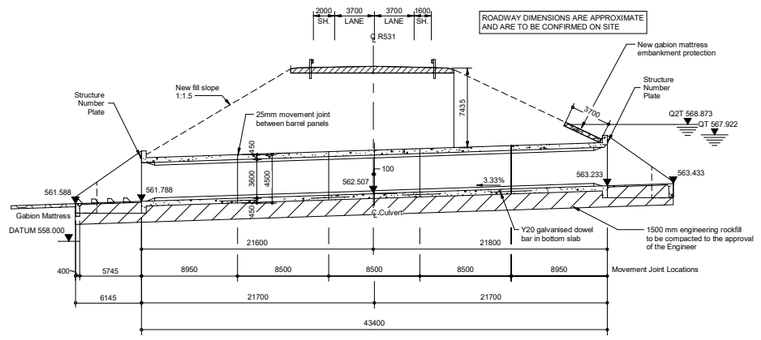
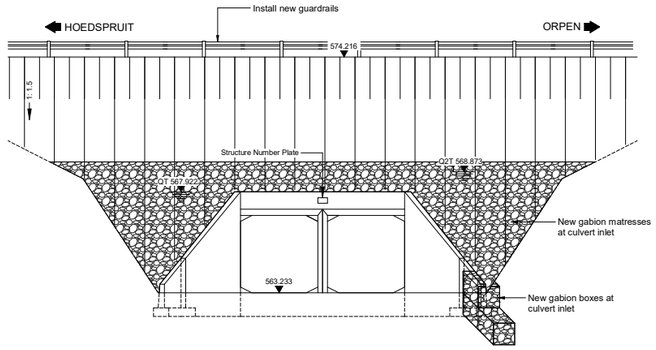
Note:
All dimensions to be checked on site before any work is put in hand.
Refer any discrepancies to the Engineer.



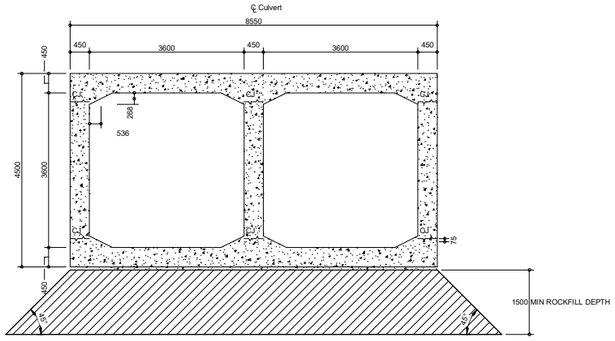
CULVERT CENTRELINE SECTION

1 : 200



UPSTREAM ELEVATION

1 : 100

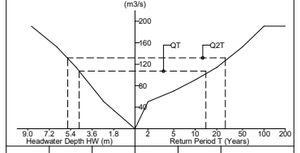


BARREL SECTION

1 : 50

SUMMARY OF HYDROLOGY, HYDRAULIC AND GEOMETRIC DATA

Flood calculation method: Alternative Rational 1
Catchment area A: 10.60 km2
Longest collector: 5.71 km
10-85 Height difference: 82 m
SDF Basin #
MAP: 951 mm
Tc: 1.16 h
Design Road Class: 3
Slope at structure: 3.33%
Natural design flood level (no culvert): 565.17 m
Natural design flow depth (no culvert): 1935 mm
Natural design flow velocity (no culvert): 4.0 m/s
Indicator flood Q20: 114.0 m3/s
Design flood return period T: 15 years
Inlet control governs hydraulic sizing
QT, Design flood elevation: 567.92 m
Q2T, flood elevation: 568.87 m
Shoulder breakpoint elevation: 574.22 m
Shoulder Break Point is dictated by road geometry

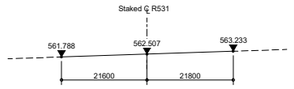


T (Years)	Q (m3/s)	HW (m)	Flood Elevation (m)	Maximum Velocity (m/s)	Exit Conditions
2	50.0	2.626	565.859	5.8	Erodible material
5	69.9	3.345	566.578	6.6	
10	90.7	4.098	567.331	7.3	
15	107.1	4.689	567.922	7.8	
20	114.0	4.940	568.173	8.0	Provide gabion mattresses downstream of apron slab
30	131.8	5.640	568.873	8.4	
50	152.1	6.564	569.797	9.0	
100	190.9	8.689	571.922	9.8	
200	190.9	8.689	571.922	9.8	

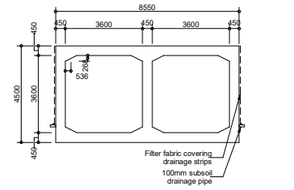
RMF = 326.0 m3/s ($100.0\ A^{0.500}$) K = 5.0

X - point data:
Skew = 1.5°
Distance = 6.940 km

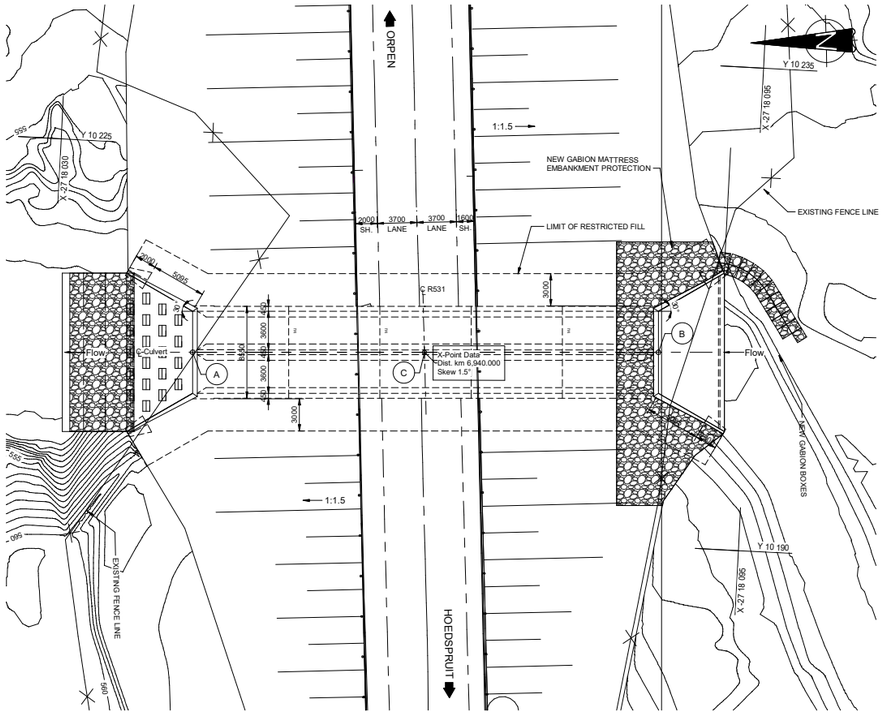
PLAN



CULVERT INVERT PROFILE



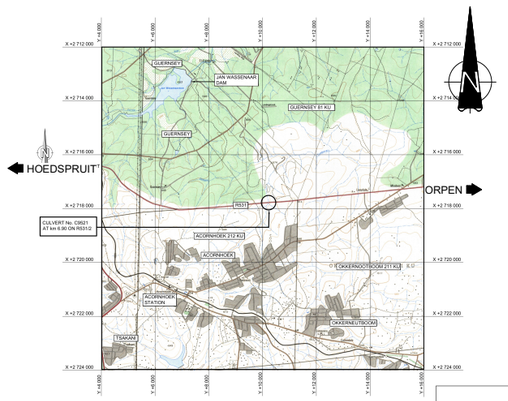
TYPICAL BARREL SECTION



PLAN

1 : 200

SETTING OUT (WGS84 Lo XX°...		
Point	X	Y
A	10,206	-2,718,043.26
B	10,208	-2,718,086.61
C	10,207	-2,718,064.83



LOCALITY PLAN

1 : 50000

DESIGN NOTES & DATA

1. **Design**
Designed in accordance with the Department of Transport's Design Manual for Standard Box Culverts and SANRAL's Code of Procedure.

2. **Loading**
The loading is in accordance with TMH 7 : Parts 1 & 2 : 1981 (Revised December 1988). The following loading and design variables have been used:
2.1 Live Load : NA ; NB36 Traffic Loading
2.2 Dead Load : Reinforced Concrete - 25.5 kN/m³
2.3 Earth Pressure behind Earwing & Barrel Walls based on 'Coulomb' theory
Density of soil 1885 kg/m³
Angle of internal friction 30°
2.4 Saturation of fill not envisaged.
2.5 Design fill height: 8.000 m
2.6 Assumed settlement condition r/sdp = 0.0
2.7 Barrel checked for Geostatic Loads.

3. **Design Parameters**
3.1 Young's Modulus of Elasticity
Concrete (short term)
In accordance with table 3 of BS 5400 : 1984
Reinforcing Steel - 210 GPa
3.2 Co-efficient of thermal expansion 1.2 x 10- /°C

4. **Characteristic Strength of Materials**
4.1 Concrete (f'cu)
Blinding C12/15-20
Barrel & Earwalls D25/30-XC4(100)-20
Wingwalls & Apron Slabs D25/30-XC4(100)-20
4.2 Steel Bar Reinforcement (fy) (in accordance with SANS-920-2011
Hot rolled high-yield-stress deformed bars (Y - bars) 450 MPa
Hot rolled mild steel bars of round cross section (R - bars) 250 MPa
Reinforcement shall be bent in accordance with SANS-282 Edition 6.

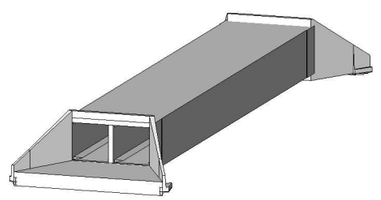
5. **General Notes**
5.1 Surface Finishes
5.1.1 Formed Surfaces
Concealed surfaces Class F1
Exposed surfaces Class F2
5.1.2 Unformed Surfaces
Top of barrel Class U1
Top of walls, invert of barrel & apron slab Class U2
5.2 All visable sharp corners shall be chamfered to 20mm x 20mm.
5.3 Concrete cover to reinforcement shall be 40mm.
5.4 Foundation Conditions
5.4.1 Type of founding material: Engineered rockfill
5.4.2 Permissible bearing pressure: 250 kPa
5.4.3 Design bearing pressure: 150 kPa
5.4.4 Anticipated settlement: mm
5.4.5 Contractor to dig 2 trial pits which are to be inspected by a Geotechnical Engineer to confirm founding conditions. A 1500mm thick rockfill layer has been included in the contract as a precaution.
5.5 Drainage strips and drainage pipes:
i) Drainage strips: 300 mm wide filter elements secured to back face of structure at 45 deg. slope as detailed.
ii) Drainage pipes: 65mm dia. perforated drainage pipes wrapped in geotextile as detailed.

6. **Method of Analysis**
The culvert has been analysed elastically using slope-deflection equations for non-prismatic sections.

7. **Construction Safety**
7.1 The Contractor shall observe all safety requirements of the construction regulations of the OHS Act No. 85 of 1993.
7.2 Special attention shall be paid to:
- Lateral support of excavations exceeding 1.5m in depth.
- Protection around open excavations.
- Fall protection from all components during erection and concreting.

8. **Culvert No.**
The STC number plate to be Type 1 with 2 plates positioned on the parapet wall at both inlet and outlet. Two additional plates to be attached to a mounting block behind the guard rail.

PAVEMENT CROSS-SECTION				
Layer No.	Description	Material Type	COTO Reference
1	50mm Surfacing Layer	Sand skeletal (Continuously graded) mix, Level II, 14mm NMPS, PG58E-22	Chapter 9
2	60mm Base Layer	Sand skeletal (Continuously graded) mix, Level II, 14mm NMPS, PG58E-22	Chapter 9
3	150mm Upper Subbase Layer	C4 (G5A)	Chapter 4 and 5
4	150mm Lower Subbase Layer	C4 (G5A)	Chapter 4 and 5
5	150mm Upper Selected Subgrade Layer	G6	Chapter 4 and 5
6	150mm Lower Selected Subgrade Layer	G7	Chapter 4 and 5



No.	DATE	REVISION	CONSULT. ENG.

CONSTRUCTION RECORD (AS-BUILT)
WORKS CONTRACT ENGINEER
Name :
Prof. Reg. No. :
Date :
SANRAL PROJECT MANAGER
Name :
Date :

DESIGNED BY
NAME
Prof. Reg. No.
CHECKED BY
NAME
Prof. Reg. No.
DRAWN BY
NAME

CONSULTANT APPROVAL
Name :
Prof. Reg. No. :
Date :

HEAD OFFICE
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Pretoria
0184

PO Box 415
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South Africa

Tel: (012) 844 8000

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Reg No. 1998/009584/30
BUILDING SOUTH AFRICA THROUGH BETTER ROADS

NORTHERN REGION
38 Ida Street
Menlo Park
Pretoria
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Private Bag X17
Lynnwood Ridge
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Tel: (012) 426 6200

ACCEPTANCE
THIS ACCEPTANCE IS FOR PROCEDURAL AND ADMINISTRATIVE REVIEW PURPOSES ONLY AND DOES NOT ATTRACT LEGAL LIABILITY OR LIABILITY OF ANY KIND FROM WHATSOEVER CAUSE OR HOWEVER ARISING.
for the SA NATIONAL ROADS AGENCY SOC LTD.
Date:

PROJECT DESCRIPTION
R531 SECTION 2 - EMERGENCY REPAIR OF DAMAGED STEEL ARMCO CULVERT AT KM 6.9 AND SINKHOLE AT KM 11.4
MAJOR CULVERT C9521 AT KM 6.94
GENERAL ARRANGEMENT

SCALE :
SHEET 12 OF

PROJECT NUMBER	N.XXXX	
DRAWING LOCATION DATA	START	END
ROUTE	R531	R531
SECTION	2	2
DRAWING km DISTANCE	6.94	6.94
DRAWING TYPE	STRUCTURES - CULVERTS	
BRIDGE/STRUCTURE No.		
CONSULTANT DRAWING No.	G156-07-6000/01	VER
SANRAL DOCUMENT #		

SANRAL TITLE BLOCK #1648234\(DWG/PDF) VERSION V1.1.1