8 LOCAL ROAD DESIGN STANDARDS

8.1 Introduction

Road design standards and literature in South Africa generally do not address the type of rural Local Roads under consideration in this report and very little documented guidance is available to establish suitable standards for local conditions. Rural Local Roads of this type are often referred to as 'non-engineered' and are usually constructed without formal design drawings other than a typical cross-section and drainage standards, relying on the experience of the engineers and machine operators involved. Hence in order to establish design standards it is therefore necessary to return to basic principles and to focus on the primary objectives of the programme. The following issues need to be addressed in the development of appropriate standards:

- All weather accessibility
- Restricted budgets
- Labour enhanced construction and maintenance possibilities
- Limited maintenance
- Low traffic volumes
- To reach as many communities as possible.

The intention of this section of the report is thus to draw up guidelines based on local experience, addressing the above issues. These guidelines should not be seen as being prescriptive, but merely the first step in establishing standards which have an emphasis on accessibility and affordability, and which in due course may be modified as implementation proceeds. The guidelines are not meant to replace good engineering judgement but should assist in a more uniform approach to implementation.

8.2 Network Hierarchy

Historically, Community Access Roads in KwaZulu-Natal have not been recognised as forming an integral part of the Provincial road network, with the result that they were not funded by the road authorities. Their importance has nevertheless been highlighted over recent years. The need for all weather access is invariably voiced by rural communities as being of primary importance to their well-being and upliftment.

Local Roads are therefore the vital link between communities and the formal road network and while they may form the lowest level in the road hierarchy, they are just as important to the community as the recognised road network. In terms of the road network they are frequently characterised by their discontinuity i.e. 'the end of the road'. They function primarily as collector roads to the formal road network, servicing community facilities along the route.

The roads have frequently developed from tracks in the veld, which are generally not built to any formal geometric standard, nor do they have proper drainage. As difficulties arise with one track, so another is established which leads to a proliferation of tracks, and inevitably results in some degree of soil erosion and environmental damage.

It is therefore important that any road improvement be assessed and planned to meaningfully connect into the formal road network and that where possible, continuity is established to open up areas and to link up communities. This will assist in developing new markets and opportunities for communities that have previously been isolated from each other and from their rural centres.

"Local Roads may be defined as those rural roads which do not qualify as District or Main Roads, but provide access from a proclaimed road to public infrastructure such as schools, clinics and community facilities, or provide access to a settlement of a minimum of 50 persons or at least 5 homesteads."

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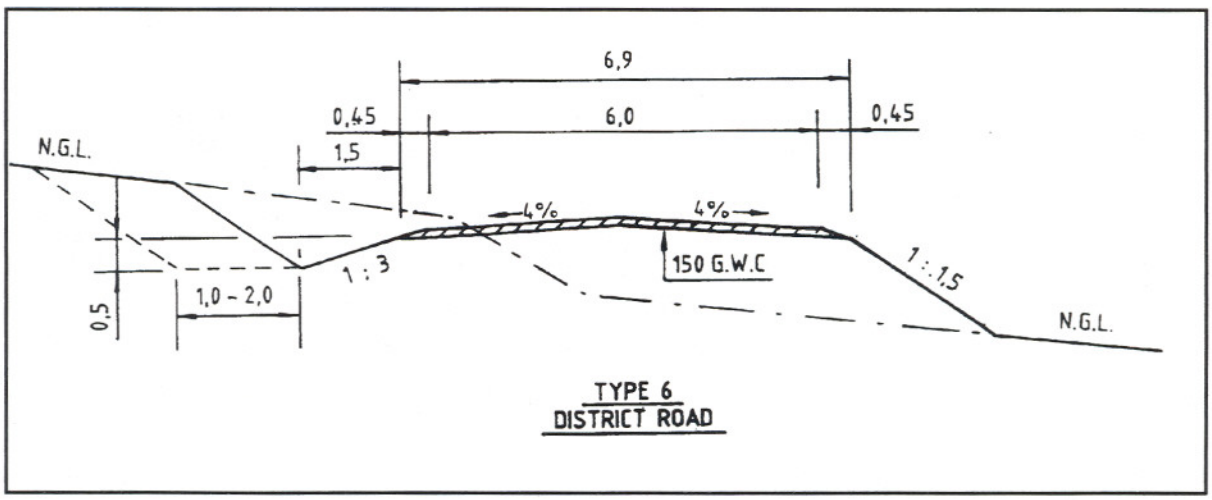
8.3 Traffic and Cross Section Standards

Traffic volumes are generally less than 30 vehicles per day on Local Roads due to low vehicle ownership and low economic activity in rural communities. The importance of a Local Road is therefore not necessarily a function of the volume of traffic. The importance lies more with the type of traffic using the route, whether it be public transport such as buses or taxis, or service providers such as mobile clinics, teachers or agricultural vehicles. An assessment of traffic should therefore not only focus on the volume of traffic, but also on facilities and population served by the road, although as traffic increases the traffic volume will become the more predominant factor. This would suggest that various classes of Local Road be considered.

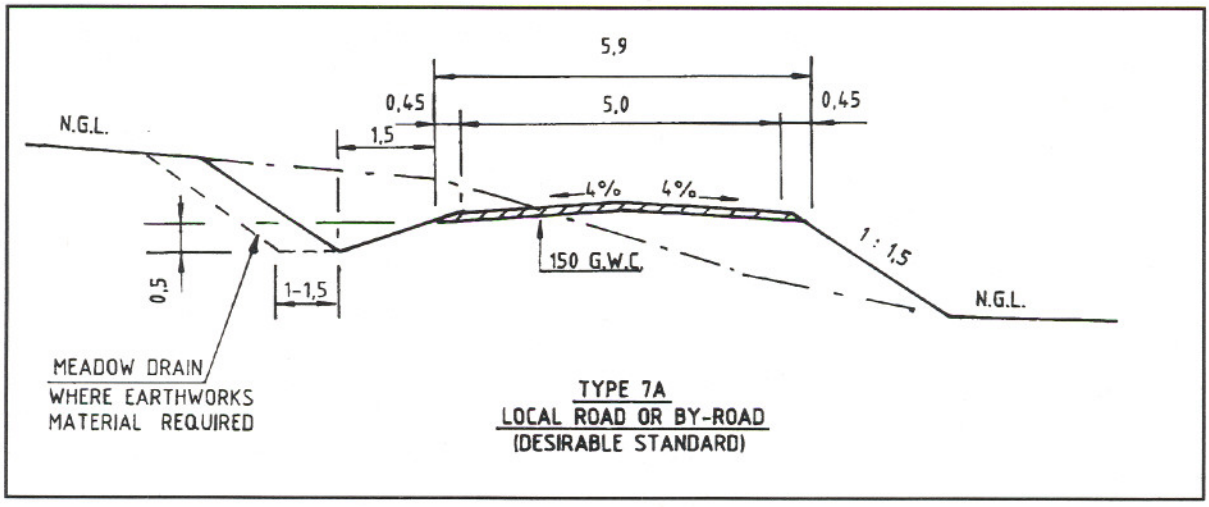
The following cross section standards are proposed for Types 6, 7A and 7B roads, and are compatible with present Departmental standards. The cross-sections are included in a set of drawings as presented in Figures 8.1 to 8.4 of dish crossing and concrete causeway details which are recommended for Community Access Roads.

(i) Type 6 District Road Standard



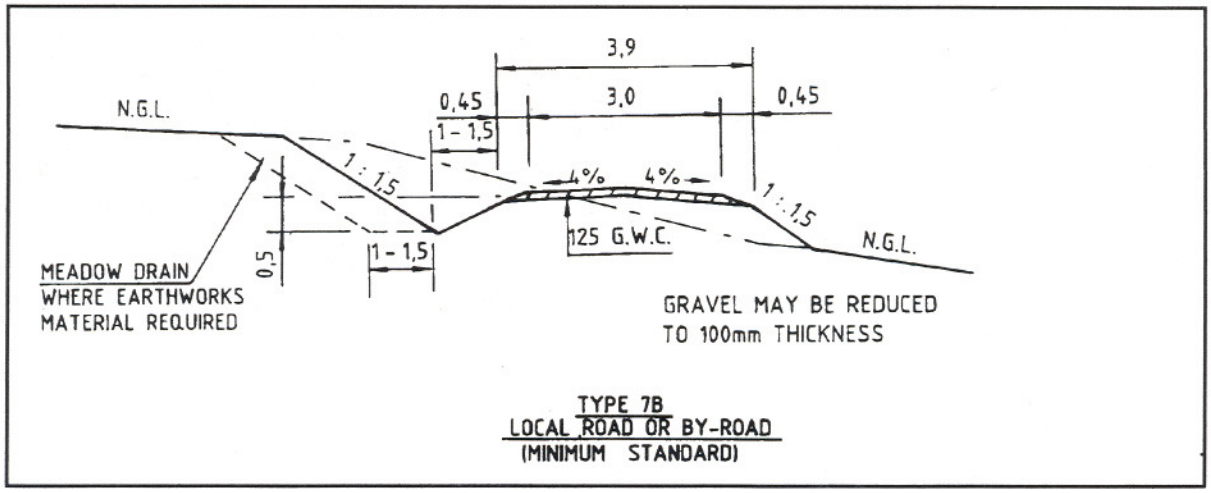
This standard is applicable where roads qualify for District Road status in terms of the proposed points system presented in Section 10.5 of this report. Where roads do not yet qualify for District Road status but are expected to qualify soon after construction, this standard should also be adopted.

(ii) Type 7A Local or By-Road Standard (Desirable Standard)



This standard is applicable to roads which are not likely to be proclaimed as District Roads in the foreseeable future, according to the points system, but merely serve as access to and between communities. It is expected that the majority of Local Roads will be constructed to this standard.

(iii) Type 7B Local or By-Road Standard (Minimum Standard)



In terrain of steep crossfall or where traffic volumes are expected to be low, consideration could be given to reducing a Type 7A cross section to a Type 7B cross

section as indicated below. This will bring about a saving in earthworks, drainage and gravelling costs and so allow a longer length of road to be constructed. Passing opportunities will need to be provided at regular intervals and widening will be necessary on sharp bends. Widths could alternate between a Type 7A and Type 7B cross section as prevailing conditions change.

8.4 Geometric Design

8.4.1 General

The horizontal and vertical alignment of Local Roads should generally follow the alignment of existing tracks, as suggested by the prevailing topography. Circular curves should nevertheless be properly set out and the intention should be to achieve balanced alignment parameters between vertical and horizontal alignments as are applied for higher order roads. The following guidelines are proposed as minimum standards although circumstances may dictate otherwise. Where they cannot be adhered to, other precautionary measures may have to be taken.

8.4.2 Earthworks

Earthworks should in general be kept to a minimum without compromising drainage requirements and side borrow is preferred to the hauling of earthworks.

8.4.3 Horizontal and Vertical Alignments

Where roads could become District Roads in the foreseeable future, they should be constructed to District Road standards, which is more or less to a 60 km/h design speed. An **average travelling speed** of 30 km/h is the acceptable norm for Local Roads. Minimum curve radii are proposed as follows:

Terrain Type	Radius (m)
Mountainous	15
Hilly	50
Rolling	90
Flat	130

Where possible, the following **minimum stopping sight distances** should be maintained for Local Roads. In the case of intersections, sharp curves or where pedestrians

make use of the road, they may have to be adjusted accordingly.

Terrain Type	Minimum Visibility (m)
Mountainous	35
Hilly	50
Rolling	70
Flat	90

Minimum radius horizontal curves should in general be avoided on or after crest vertical curves.

Gradients should preferably not exceed 14% and in no circumstances exceed 20%.

Where gradients in excess of 14% are unavoidable, consideration will need to be given to surfacing to avoid erosion and vehicle traction difficulties.

8.5 Drainage Requirements

Careful attention should be given to drainage requirements and they should in general not be compromised to achieve savings, as they invariably lead to erosion and high maintenance costs.

8.5.1 Road Drainage

The requirements of the Department's Betterment and Gravelling Manual should be consulted for the road drainage requirements. Where practical, however, dished crossings are preferred for the Type 7 roads as opposed to pipe crossings. Discharge points should nevertheless be as per the Manual.

For catchments larger than 3 hectares consideration may have to be given to piped crossings for safety reasons.

Typical details for dished crossings are included as Figures 8.2 and 8.3.

8.5.2 River and Stream Crossings

River and stream crossings should generally be constructed as concrete drifts at river/streambed level, with suitable cut-off walls upstream and downstream of the slab where they

are not cast directly onto rock. A typical detail can be seen in Figure 8.4.

The width of the crossing should be adequate for one lane of traffic only (i.e. 3m), with approach gradients preferably less than 8% where possible.

Where the base stream flow is expected to be deeper than 50mm over the width of the crossing for most of the year with flow velocities in excess of about 1 m/s, a vented crossing should be considered for safety reasons. Concrete bollards should be constructed on both sides of the crossing to demarcate the crossing and to indicate flow depth.

For larger rivers where a box culvert or bridge may be necessary, the Department's Bridge Engineer should be consulted.

8.6 Road Reserve

Where a road could qualify as a District Road, a 20-metre road reserve will have to be secured and the road aligned accordingly. Any difficulties with encroachment should be noted and the extent of the road reserve pointed out to the local community to avoid future development in the proposed road reserve. This could be done by means of painted boulders placed at the road reserve boundary.

For a Type 7B road an informal road reserve width of 10m is desirable.

8.7 Road Materials Requirements

(i) Earthworks

Where possible the insitu soil and soft rock materials should be used for earthworks and possibly also as a riding surface, provided the road is trafficable in wet weather.

In flatter areas the road should be raised 300 - 500mm above the surrounding terrain except that in areas of pure sand the road should not be raised.

(ii) Gravel Wearing Course

Where roads will shortly qualify for District Road status, a 150 mm gravel wearing course should be used. For lower order roads of Type 7 standard, the gravel wearing course could be reduced in thickness to between 125 and 100 mm, depending on conditions. Where the insitu material is adequate for all weather travel, no wearing course need be imported in order to save costs.

8.8 Community Liaison

Local communities should be advised of the standards proposed for their road(s) to avoid any misunderstanding i.e. road widths, overtopped causeways, realignments etc.

The status of land ownership along the route will need to be established, particularly where realignments are proposed away from the existing tracks. This may require written agreement from landowners or community leadership in the case of communal lands.

Borrowpits should preferably be finalised before the commencement of works, particularly where they are located on communal lands. To avoid any demands for royalty payments, written agreements from the community leadership should be arranged for in the case of community lands.

An open transparent manner should be adopted in matters affecting the communities and the local Rural Road Transport Forum needs to be regularly informed of progress. They should also be consulted on labour related issues where local labour is to be employed for the construction of the road. A project liaison committee could be considered for these purposes.

8.9 Conclusion

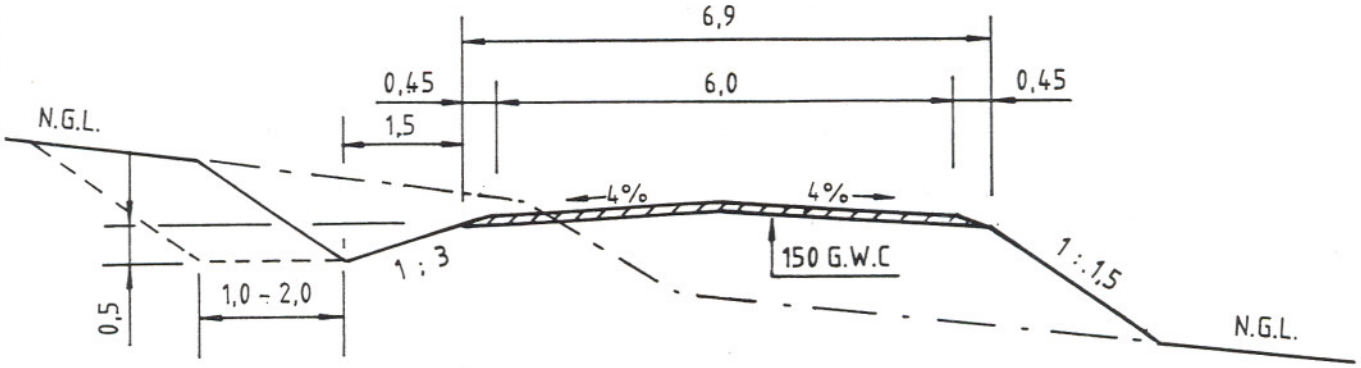
The guidelines proposed in this section for the design of Local Roads should be updated from time to time and they should ultimately develop into an extension of the Department's project manuals. Local Road standards should not be dealt with in isolation but should be compatible with Main Road and District Road standards.

rather than on high geometric standards. It is essential however that safety standards appropriate to low speed traffic be adopted, and this together with the cost implications will need to be closely monitored by the site staff involved.

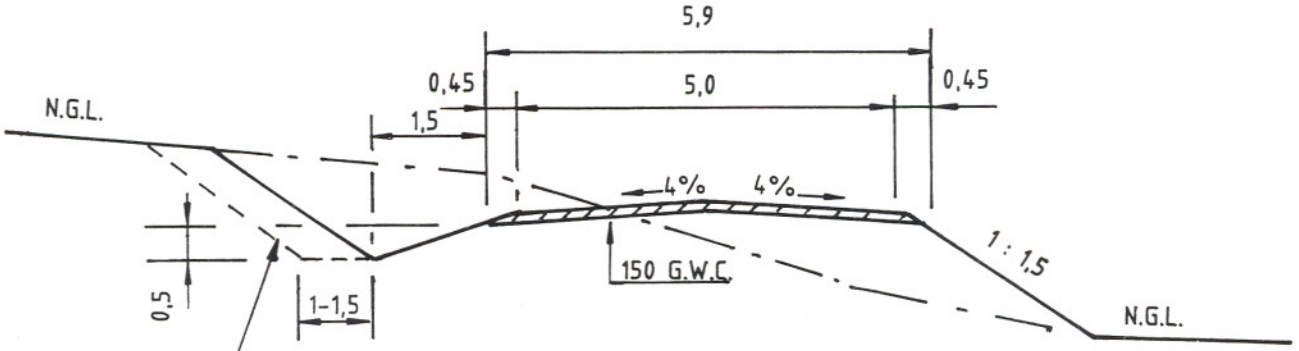
The objective is to provide all-weather access to as many communities as possible within the limited budgets, without compromising particularly on the provision of adequate stormwater drainage requirements, as deficiencies in this regard generally cause an increase in maintenance costs with possible serious adverse environmental implications.

References

1. KwaZulu-Natal Department of Transport, Maintenance Directorate. *"Betterment and Gravelling Manual"* October 1996.
2. KwaZulu-Natal Department of Transport, *"Standard Details".*
3. KwaZulu Department of Works. *"Tribal Road Upgrading and Maintenance Programme (TRUMP), Guide Manual, Section 3 : Technical Procedures, Draft 1994."*

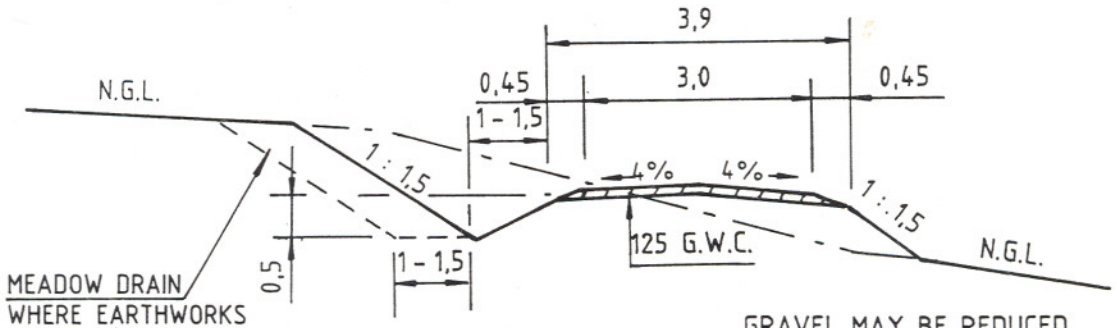


TYPE 6
DISTRICT ROAD



MEADOW DRAIN
WHERE EARTHWORKS
MATERIAL REQUIRED

TYPE 7A
LOCAL ROAD OR BY-ROAD
(DESIRABLE STANDARD)



MEADOW DRAIN
WHERE EARTHWORKS
MATERIAL REQUIRED

GRAVEL MAY BE REDUCED
TO 100mm THICKNESS

TYPE 7B
LOCAL ROAD OR BY-ROAD
(MINIMUM STANDARD)

stewart scott incorporated CONSULTING ENGINEERS

APPROVED :

COMMUNITY ACCESS ROADS

PROJ./DWG. TITLE

TYPICAL CROSS SECTIONS

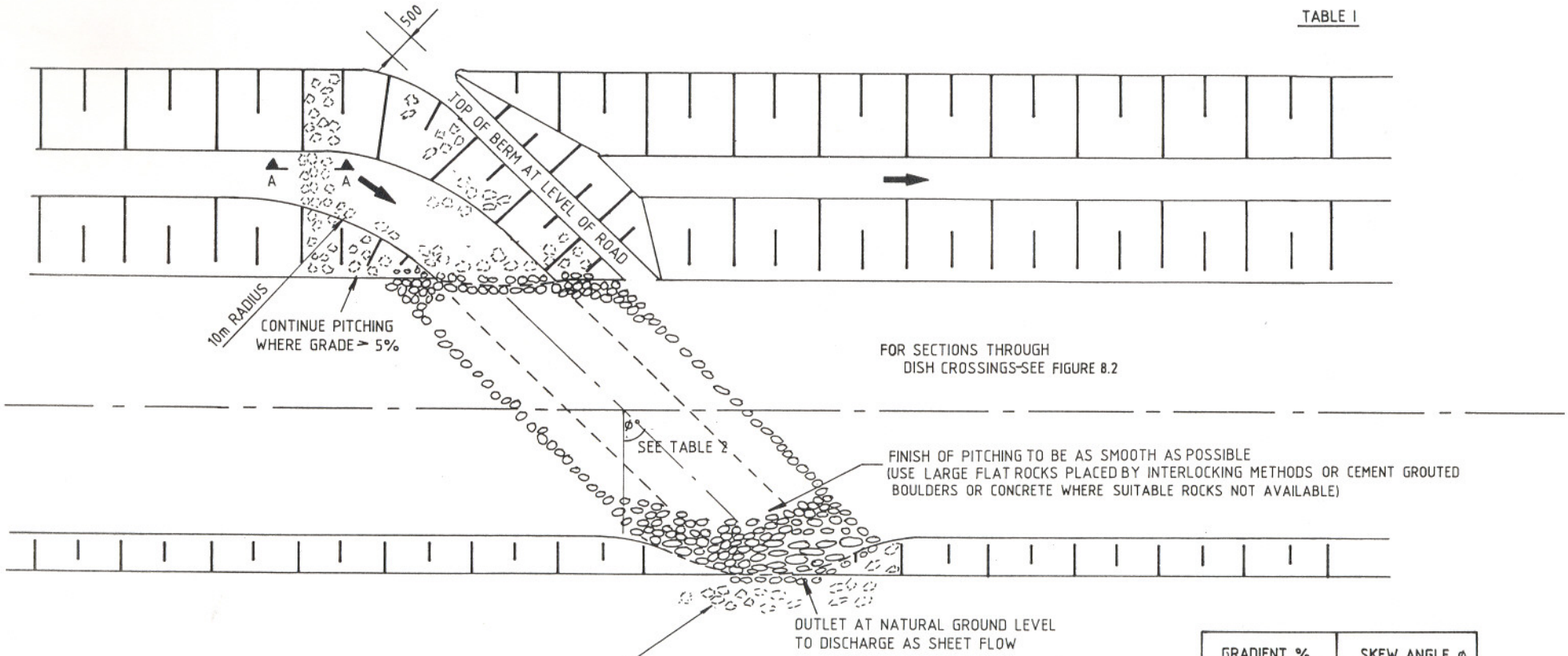
DRAWN D.E.L.	DATE OCT 1996
CHECKED M.U.	SCALE 1:100
APPROVED	PROJ. No. TA 130929

FIGURE 8.1

REV.

ROAD GRADIENT %	0 - 1	1 - 3	3 - 5	5 - 7	7 - 10	> 10
MAX. DISTANCE BETWEEN CROSSINGS m	300	200	150	100	80	50

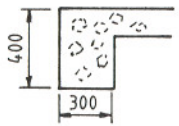
TABLE 1



GRADIENT %	SKEW ANGLE ø
0 - 1	0°
1 - 3	20°
3 - 5	30°
5 - 10	40°
10	50°

TABLE 2

NOTES :
1. DISH CROSSINGS TO BE PROVIDED FOR CATCHMENT AREAS LESS THAN 10ha
2. SPACING OF DISH CROSSINGS-SEE TABLE 1



SECTION A - A
CUT OFF WALL WHERE GRADE > 5%

No.	REFERENCE DRAWINGS

REVISIONS	DATE	CHKD	APPRV
ONLY REVISIONS MARKED THUS △ ARE VALID			

stewart scott incorporated CONSULTING ENGINEERS

APPROVED :

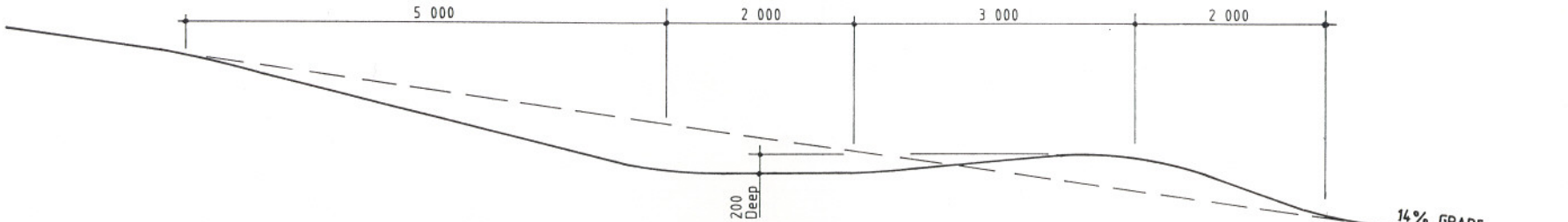
COMMUNITY ACCESS ROADS

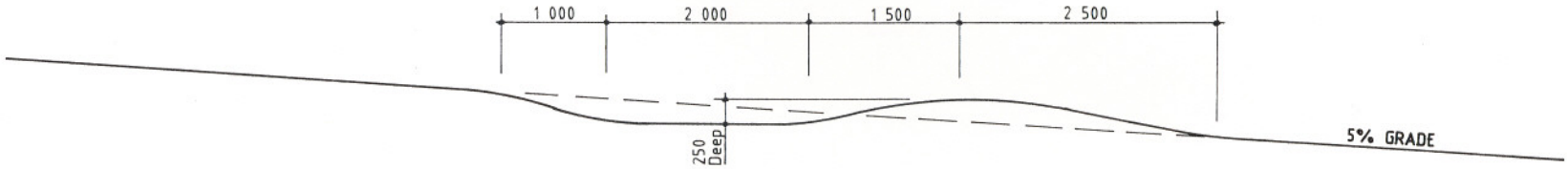
PROJ./DWG. TITLE

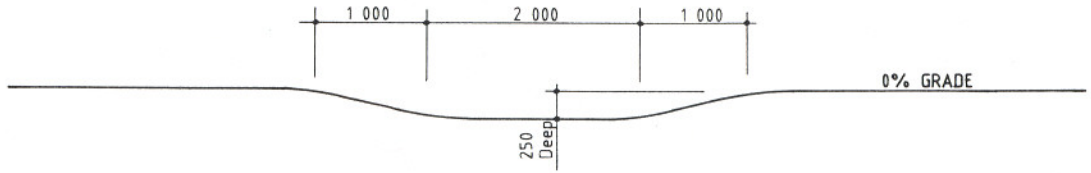
DISH CROSSING DETAIL

DRAWN	DATE
L.V.N.	10/10/96
CHECKED	SCALE
APPROVED	PROJ. No. TA 130929

FIGURE 8.2 REV. △







No.	REFERENCE DRAWINGS

REVISIONS	DATE	CHKD	APPRV
ONLY REVISIONS MARKED THUS △ ARE VALID			

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APPROVED

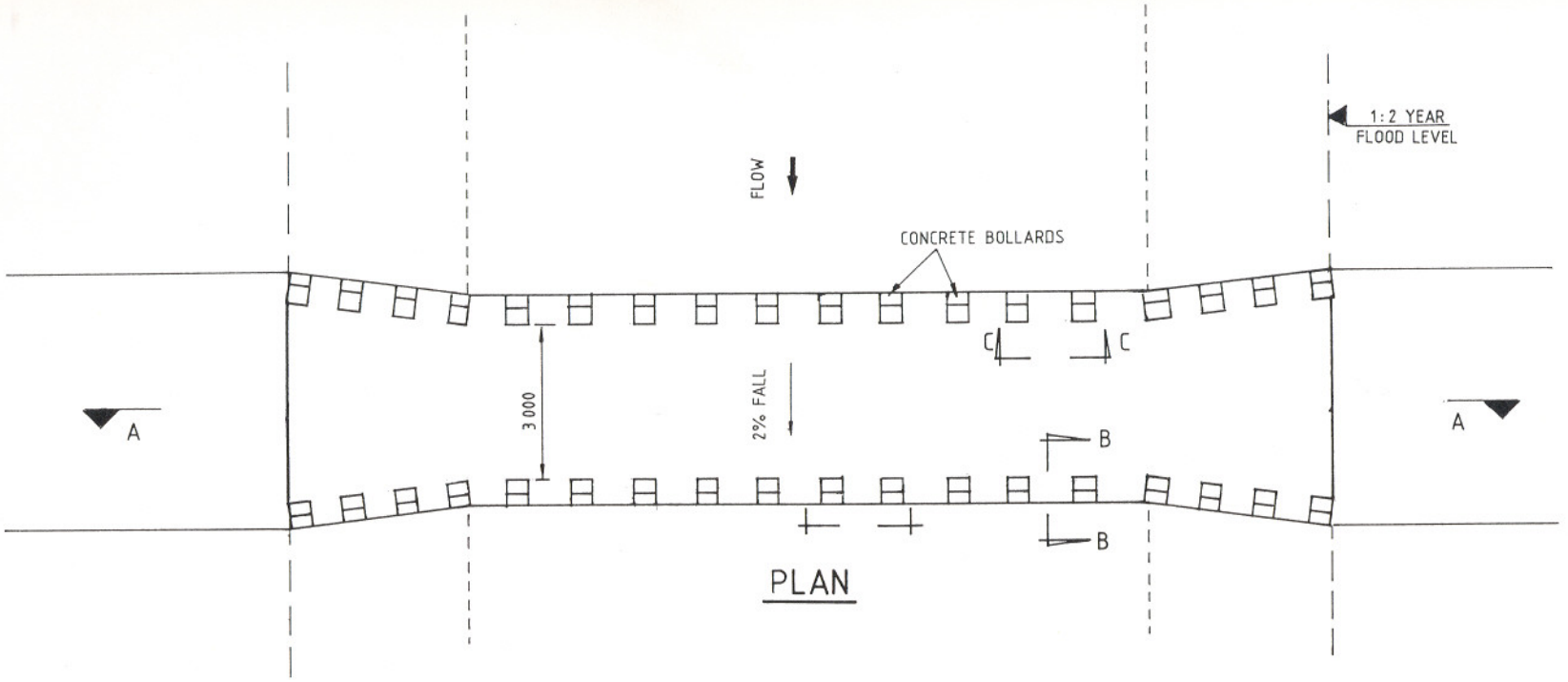
COMMUNITY ACCESS ROADS

PROJ./DWG. TITLE

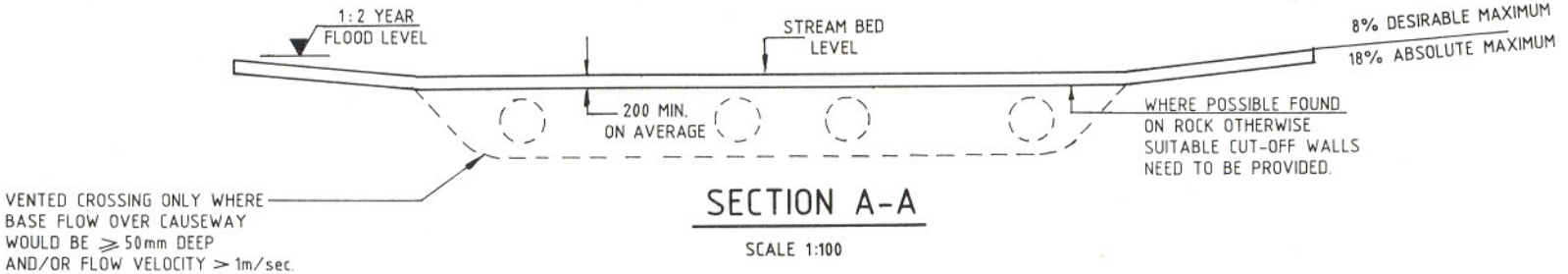
DISH CROSSING
DETAILS OF SELECTIVE CROSS SECTIONS

DRAWN	DATE
D.E.L.	OCT. 1996
CHECKED	SCALE
M.U.	1:100
APPROVED	PROJ. No.
	TA 130929

FIGURE 8.3 REV △

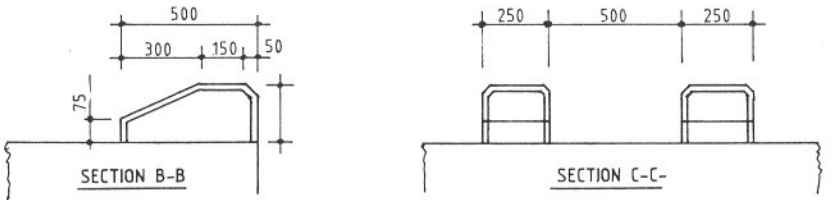


PLAN



SECTION A-A

SCALE 1:100



BOLLARD DETAILS

SCALE 1:20

No.	REFERENCE DRAWINGS	REVISIONS	DATE	CHKD	APPRV	stewart scott Incorporated CONSULTING ENGINEERS	COMMUNITY ACCESS ROADS
		ONLY REVISIONS MARKED THUS △ ARE VALID				APPROVED :	PROJ./DWG. TITLE: CONCRETE CAUSEWAY DETAILS

DRAWN L.V.N.	DATE 25/10/96
CHECKED	SCALE AS INDICATED
APPROVED	PROJ. No. TA 130929

FIGURE 8.4 REV △

REF. 261