Volume-4
Technical Drawings

Small Structures for Rural Roads

A Practical Planning, Design, Construction & Maintenance Guide

Paul Larcher, Robert Petts & Robin Spence
English Version, May 2010

gTKP
global Transport Knowledge Partnership

committed to sustainable transport

A3 Design Drawings

Acknowledgements

The initial funding for the research and drafting of this guideline was provided by DFID (Department for International Development) through their Knowledge and Research (KaR) programme. The guideline has benefited from constructive advice and guidance from a large number of different people, too numerous to mention, for which the authors are very grateful. The following people have contributed in detail to the work; Andreas Beusch, Michael Broadbent, Able Chiteshe, Jasper Cook, Simon Done, Robert Geddes, Colin Gourley, Kingstone Gongera, Heng Kackada, Tesfaye Kunbi, Peter O'Neill, Kamal Pande, David Salter, Dave Stiedl and Julie Turner. The diagrams have been drawn by Patricia Petts. The authors are grateful to Simon Done, John Howe, Intech Associates and TRL for contributing a number of photographs for the guideline. All contributions are gratefully acknowledged. The authors are, of course, solely responsible for the opinions in this guideline. Edition 1 May 2010

Larcher P., Petts R. and Spence R. (2010)
Small Structures for Rural Roads; A Practical Planning, Design, Construction & Maintenance Guide (SSRRG)

The original draft document (2005) was an output from a project funded by the UK Department for International Development (DFID) for the benefit of low-income countries. This current edition (2010) was updated and edited by TRL Ltd in association with Intech Associates, OtB Engineering (International) Ltd and KACE (Cambodia) through the DFID-South East Asia Community Access Programme (SEACAP). The document has been reviewed and finalised by the Global Transport Knowledge Partnership (gTKP) under management of the International Road Federation (IRF) with contributions from the World Bank, Asian Development Bank and the Africa Community Access Programme (AFCAP).

The views expressed are not necessarily those of DFID, WB, ADB or IRF.

The aim of this document is to provide guidance to planners, designers and practitioners of rural roads in developing and transition counties. It is based on proven techniques and experience and should be the basis of introduction of low cost but durable construction practices in environments experiencing severe resource restrictions. It is intended that rural road practitioners and professionals will be able to utilise and adapt the knowledge in this document to introduce more appropriate, affordable and
sustainable techniques, standards and specifications into everyday practice, academic curricula and training, and contribute to rural poverty reduction.

This document is web-posted by gTKP (www.gtkp.com) to be available to practitioners free of charge. Hard copies may be obtained on application to info@gtkp.com .

It is intended that this Guideline should be a dynamic document with regular updates to accommodate new knowledge and experience. Users are actively encouraged to comment on and contribute to the ongoing development of this Guideline. Please send your comments or contributions for future editions to:

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Published in separate volumes:

Volume-1: Planning & Initial Design
Volume-2: Detailed Design Construction & Maintenance
Volume-3: Design Drawings and Bills of Quantities

We also thank the following organizations for their contributions:

DFID Department for International Development
INTERNATIONAL ROAD FEDERATION
FEDERATION ROUTIERE INTERNATIONALE
ADB
SEACAP
AFCAP

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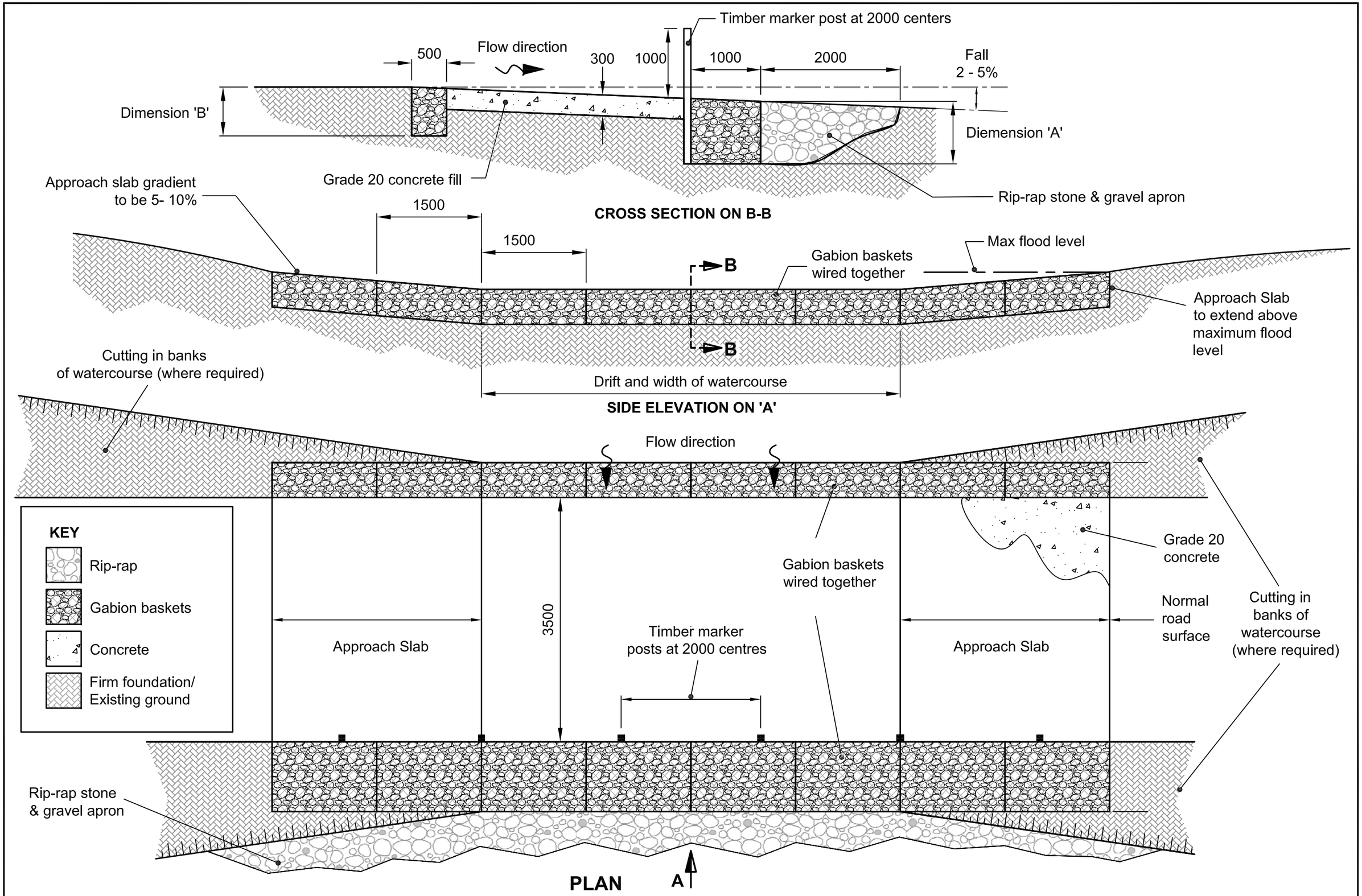


NOTES: **(1)** All dimensions in mm. **(2)** Drift warning sign to be placed on approaches 100m before drift.
(3) Top of Gabion Baskets to be placed at the level of stream bed maximum flood level (to be 5 or 10 years flood depending on road importance).
(4) Dimension 'A' - 1m - 1.5m depending on scour risk. **(5)** Dimension 'B' - 0.7m - 1m depending on scour risk.
(6) Gravel fill to be compacted in 150mm layer. **(7)** Drift running width may be increased according to national standards.
(8) Gabions may be substituted by masonry or concrete cut-off walls.

Low cost structures for Rural Roads

Gabions Drift

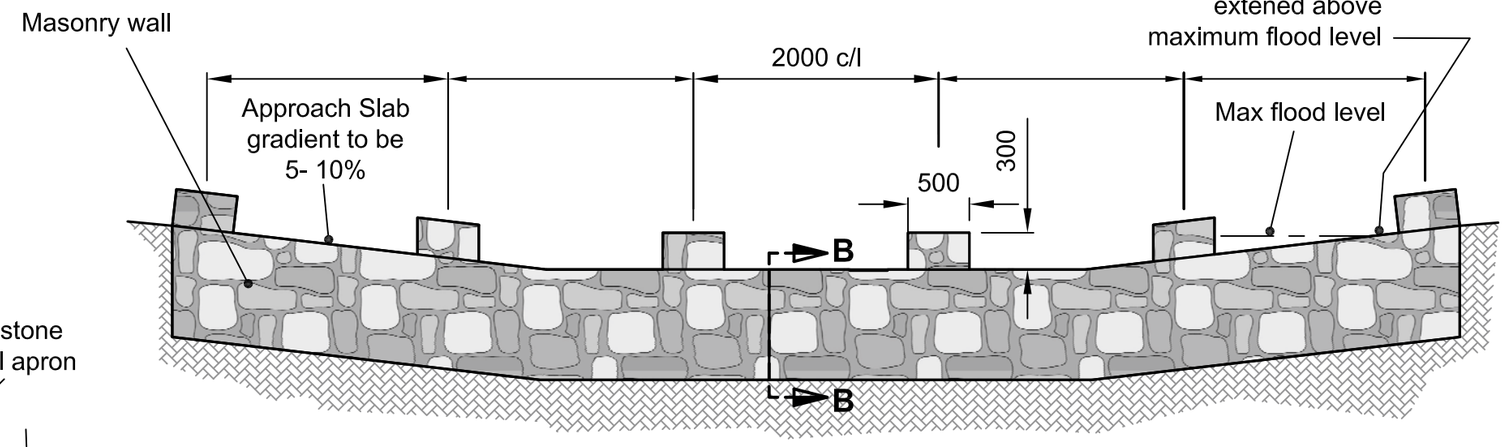
Concrete & Gabions for high velocity flows.

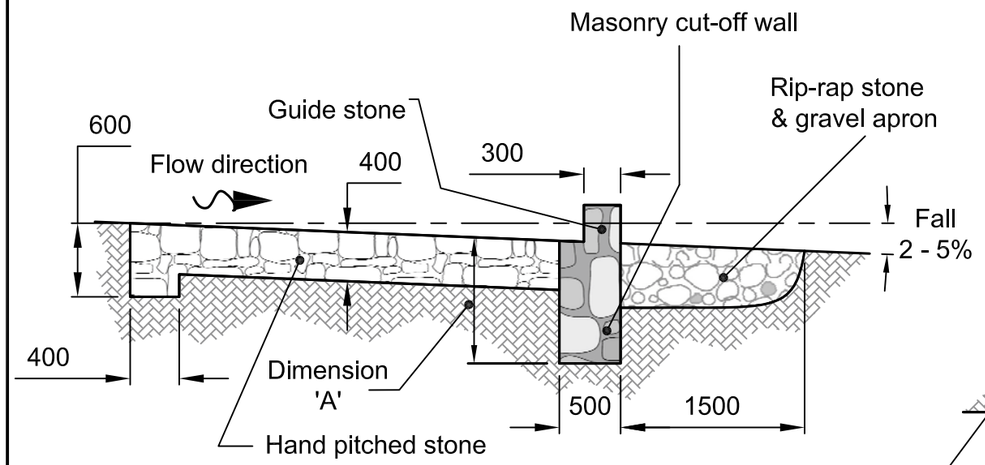
Institute of Development Engineering Loughborough University, Leicestershire LE11 3TU

Scale: 1 : 50 (at A3)

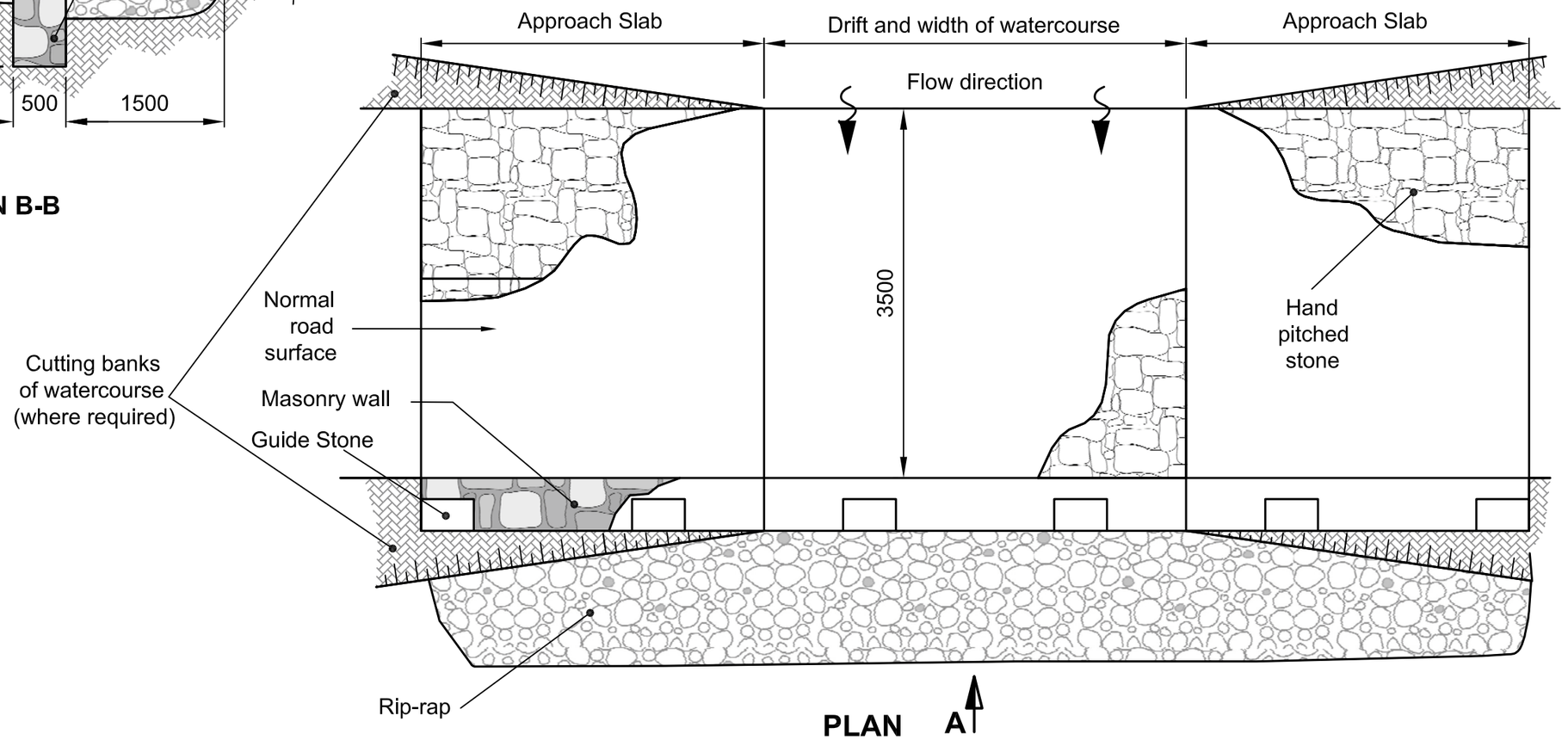
Drawing No: 1.1

SIDE ELEVATION ON 'A'





CROSS SECTION ON B-B



KEY

- Rip-rap
- Masonry
- Hand pitched stone
- Firm foundation/ Existing ground

NOTES: **(1)** All dimensions in mm. **(2)** Dimension 'A' - 1m - 1.5m depending on scour risk.
(3) Rip-rap downstream protection may be substituted for hand pitched stone, reinforced with vegetation. **(4)** Guide stone to be painted white.
(5) Maximum flood level to be 5 or 10 years flood depending on road importance.
(6) Drift warning sign to be placed on approaches 100m before drift. **(7)** Top of drift to be at existing stream bed level
(8) Drift running width may be increased according to national standards.

Low cost structures for Rural Roads

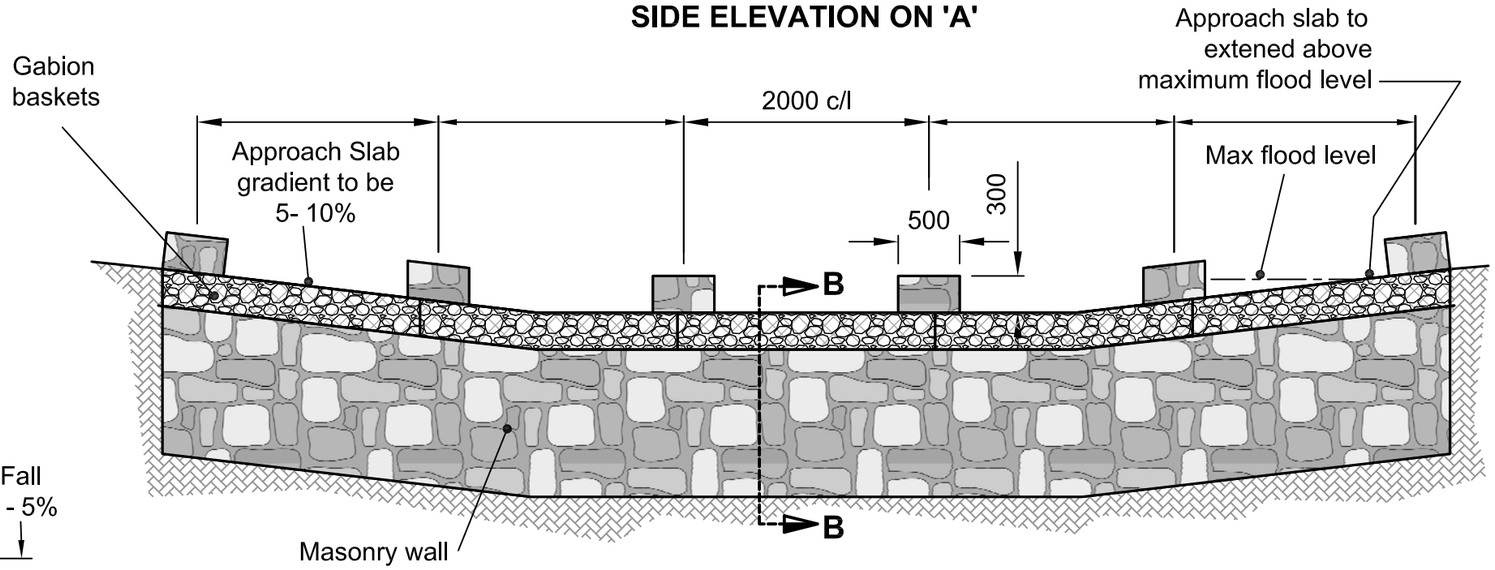
Pitched Stone Drift

Natural stone & gravel for occasional small and low velocity flows.

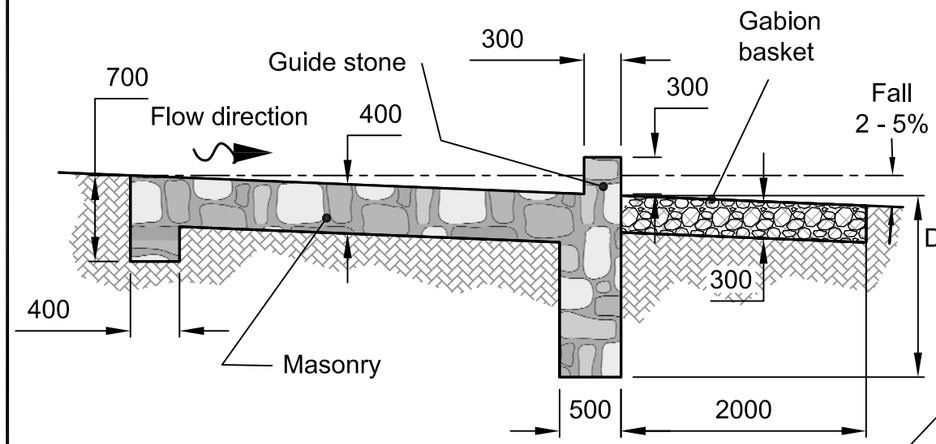
Scale: 1 : 50 (at A3)

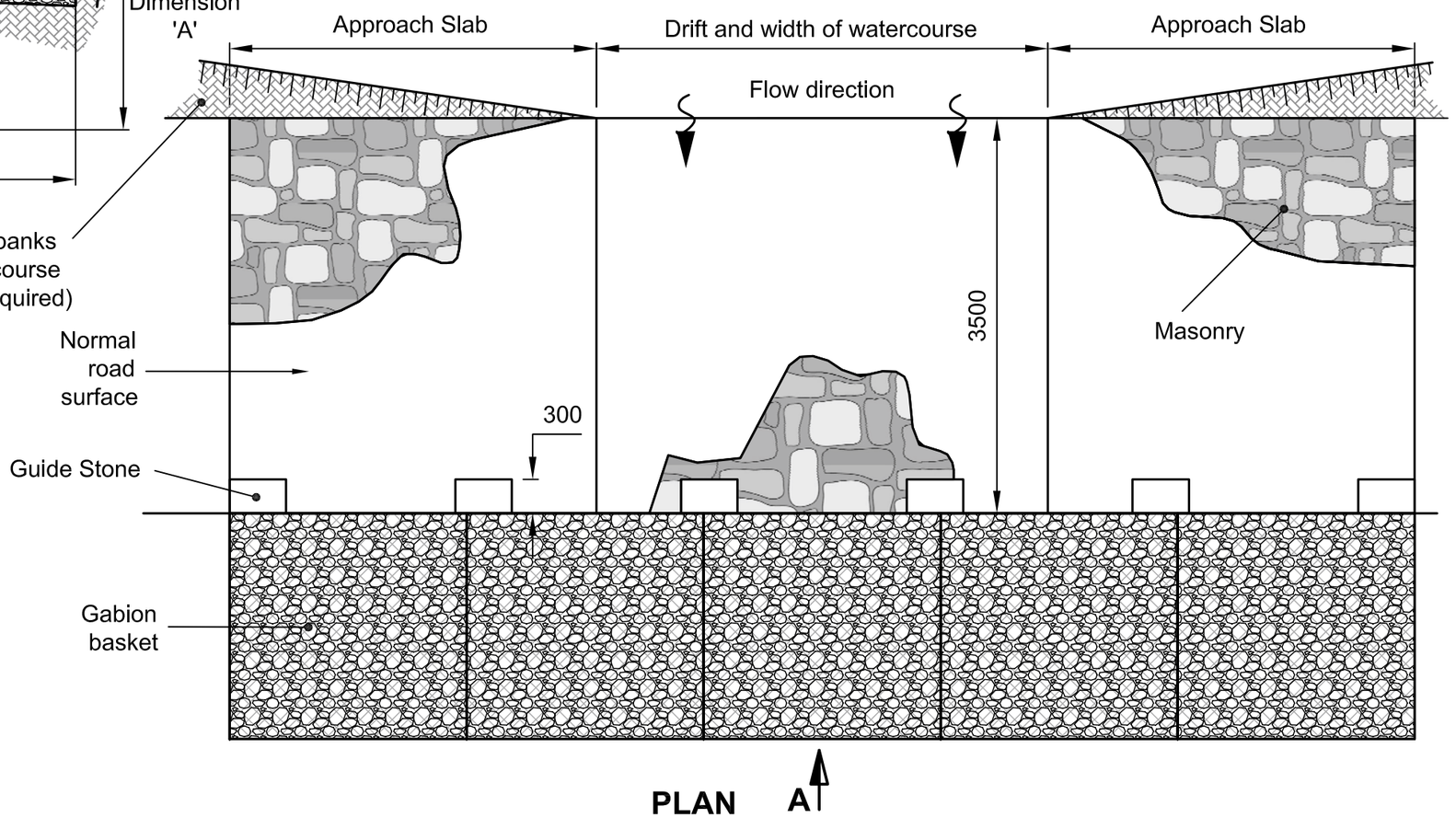
Drawing No: 1.2

SIDE ELEVATION ON 'A'



CROSS SECTION ON B-B





KEY

- Masonry
- Gabion baskets
- Firm foundation/ Existing ground

PLAN

A

NOTES: **(1)** All dimensions in mm. **(2)** Dimension 'A' - 1m - 1.5m depending on scour risk.
(3) Gabion downstream protection may be substituted by rip-rap. **(4)** Guide stone to be painted white.
(5) Drift warning sign to be placed on approaches 100m before drift.
(6) Maximum flood level to be 5 or 10 years flood depending on road importance. **(7)** Top of drift to be at existing stream bed level.
(8) Drift running width may be increased according to national standards.

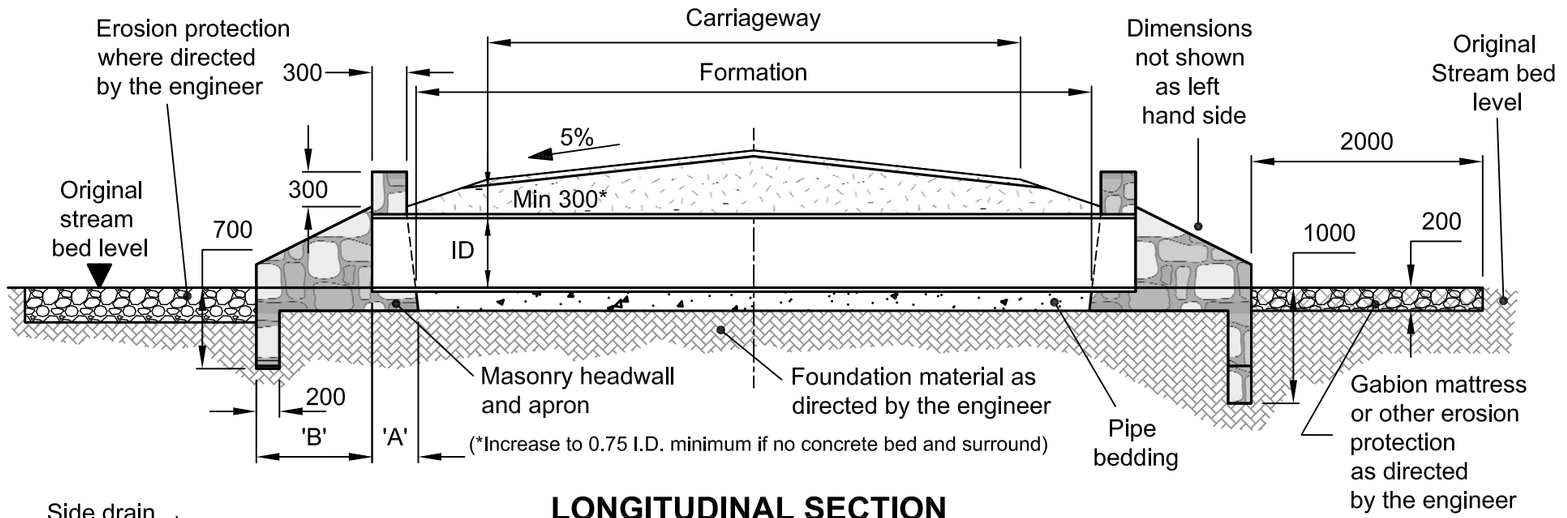
Low cost structures for Rural Roads

Masonry Drift

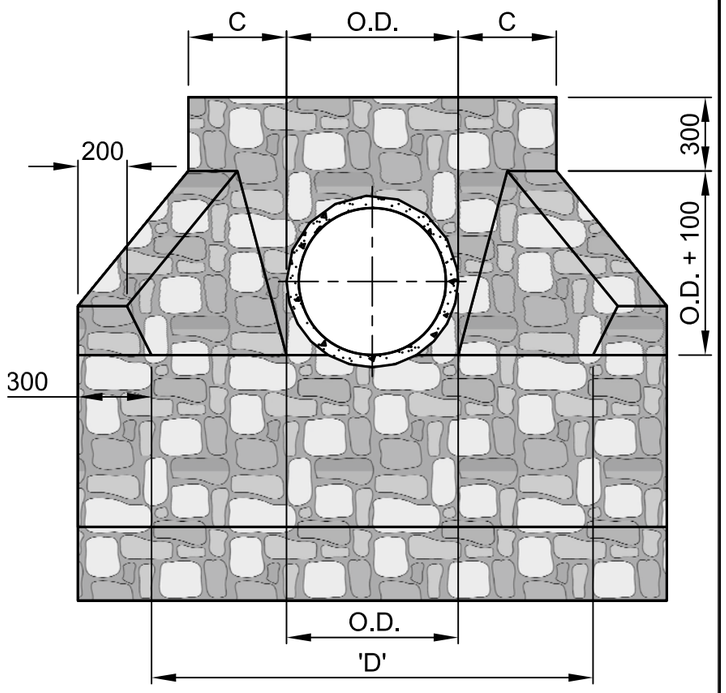
Cement bound natural stone, alternative solution to concrete.

Scale: 1 : 50 (at A3)

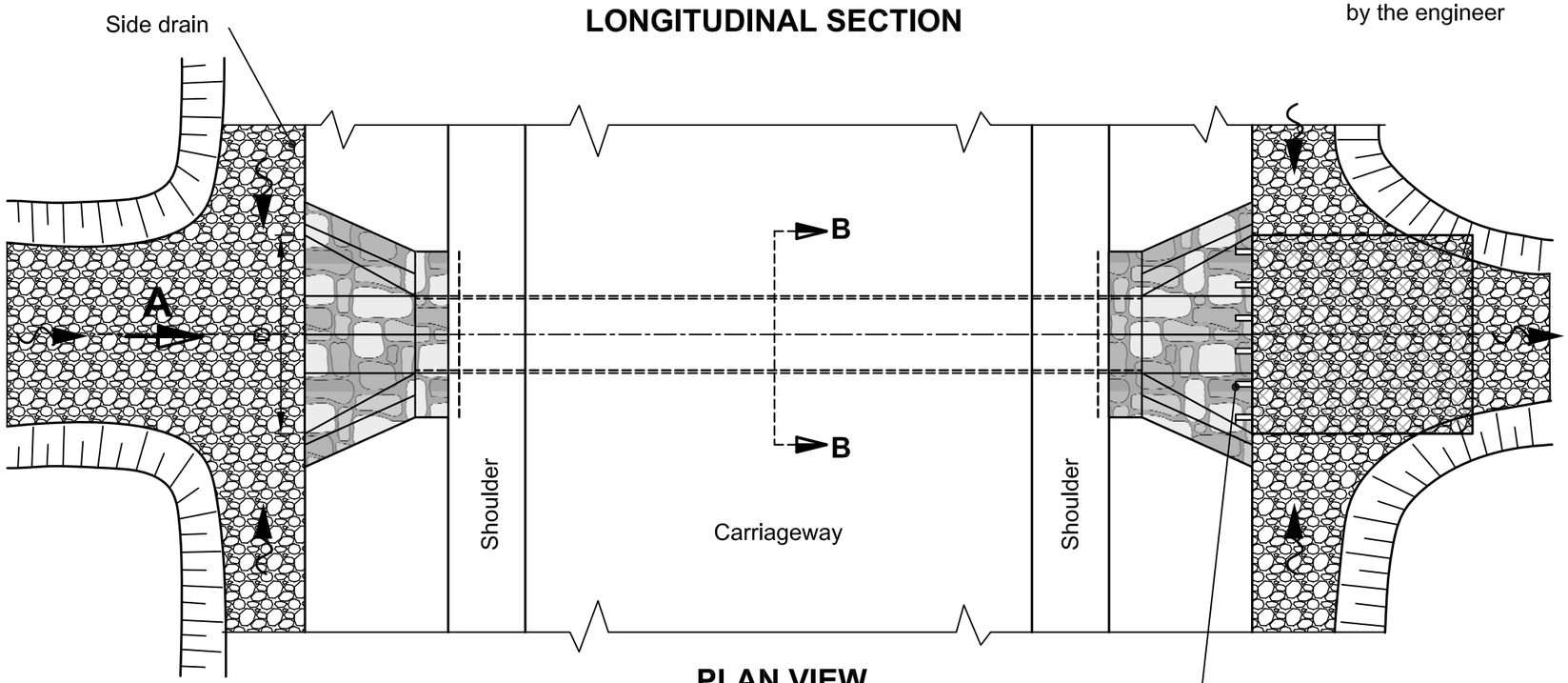
Drawing No: 1.3



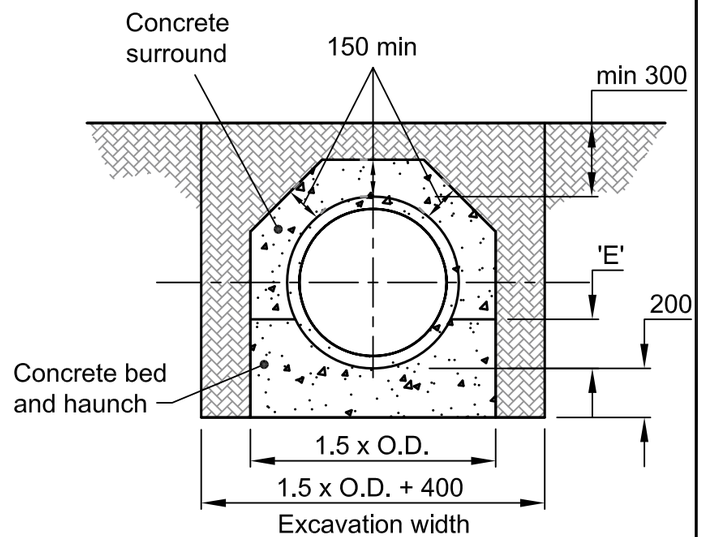
LONGITUDINAL SECTION



END ELEVATION ON 'A'
Scale 1:25



PLAN VIEW



CROSS SECTION ON B - B
Scale 1:25

KEY

- Concrete
- Masonry
- Gabion stone mattress
- Firm foundation/ Existing ground
- Road surface
- Rip-rap

Table of dimensions (mm)

Pipe Diameter	A	B	C	D	E
600	400	1000	400	1750	200
900	450	1630	500	2780	300
1200	500	2280	600	3830	400

NOTES: **(1)** All dimensions in mm. **(2)** O.D. - Outside Diameter, I.D. inside Diameter. **(3)** Pipes may consist of the following:
- plain concrete pipes with concrete surround 600
- reinforced concrete pipes with concrete bed and haunch
- cast in situ internally formed pipes of class 10 concrete of minimum 200mm thickness - refer to Drg. 2.3.
- corrugated metal pipes.
- timber stave pipe.

(4) Refer to section 8.5.4 for bedding and cover requirements of pipes.
(5) Arrangement shown for stream culvert. Relief culvert similar but without side drain downstream to culvert on high side of road.
(6) Culvert pipe invert slope - Min 2% Max 5%.

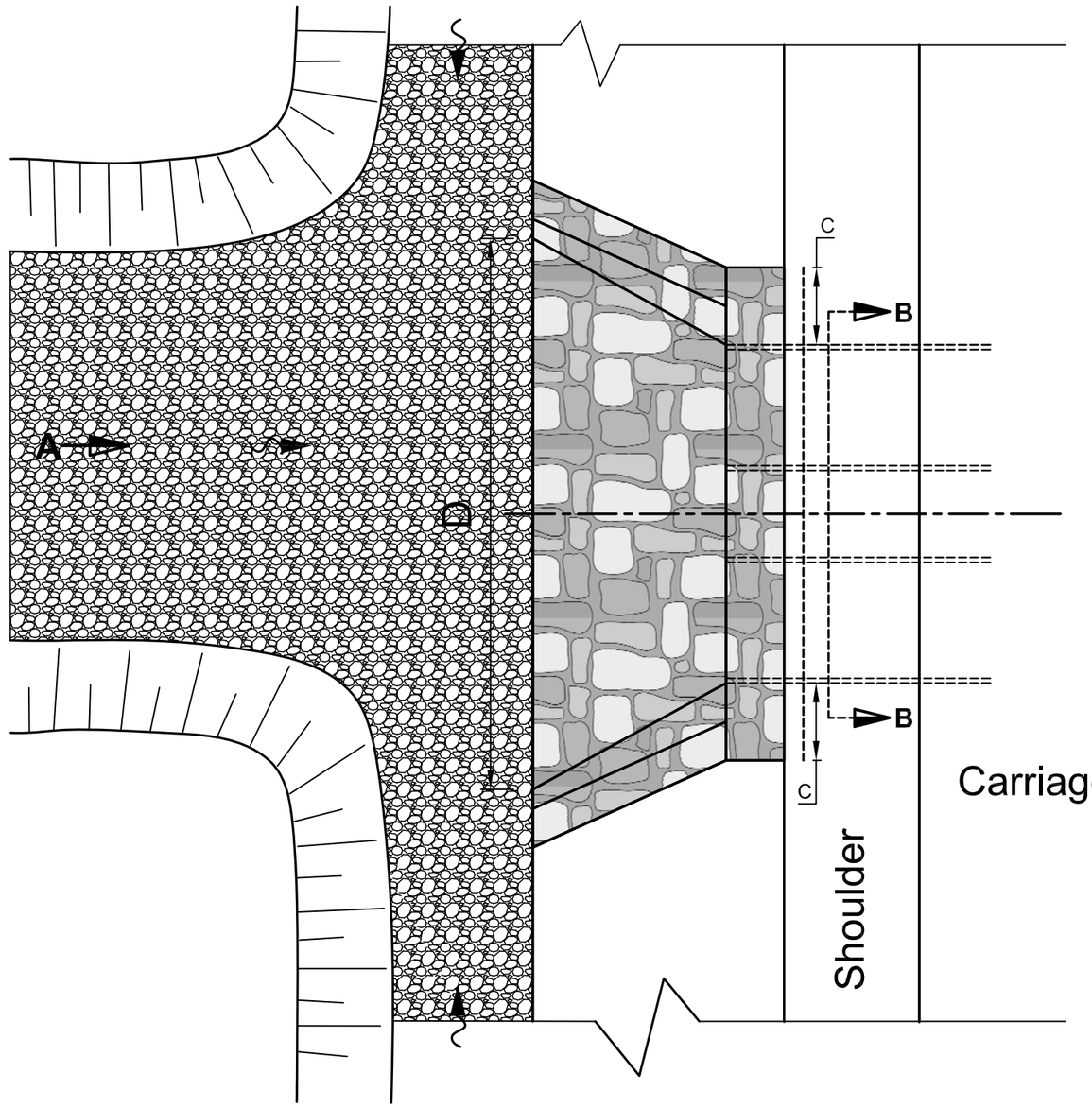
Low cost structures for Rural Roads

Single Pipe Culvert

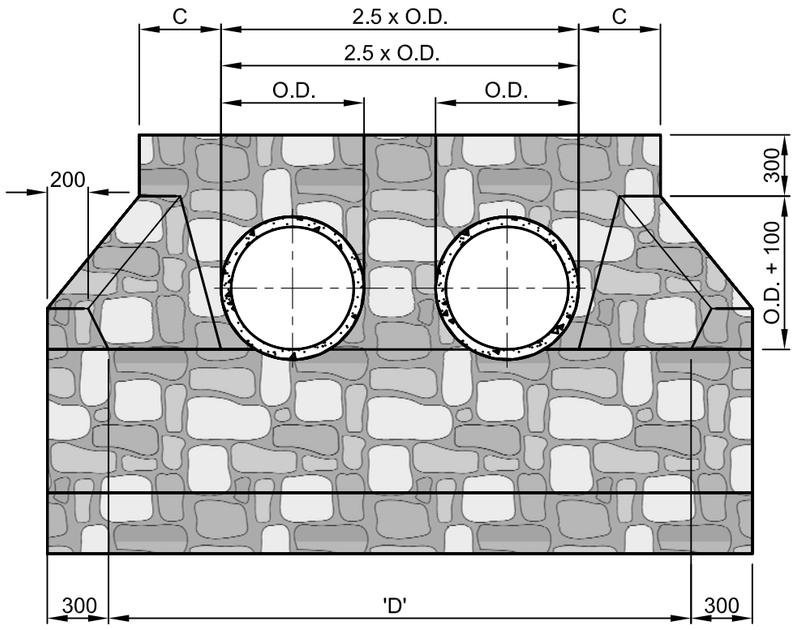
General culvert design for relief and stream culverts

Scale: 1 : 50 (at A3)

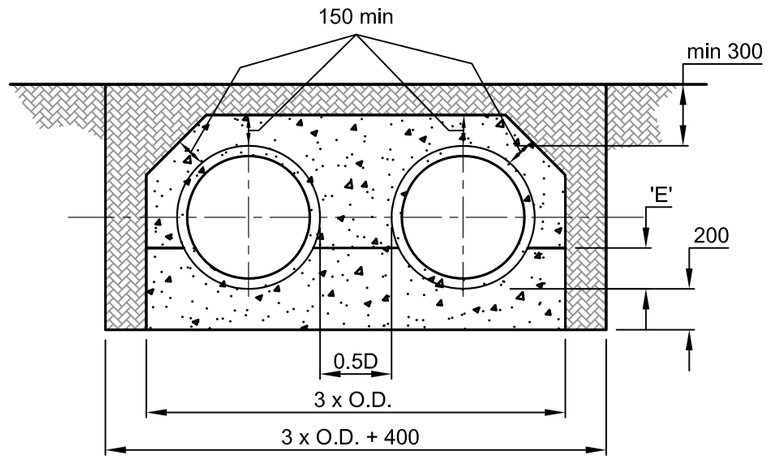
Drawing No: 2.1



PLAN VIEW



END ELEVATION ON A



CROSS SECTION ON B - B

KEY

Concrete
Masonry
Rip-rap
Firm foundation/ Existing ground

Table of dimensions (mm)

Pipe Diameter	A	B	C	D	E
600	400	1000	400	2500	200
900	450	1630	500	3880	300
1200	500	2280	600	5280	400

NOTES: **(1)** All dimensions in mm. **(2)** Refer to Drg. 2.1 for general culvert arrangement. **(3)** O.D. - Outside Diameter, I.D. inside Diameter. **(4)** Pipes may consist of the following: ● plain concrete pipes with concrete surround 600 ● reinforced concrete pipes with concrete bed and haunch ● cast in situ internally formed pipes of class 10 concrete of minimum 200mm thickness - refer to Drg. 2.3. ● corrugated metal pipes. ● timber stave pipe. **(5)** Refer to section 8.5.4 for bedding and cover requirements of pipes. **(6)** Arrangement shown for stream culvert. Relief culvert similar but without side drain downstream to culvert on high side of road. **(7)** Culvert pipe invert slope - Min 2% Max 5%.

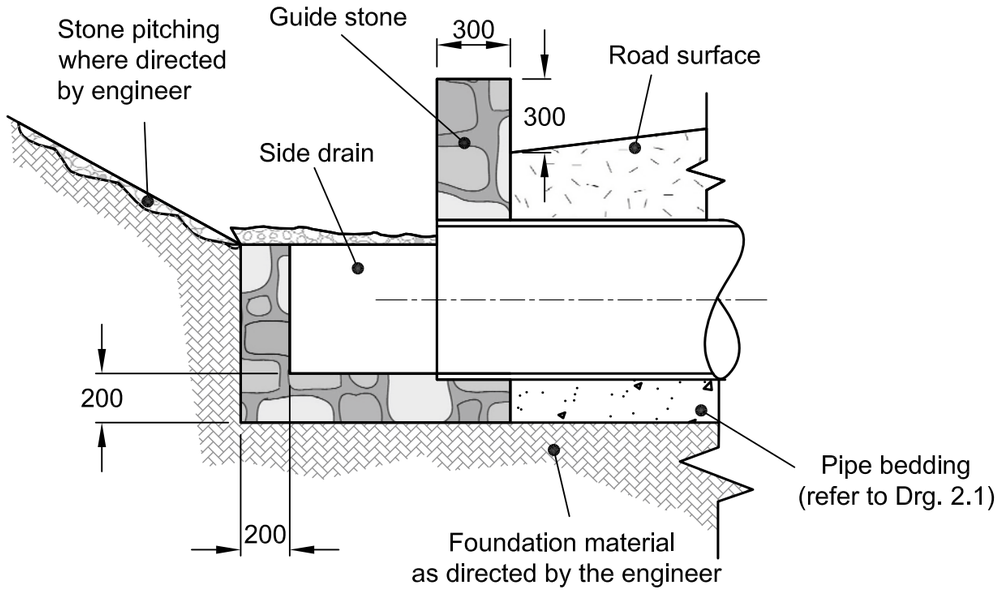
Low cost structures for Rural Roads

Culvert Alternative Arrangements

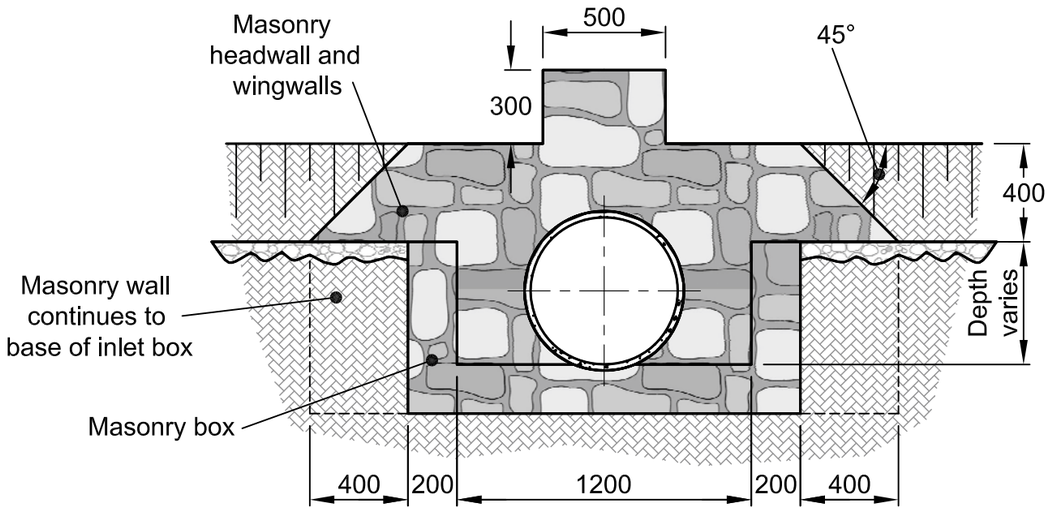
Twin barrel culvert - for high flow

Scale: 1 : 30 (at A3)

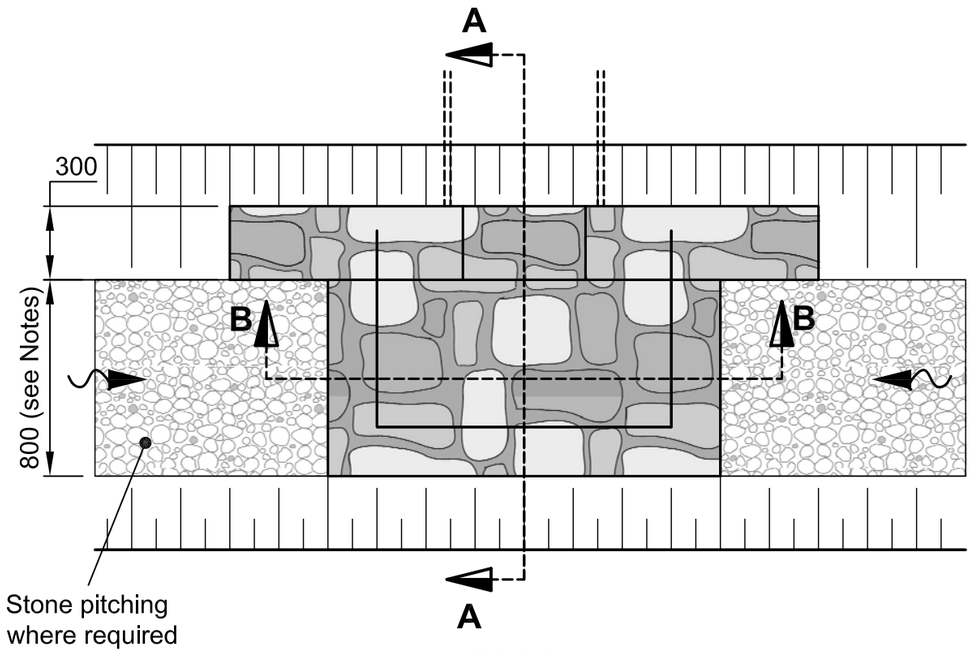
Drawing No: 2.2



CROSS SECTION ON A - A

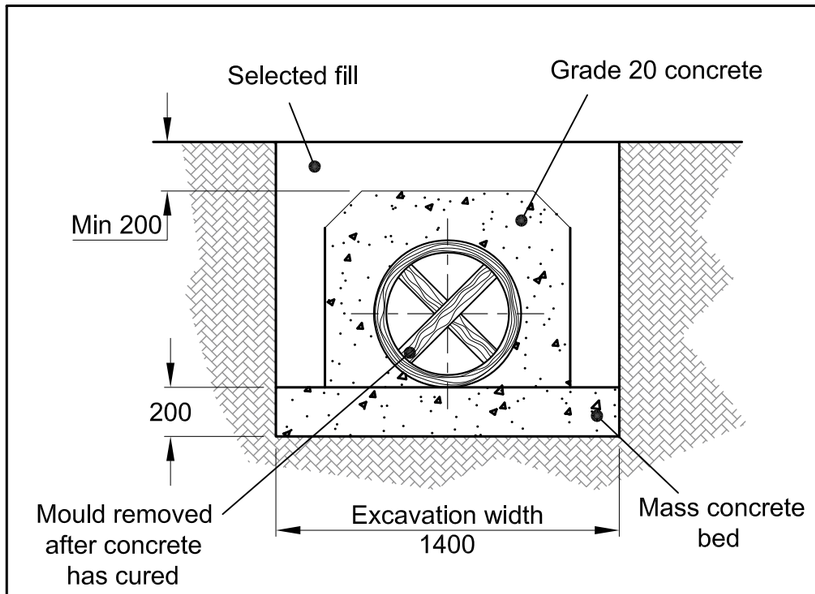


CROSS SECTION ON B - B



PLAN

600 mm diameter pipe drop inlet



Section through cast in situ 600mm diameter pipe

KEY

- Concrete
- Masonry
- Firm foundation/ Existing ground

NOTES:
(1) All dimensions in mm.
(2) On cast in situ pipes, the minimum thickness of concrete surround to be 200mm, and minimum cover above concrete to be 200mm.
(3) *width of drop inlet may be increased from 800mm according to width of side drains.
(4) Depth of drop inlet determined by site conditions.
(5) Refer to drawing 2.1 for general culvert arrangement.
(6) Culvert pipe invert slope - Min 2% Max 5%.

Low cost structures for Rural Roads

Culvert Alternative Arrangements

Drop inlet - for steeply sloping and flat ground, and cast in situ pipes

Scale: 1 : 25 (at A3)

Drawing No: 2.3