1: Excavation/Shaping
Step 2: Loose stones
Step 3: Backfilling

A: Apron (loose stones)
B: Stone packing/Stone masonry
C: Direction of water flow

Scour checks made of loose stones (NTS)



Section through loose stones (Scale 1:25)



Plan of loose stone packing (NTS)

Gradient (%)	4 or less	5	6	7	8	9	10	>10
Maximum spacing of Scour checks (m)	Not applicable	20	15	10	7.5	6	5	4

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: WWP 003

Title: STANDARD STRUCTURES MANUAL

WATER WAY PROTECTIONS (SCOUR CHECKS)
Plan, Elevations and Sections

Scale: As shown
Dimension: mm
Date: June 2001
Sheet: 1/1

File Name: P/Roads and Highways/50999A/Data /Drawings/ Water ways

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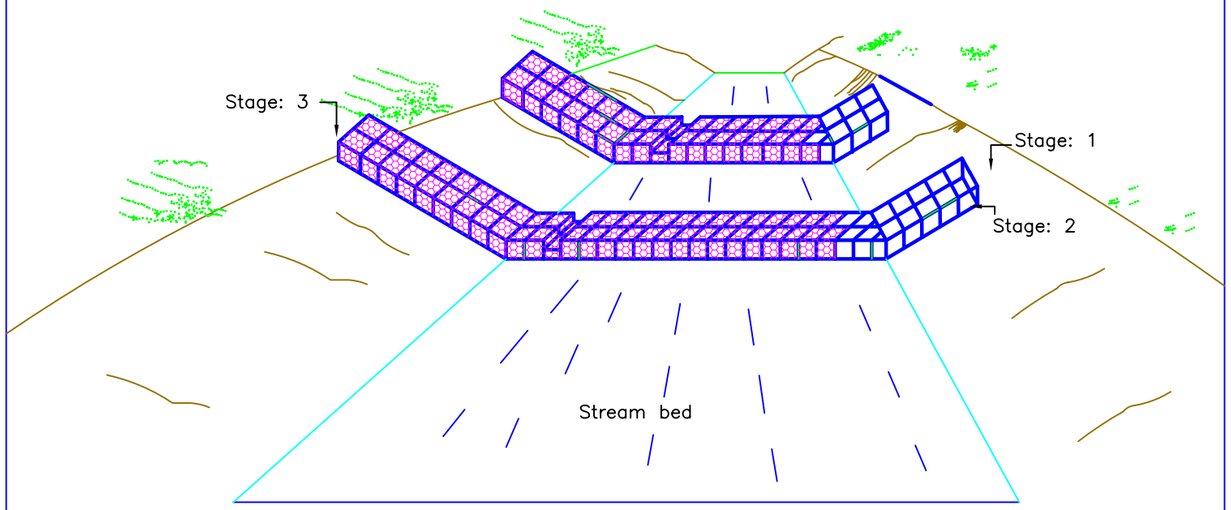
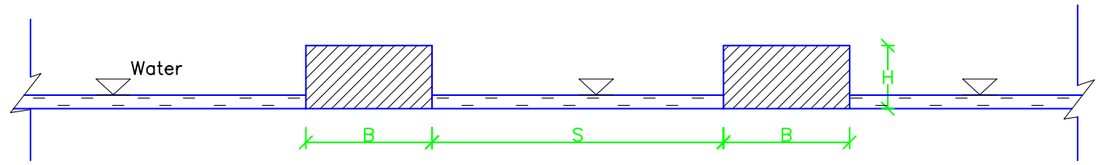
Weir construction procedures

Stage 1: Preparation/Shaping
Stage 2: Weir Construction
Stage 3: Backfilling at the edges and Cleaning

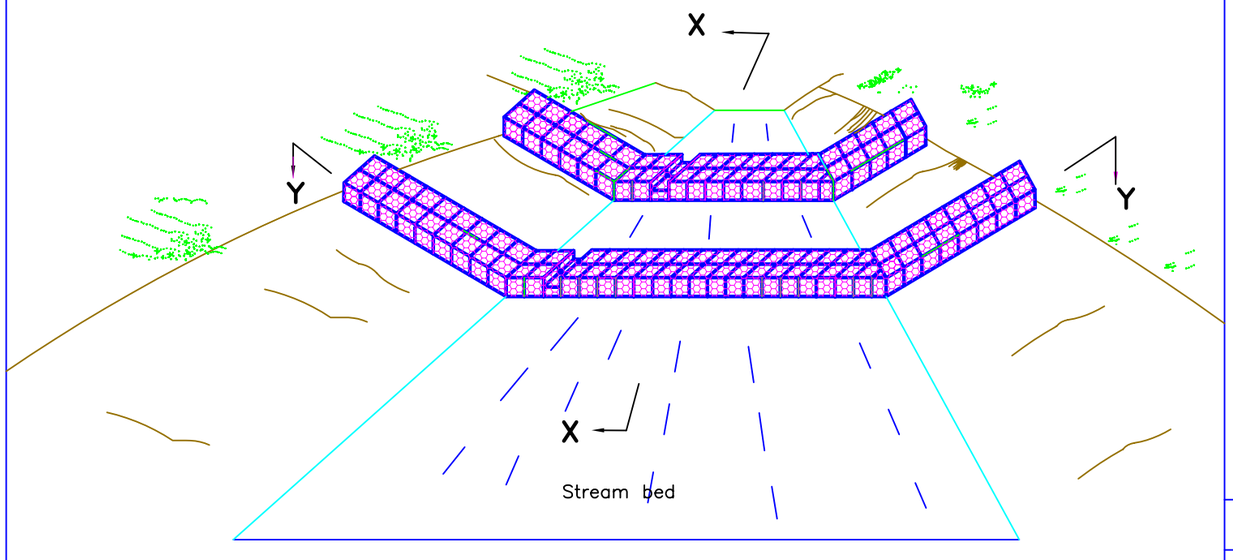


Weirs under construction

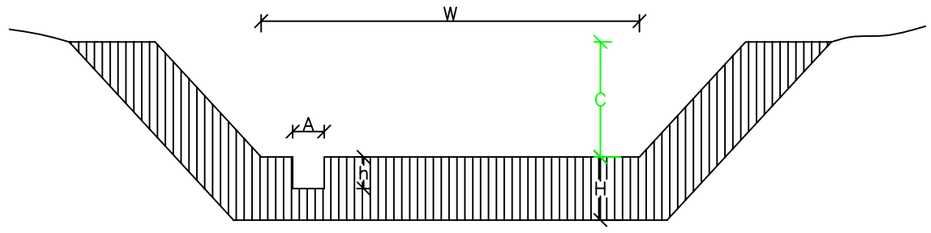


B: Min. 2000mm
S: Varies
H: Min. 1000mm

Section X–X



Completed Weirs



A: min. 500mm
h: Min. 500mm
H: Min. 1000mm
W. Varies
C. Varies

SECTION Y–Y

Project: SUPPORT TO DISTRICT ROAD NETWORKS PROGRAMME

Drawing Number: WWP 004

Title: STANDARD STRUCTURES MANUAL

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WATER WAY PROTECTION

Downstream weirs

File Name: P/Roads and Highways/50999A/Data/Drawings /Weir				Scale NTS; Dimension —; Date June 2001
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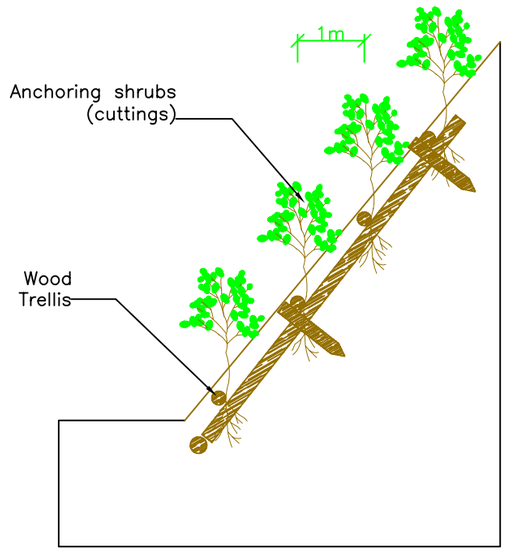
Section B-11

Environmental Protection / Stabilisation Methods

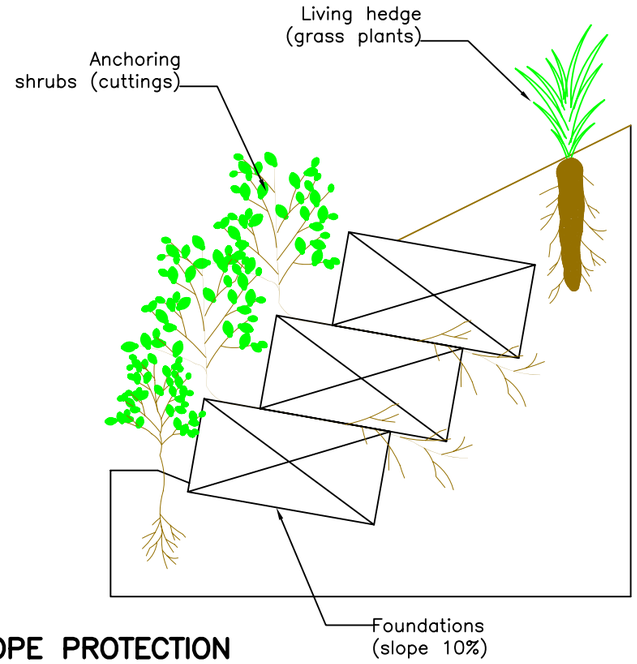
Slope Stabilisation

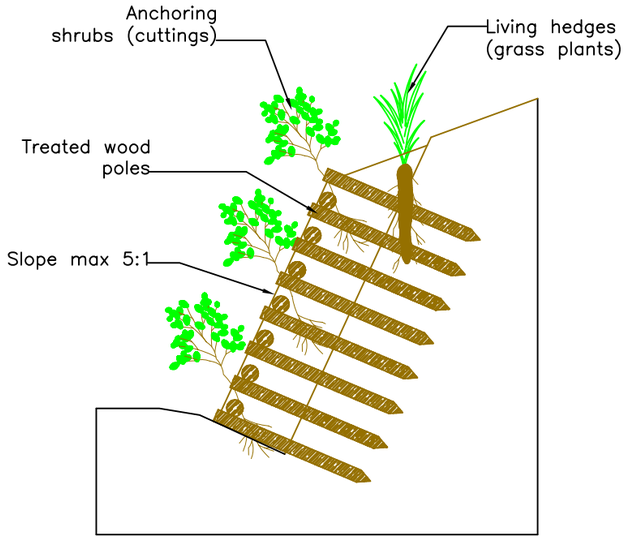
Environmental Protection / Stabilisation Methods

Section B-11
Slope Stabilisation

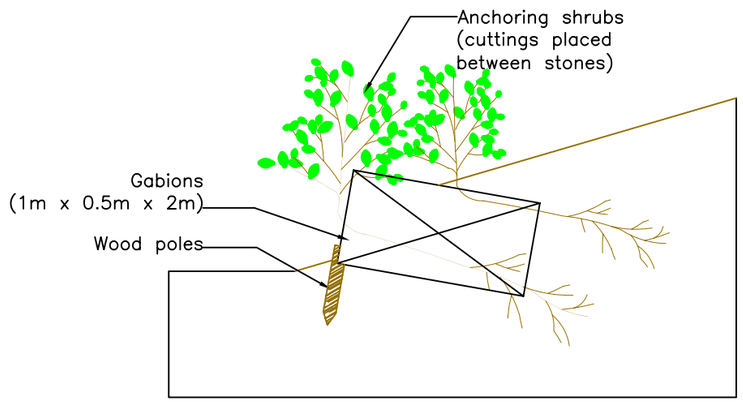


BIO–ENGINEERED SLOPE PROTECTION

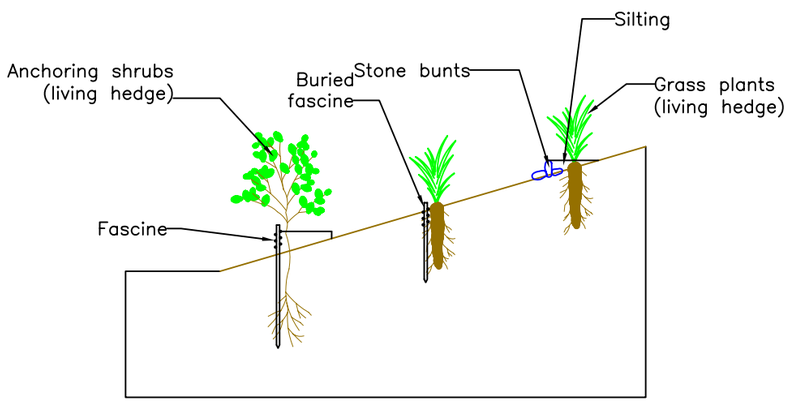


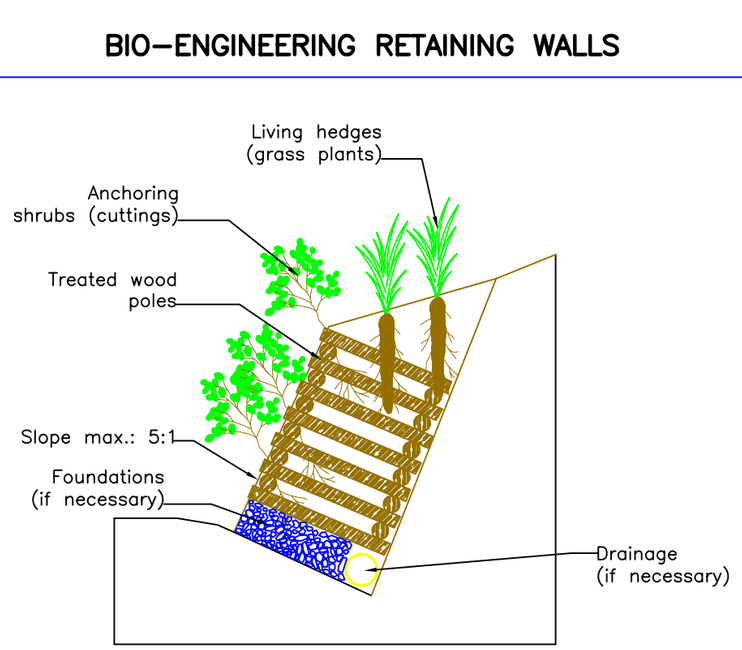


BIO–ENGINEERING RETAINING WALLS



BIO–ENGINEERED SLOPE PROTECTION





BIO–ENGINEERING RETAINING WALLS

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STRUCTURES MANUAL

Drawing Number: SLS 001

BIO-ENGINEERING
Slope Protection and Retaining Walls

Scale: NTS

Dimension: -

File Name: P/Roads and Highways/50999A/Data/Drawings /Bio-Engineering

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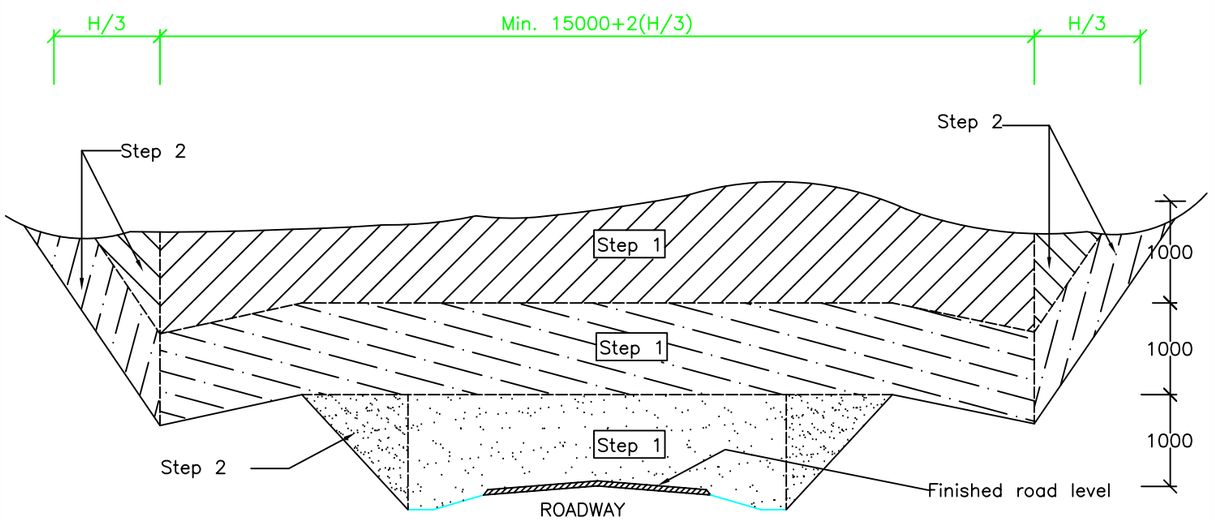
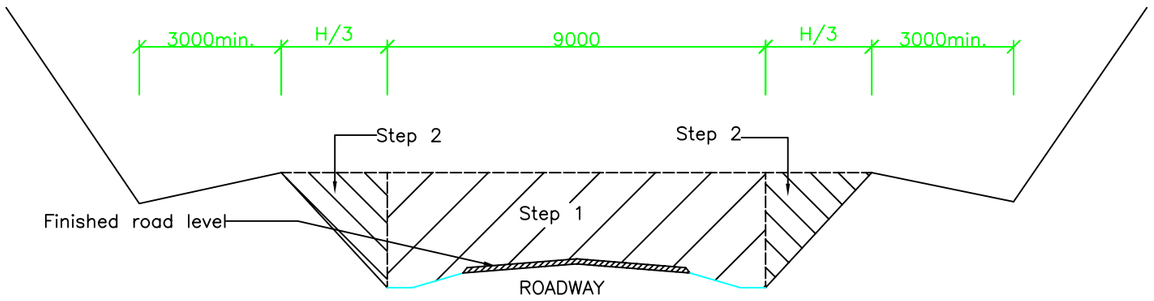


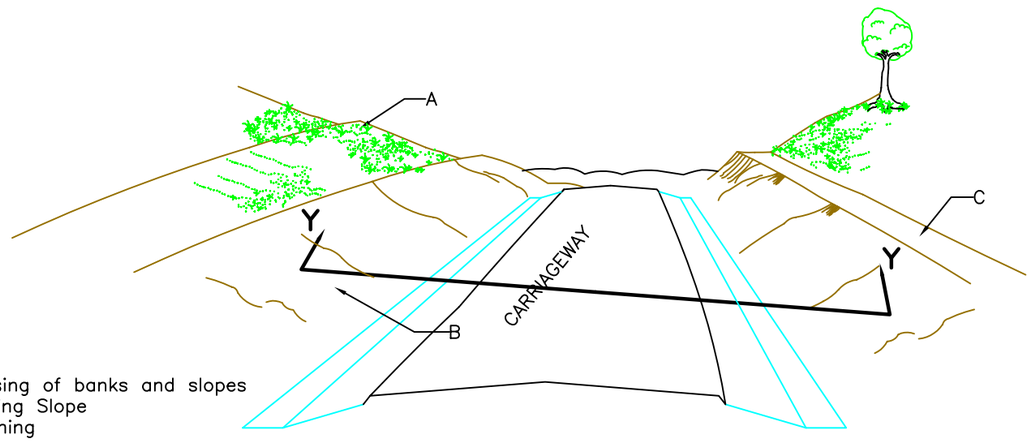
Step 1: Excavation
Step 2: Shaping

CONSTRUCTION PROCEDURE



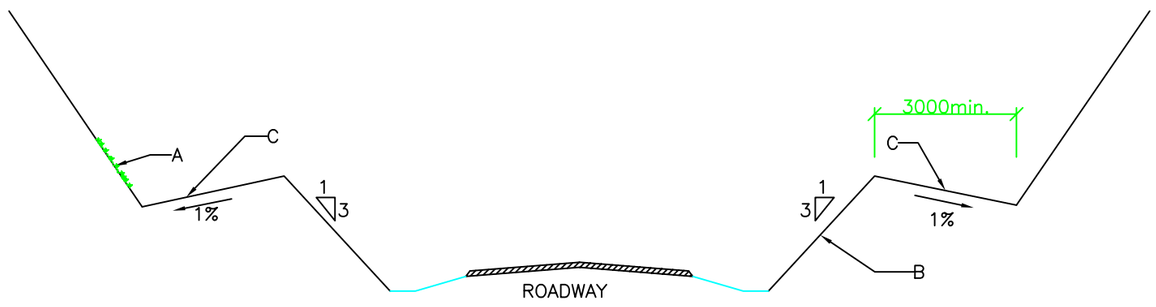
Step 1: Excavation
Step 2: Shaping

CONSTRUCTION PROCEDURE



A. Grassing of banks and slopes
B. Shaping Slope
C. Benching

BENCHING, GRASSING SLOPES, SHAPING



A. Grassing of banks and slopes
B. Shaping Slope
C. Benching

SECTION Y–Y

NOTES:

1. Benching is carried out at interval of 1.0m

Project: SUPPORT TO DISTRICT ROAD NETWORKS PROGRAMME

Title: STANDARD STRUCTURES MANUAL

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Drawing Number: SLS 002

ENVIRONMENTAL PROTECTION
Benching

Scale: NTS

Dimension: —

File Name: P/Roads and Highways/50999A/Data/Drawings/Slope Stabilisation

Date: June 2001

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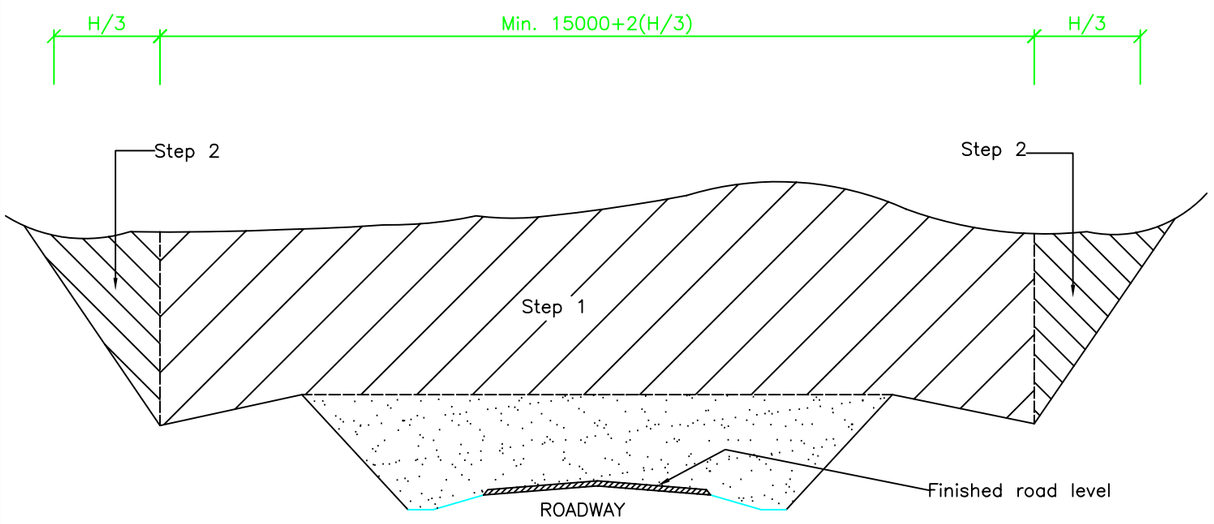
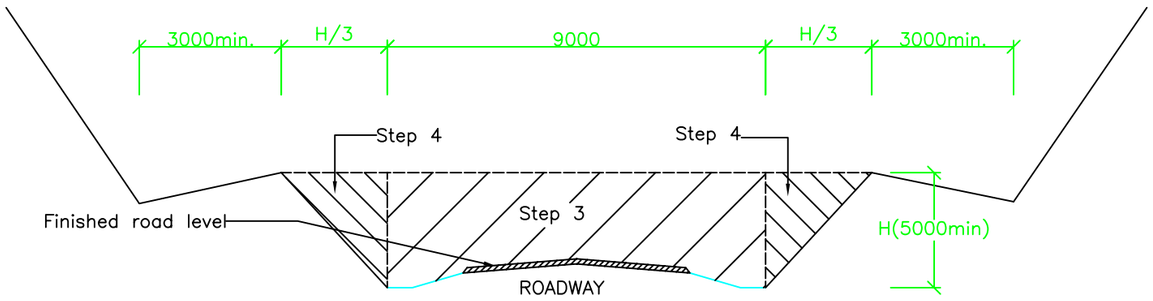


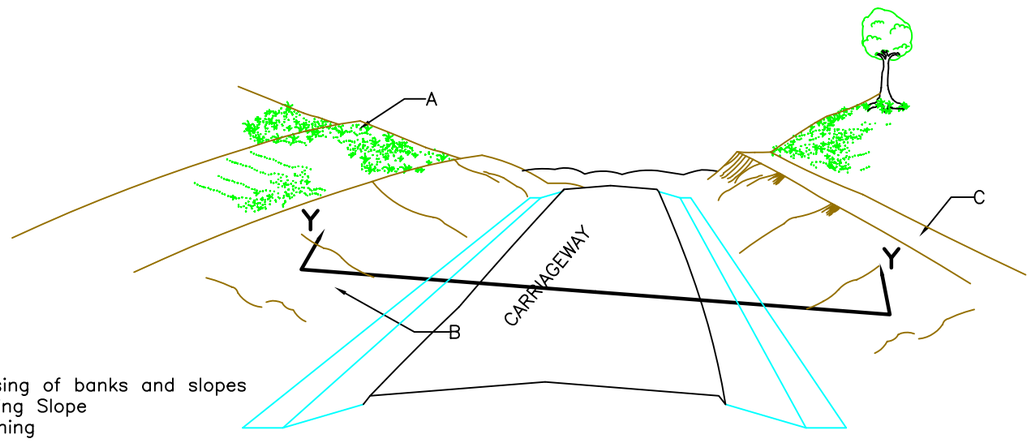
Step 1: Excavation
Step 2: Shaping

CONSTRUCTION PROCEDURE



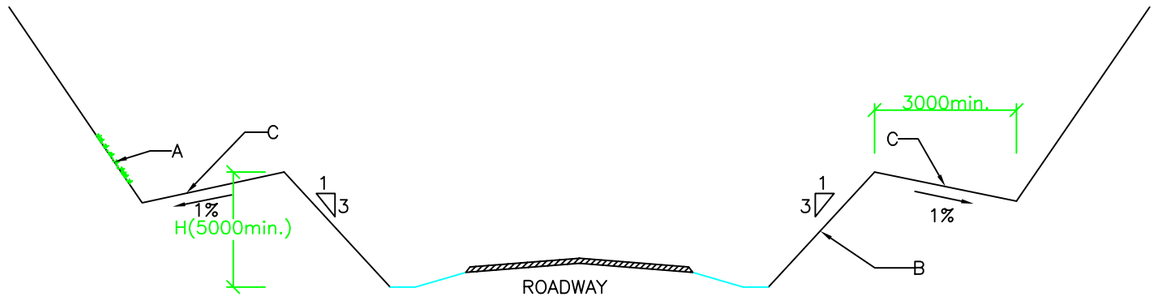
Step 3: Excavation
Step 4: Shaping

CONSTRUCTION PROCEDURE



A. Grassing of banks and slopes
B. Shaping Slope
C. Benching

BENCHING, GRASSING SLOPES, SHAPING



A. Grassing of banks and slopes
B. Shaping Slope
C. Benching

SECTION Y–Y

NOTES:

1. Benching is required when H is more than 5m high

Project: SUPPORT TO DISTRICT ROAD NETWORKS PROGRAMME

Title: STANDARD STRUCTURES MANUAL

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Drawing Number: SLS 002

ENVIRONMENTAL PROTECTION
Benching

Scale: NTS

Dimension: —

File Name: P/Roads and Highways/50999A/Data/Drawings/Slope Stabilisation

Date: June 2001

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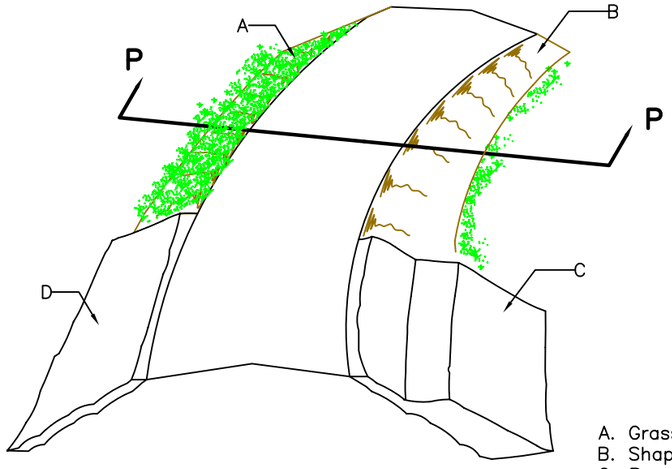
Sheet: 2/3



A. Grassing of banks and slopes
B. Shaping Slope
C. Berm
D. Cladding with top soil (150mm)

SHAPING, GRASSING SLOPES, BERM

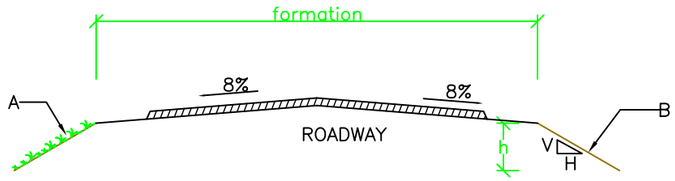
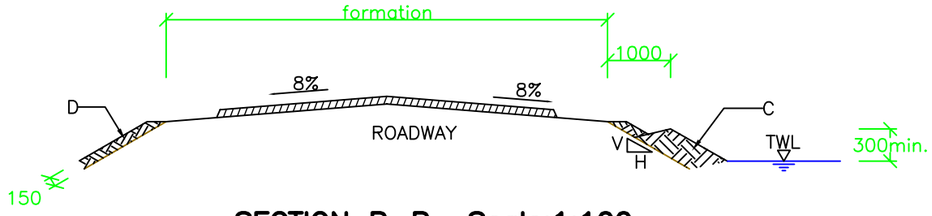


Table: Shaping

h(m)	H	V
<2	2	1
?2	3	1

A. Grassing of banks and slopes
B. Shaping Slope

SECTION P–P Scale:1:100

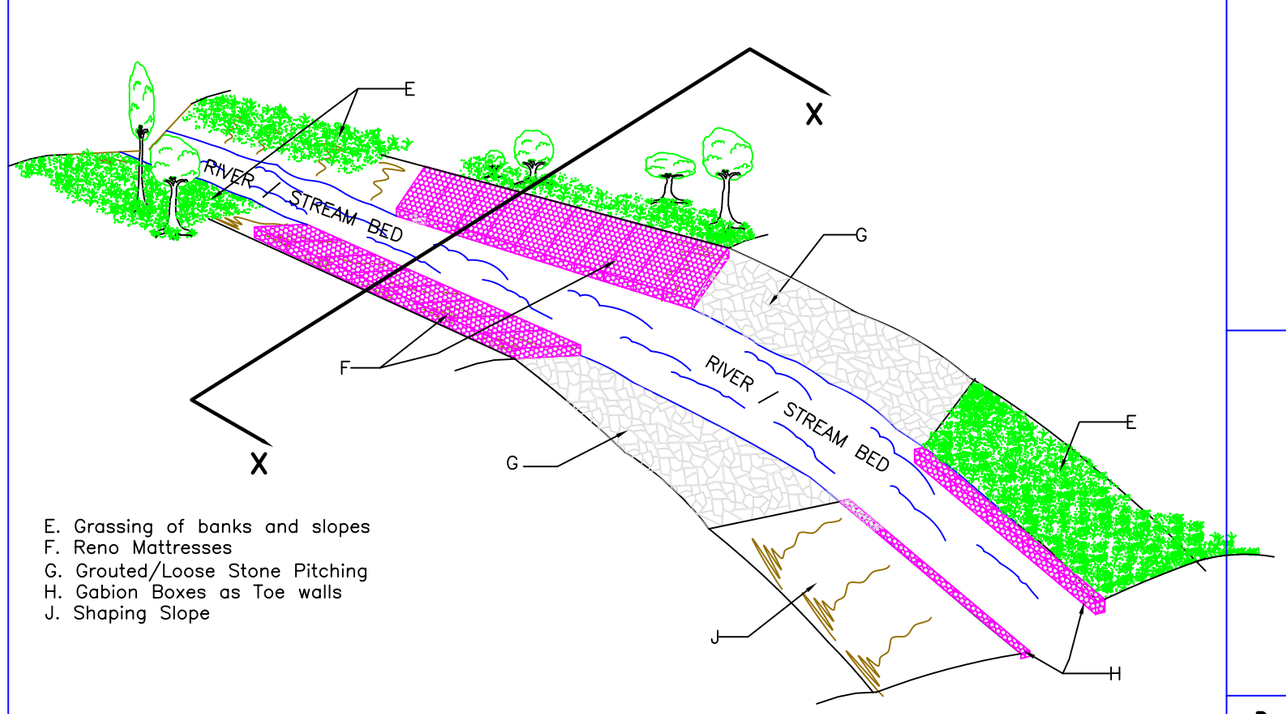


C. Berm
D. Top soiling (150mm)

SECTION P–P Scale:1:100

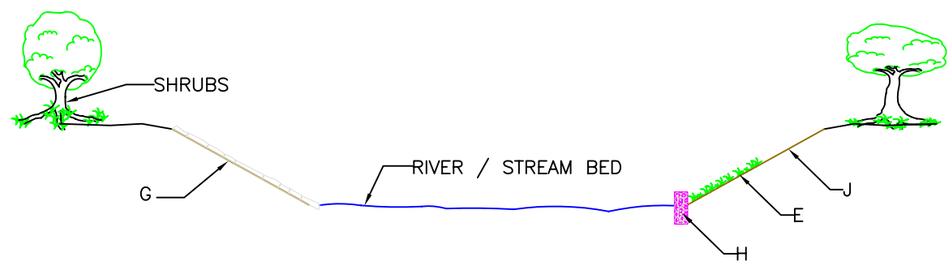
NOTES:

1. TWL = Top Water Level

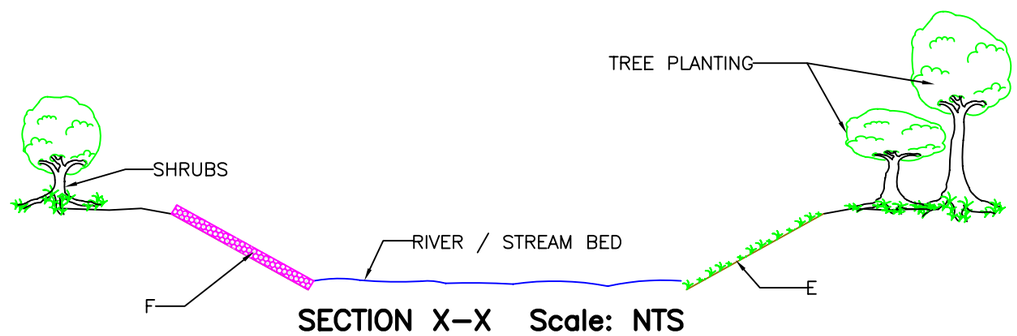


E. Grassing of banks and slopes
F. Reno Mattresses
G. Grouted/Loose Stone Pitching
H. Gabion Boxes as Toe walls
J. Shaping Slope

DIFFERENT METHODS OF SLOPE PROTECTION



SECTION X–X Scale: NTS



SECTION X–X Scale: NTS

Project: SUPPORT TO DISTRICT ROAD NETWORKS PROGRAMME

Drawing Number: SLS 002

Title: STANDARD STRUCTURES MANUAL

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TELEFAX: 321364, 321425

ENVIRONMENTAL PROTECTION
Slope Protection Methods

Scale: 1:100, NTS

Dimension: —

File Name: P/Roads and Highways/50999A/Data/Drawings/Slope Stabilisation

Date: June 2001

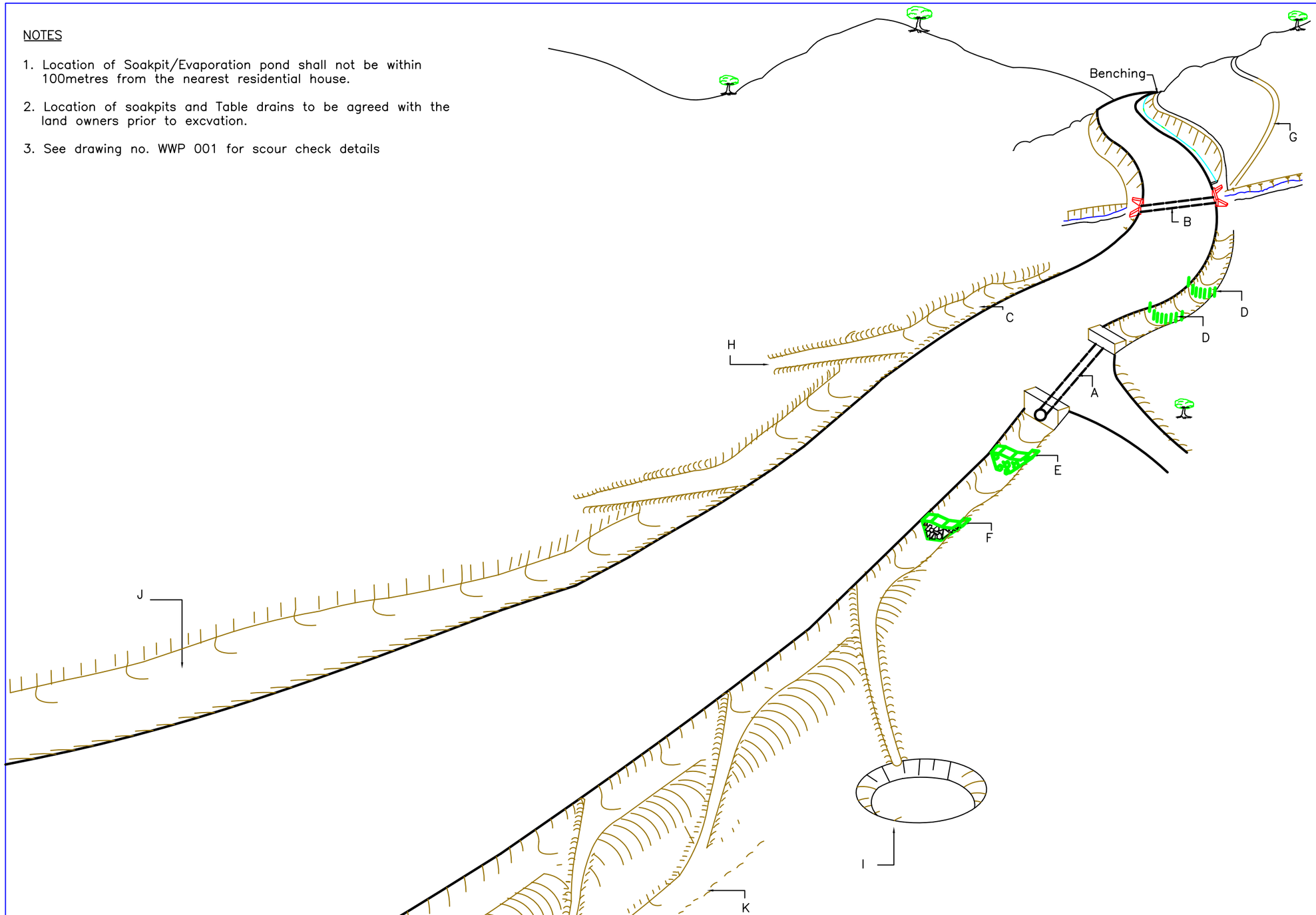
Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	PWJ	3/3

Section B-12
Environmental Protection / Stabilisation Methods
Drains

Section B-12
Drains

NOTES

1. Location of Soakpit/Evaporation pond shall not be within 100metres from the nearest residential house.
2. Location of soakpits and Table drains to be agreed with the land owners prior to excvation.
3. See drawing no. WWP 001 for scour check details



Drainage layout (NTS)

A – Access culvert

B – Cross culvert

C – Side drain

D – Scour checks (Wooden Stakes)

E – Scour checks (Loose stones)

F – Scour checks (Stone masonry

G – Catch water drains

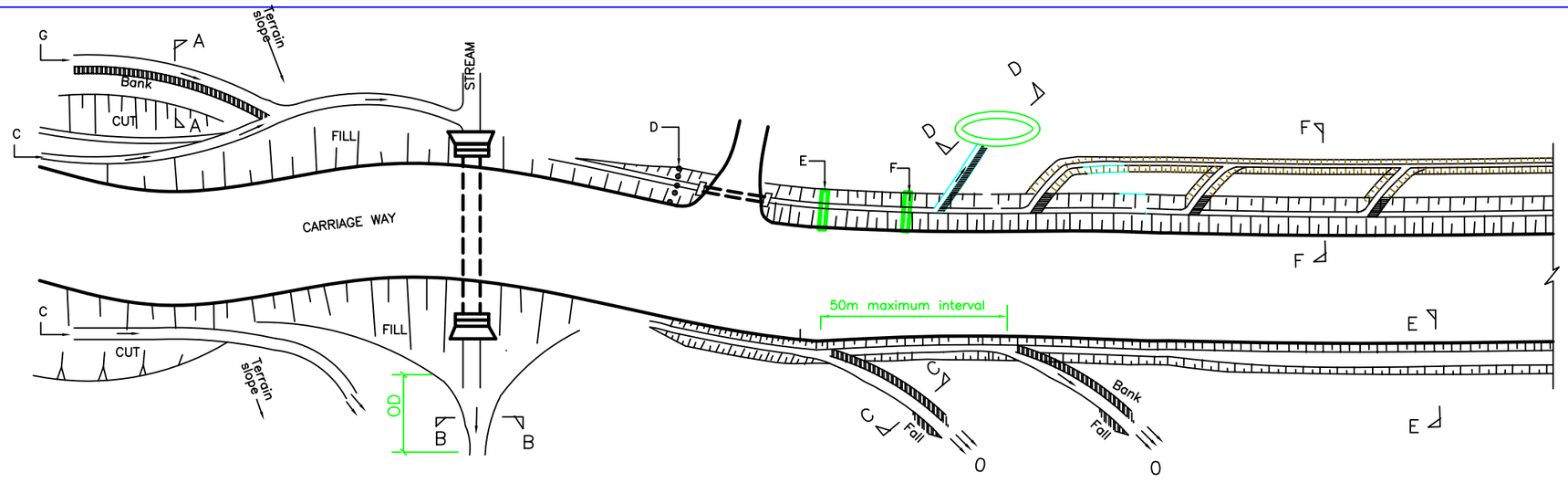
H – Mitre drains

I – Soak pit

J – Table drains

K – Parallel drains

Project: SUPPORT TO DISTRICT ROAD NETWORKS		**Drawing Number:** DLO 001	
Title: STANDARD STRUCTURES MANUAL		**DRAINAGE LAYOUT** **Elevation**	Scale As shown
\\Server\p\Roads & Highways\50999A\Data\Drawings\logo3.jpg	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS, P. O. BOX 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425		Dimension mm
		File Name: P/Roads and Highways/50999A/Data /Drawings/ Drainage layout 1	Date June 2001
		Drawn by JMA / Designed by JMA / Checked by FCO / Approved by MMK	Sheet: 1/2



Typical Drainage layout plan (NTS)

O – Drain bottom at ground level

OD – Outflow drain as required

A – Access culvert

B – Cross culvert

C – Side drain

D – Scour checks (Wooden Stakes)

E – Scour checks (Loose stones)

F – Scour checks (Stone masonry

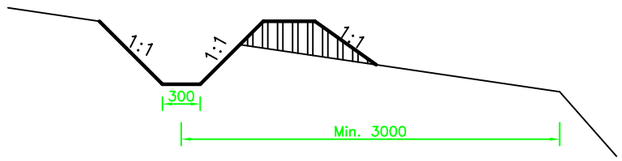
G – Catch water drains

H – Mitre drains

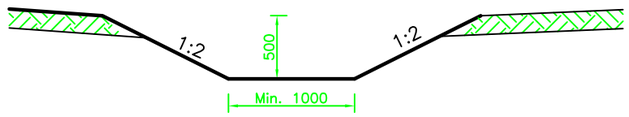
I – Soak pit

J – Table drains

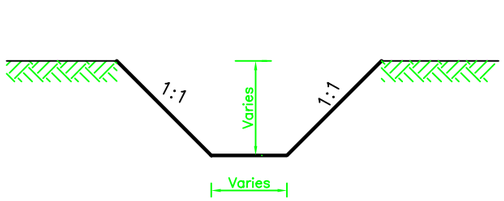
K – Parallel drains



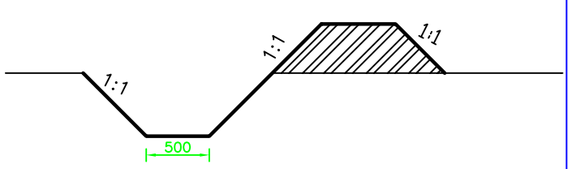
SECTION A–A (Scale 1:50)



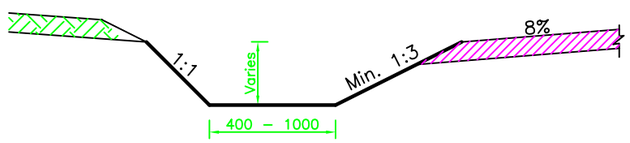
SECTION D–D (Scale 1:50)



SECTION B–B (Scale 1:50)



SECTION C–C (Scale 1:50)



SECTION E–E (Scale 1:50)

SECTION F–F (Scale 1:50)

TABLE: MITRE DRAIN SPACING (METRES)

Invert gradient (%)		1	2	3	4	5	6	7	8	9	10
Invert Material	Fine sand and loam	30	21	17	15	13	12	11	10	10	9
	Clays	40	28	23	20	18	16	15	14	13	12
	Coarse	50	35	29	25	22	20	19	18	17	16

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Drawing Number: DLO 002

Title: STANDARD STRUCTURES MANUAL

DRAINAGE LAYOUT
Plan and Sections

Scale: As shown

Dimension: mm

File Name: P/Roads and Highways/50999A/Data /Drawings/ Drainage layout 1

Date: June 2001

Drawn by: JMA | Designed by: JMA | Checked by: FCO | Approved by: MMK

Sheet: 2/2

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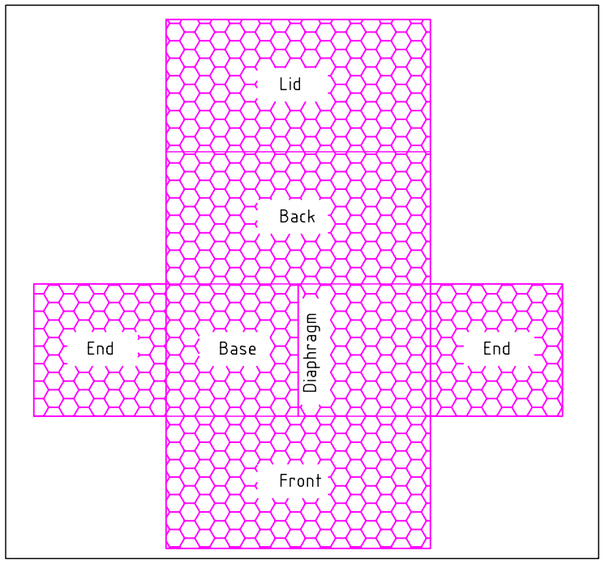
Section B-13

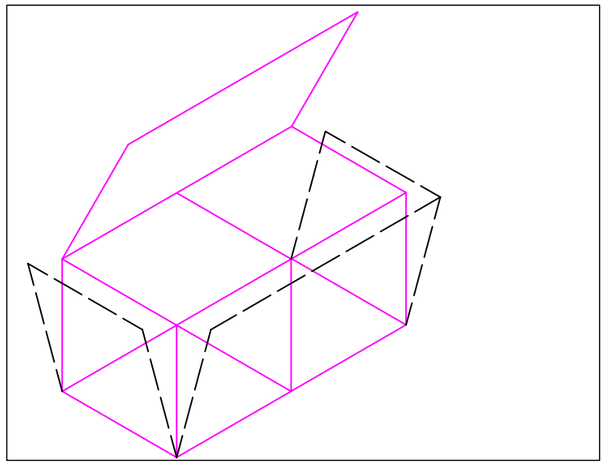
Environmental Protection / Stabilisation Methods

Gabion Boxes

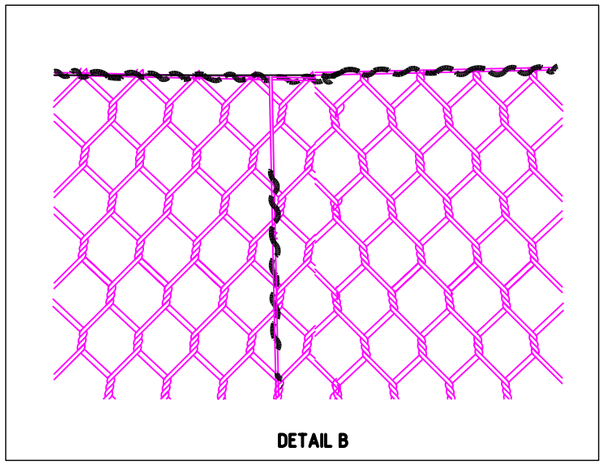
Section B-13
Gabion Boxes



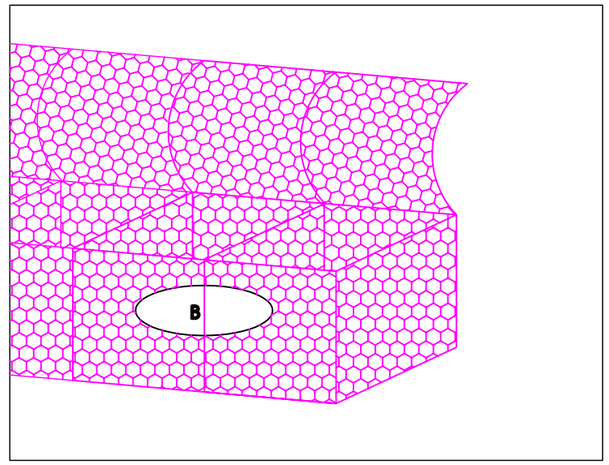
Step 1: Unfold each gabion on a hard, flat surface



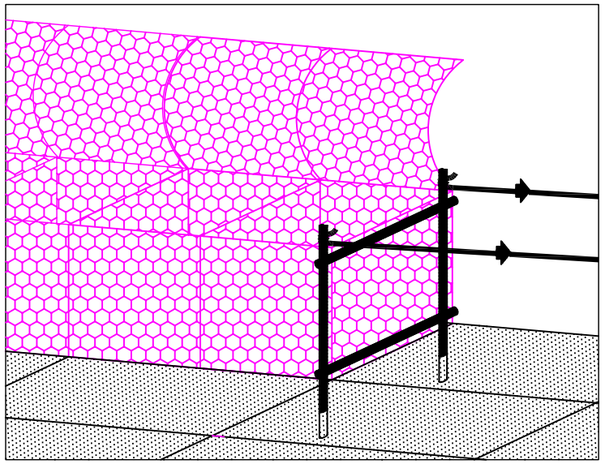
Step 2: Assemble cage:
Fold side and end panels into upright position to form a rectangular box



Step 3: Weave boxes securely together:
Wiring up of panels (Tightness of the mesh and wiring is essential at all times)

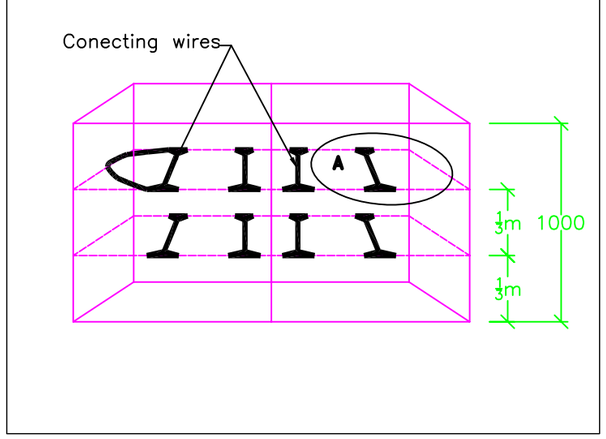


Step 3: Wiring gabions together

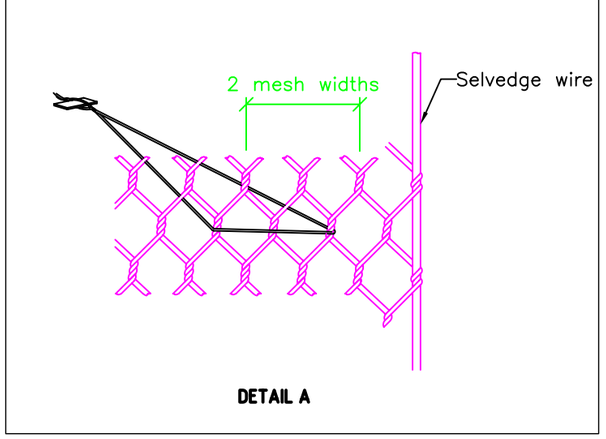


Step 4: Place empty gabion(s) in position, securing end from which work is to start

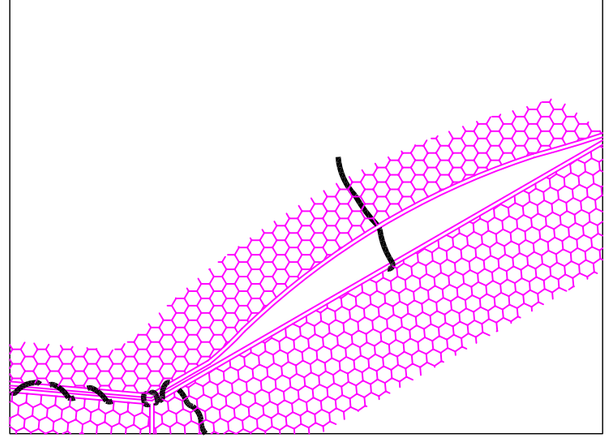
Step 5: Stake and stretch gabion cages to required shape, keeping top and bottom stretched until gabion has been filled.



Step 6: Fill gabions in steps of $\frac{1}{3}$m, fixing intermediate horizontal bracing wires between levels



Step 6: Windlass bracing



Step 7: Close and secure lids

Project: SUPPORT TO DISTRICT ROAD NETWORKS

Title: STANDARD STUCTURES MANUAL

Drawing Number: GAC 001

GABION BOXES
Gabion Cage Assembly

Scale: NTS

Dimension: mm

File Name: P/Roads and Highways/50999A/Data/Drawings/Gabion Assembly

Date: June 2001

Drawn by	Designed by	Checked by	Approved by	Sheet:
JAU	JAU	FCO	MMK	1/1

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