

# ROAD DEVELOPMENT AGENCY

P. O. BOX 50003 LUSAKA



## Trial Section on Low Volume Roads T002-Waitwika-D001

**Design, Construction Supervision and Baseline Monitoring  
of Trial Sections on Low Volume Sealed Roads in Zambia**

IN MUCHINGA PROVINCE

### **DRAWINGS**

**JANUARY 2018**



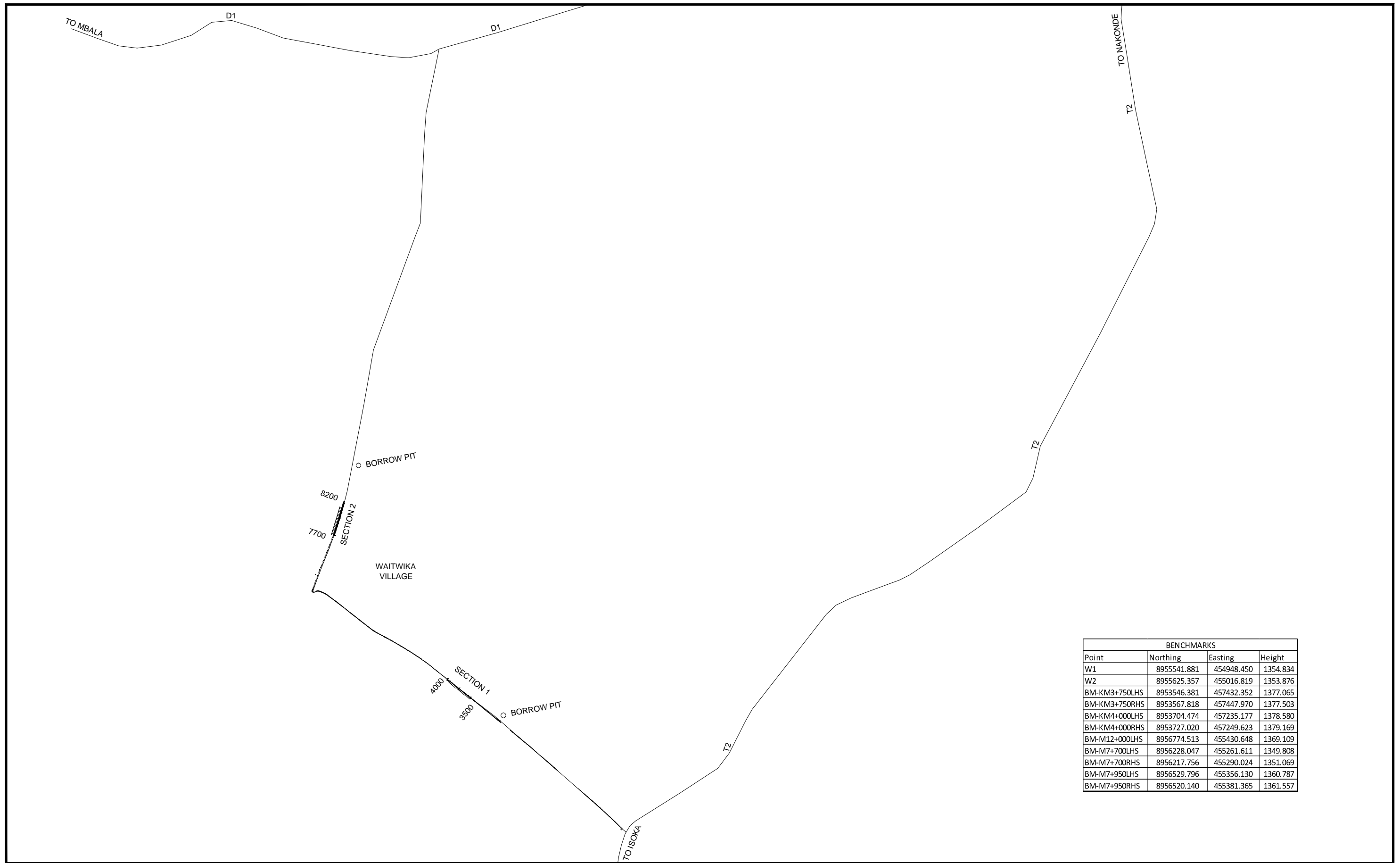
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## Trial Section on Low Volume Roads (T002-Waitwika-D001)

### LIST OF DRAWINGS

Title	Drg No	Revision	Size
<b>Overview- Location plan</b>	170308-CI-001	0	A3
<b>SECTION 1</b>			
Long Section -Section 1	170308-CI-100	B	A3
Typical Cross Section - Section 1	170308-CI-102	0	A3
Cross Section at 25m Intervals - Section 1 (Sheet 1 of 4)	170308-CI-103	0	A3
Cross Section at 25m Intervals - Section 1 (Sheet 2 of 4)	170308-CI-104	0	A3
Cross Section at 25m Intervals - Section 1 (Sheet 3 of 4)	170308-CI-105	0	A3
Cross Section at 25m Intervals - Section 1 (Sheet 4 of 4)	170308-CI-106	0	A3
<b>SECTION 2</b>			
Long Section -Section 2	170308-CI-200	B	A3
Typical Cross section - Section 2	170308-CI-201	0	A3
Typical Cross Section benching details - Section 2	170308-CI-202	0	A3
Cross Section at 25m Intervals - Section 2 (Sheet 1 of 4)	170308-CI-203	0	A3
Cross Section at 25m Intervals - Section 2 (Sheet 2 of 4)	170308-CI-204	0	A3
Cross Section at 25m Intervals - Section 2 (Sheet 3 of 4)	170308-CI-205	0	A3
Cross Section at 25m Intervals - Section 2 (Sheet 4 of 4)	170308-CI-206	0	A3
<b>GENERAL DRAWINGS</b>			
Detail of Transition between Bituminous and Gravel Section	170308-CI-002	0	A3
Typical Hump Details	170308-CI-003	B	A3
Road sign Details	170308-CI-004	A	A3
Scour Check details	170308-CI-005	0	A3
Cross Culvert at ch 7+650 - General arrangement at chainage	170308-CI-006	0	A3
Cross Culvert at ch 7+650 Reinforcements Details	170308-CI-007	0	A3
Cross Culvert at ch 7+650 Catch pit details	170308-CI-008	0	A3
Cross Culvert at ch 7+650 Catch pit Reinforcement Details 2	170308-CI-009	0	A3
Cross Culvert at ch 7+650 Bending Schedule	170308-CI-010	0	A3
Access Culvert - General arrangement and reinforcements details	170308-CI-011	0	A3



BENCHMARKS			
Point	Northing	Easting	Height
W1	8955541.881	454948.450	1354.834
W2	8955625.357	455016.819	1353.876
BM-KM3+750LHS	8953546.381	457432.352	1377.065
BM-KM3+750RHS	8953567.818	457447.970	1377.503
BM-KM4+000LHS	8953704.474	457235.177	1378.580
BM-KM4+000RHS	8953727.020	457249.623	1379.169
BM-M12+000LHS	8956774.513	455430.648	1369.109
BM-M7+700LHS	8956228.047	455261.611	1349.808
BM-M7+700RHS	8956217.756	455290.024	1351.069
BM-M7+950LHS	8956529.796	455356.130	1360.787
BM-M7+950RHS	8956520.140	455381.365	1361.557



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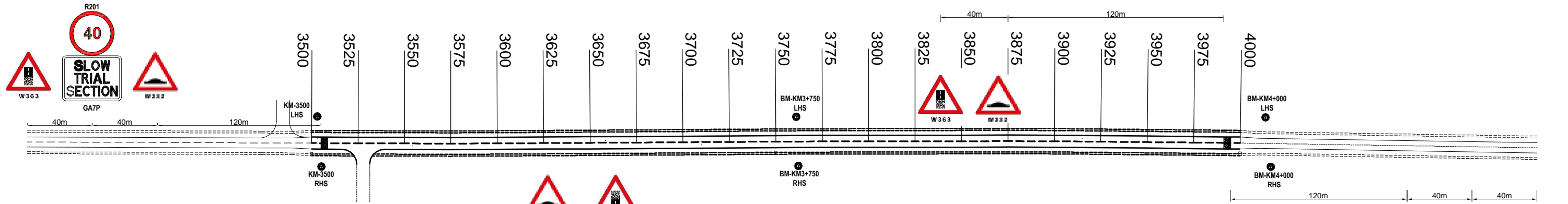
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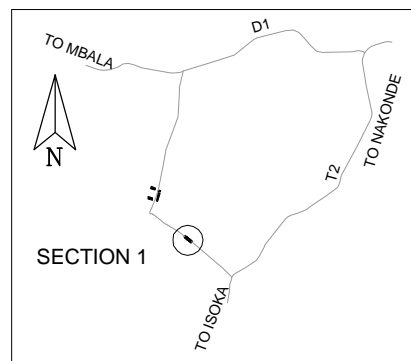
DATE: 23-10-2017  
 APPROVED BY: VA

PROJECT No:  
 DRAWING No: 170308-CI-001  
 SCALE: As Shown

PROJECT: TRIAL SECTION ON LOW VOLUME ROADS: T002-WATWIKI-D001  
 DESIGN, CONSTRUCTION SUPERVISION & BASELINE  
 MONITORING OF TRIAL SECTIONS ON LOW VOLUME SEALED  
 ROADS IN ZAMBIA  
 TITLE: OVERVIEW - LOCATION PLAN



ROAD NETWORK OVERVIEW MAP

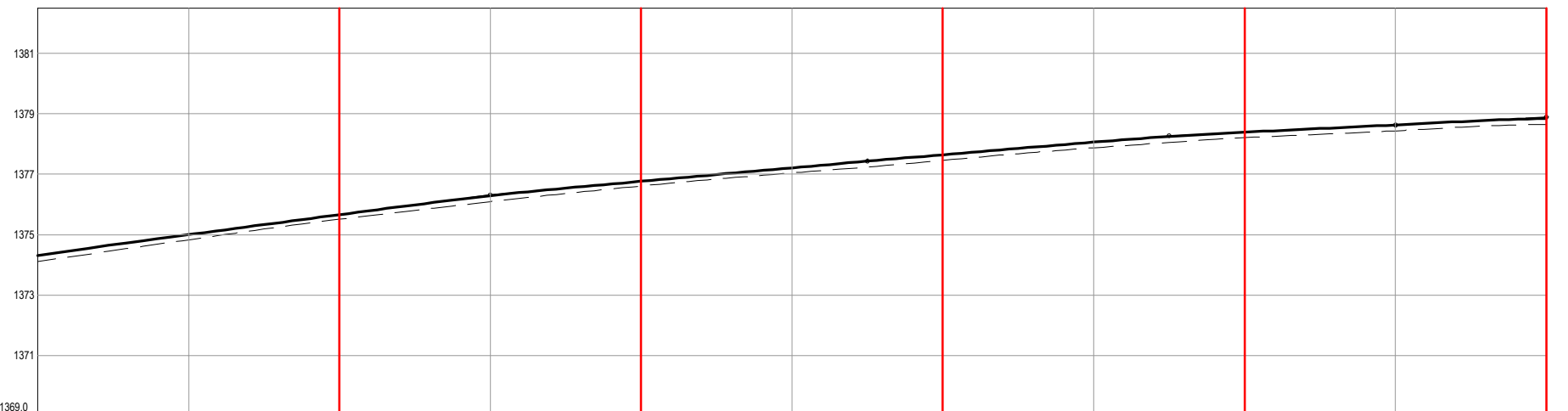


Plan Legend

Drain	-----
Benchmarks	● KM7+700 RHS

Longsection Legend

FRL	—————
Ground	- - - - -



Chainage		Centreline Ground Level	
3500.0	1374.3	1374.202	1374.116
3525.0	1374.3	1374.558	1374.469
3550.0	1374.3	1374.898	1374.831
3575.0	1374.3	1375.217	1375.183
3600.0	1374.3	1375.547	1375.522
3625.0	1374.3	1375.877	1375.804
3650.0	1374.3	1376.185	1376.099
3675.0	1374.3	1376.430	1376.366
3700.0	1374.3	1376.653	1376.616
3725.0	1374.3	1376.876	1376.846
3750.0	1374.3	1377.100	1377.045
3775.0	1374.3	1377.321	1377.234
3800.0	1374.3	1377.533	1377.463
3825.0	1374.3	1377.744	1377.691
3850.0	1374.3	1377.954	1377.926
3875.0	1374.3	1378.146	1378.099
3900.0	1374.3	1378.282	1378.221
3925.0	1374.3	1378.400	1378.322
3950.0	1374.3	1378.520	1378.434
3975.0	1374.3	1378.650	1378.567
4000.0	1374.3	1378.754	1378.648

Chainage	Grades	Vertical Curves	Superelevation
3500.0	1.3%	40.0m VC K = 75.3	
3650.0	0.9%	40.0m VC K = 94.1	
3775.0	0.8%	40.0m VC K = 780.5	
3875.0	0.5%	40.0m VC K = 108.0	
3950.0	0.5%	40.0m VC K = 652.2	
4000.0		40.0m VC K = 40.8	

Chainage	Horizontal Curves
3500.0	Curve 3 Left Direction: 309°22'36" Radius=350.0 ECC: 3507.7 BVC: 3507.7 BOC: 3507.7
3600.0	Curve 4 Left Direction: 308°48'55" Radius=350.0 ECC: 3587.7 BVC: 3587.7 BOC: 3587.7
3700.0	Curve 5 Left Direction: 308°18'07" Radius=500.0 ECC: 3685.6 BVC: 3685.6 BOC: 3685.6
3775.0	Curve 6 Right Direction: 308°15'50" Radius=350.0 ECC: 3744.9 BVC: 3744.9 BOC: 3744.9
3875.0	Curve 7 Right Direction: 308°33'06" Radius=500.0 ECC: 3885.6 BVC: 3885.6 BOC: 3885.6
4000.0	Curve 8 Right Direction: 309°11'11" Radius=500.0 ECC: 3981.7 BVC: 3981.7 BOC: 3981.7

NOTE: THE FIRST AND LAST 25M OF THE TRIAL SECTION NOT TO BE MONITORED.

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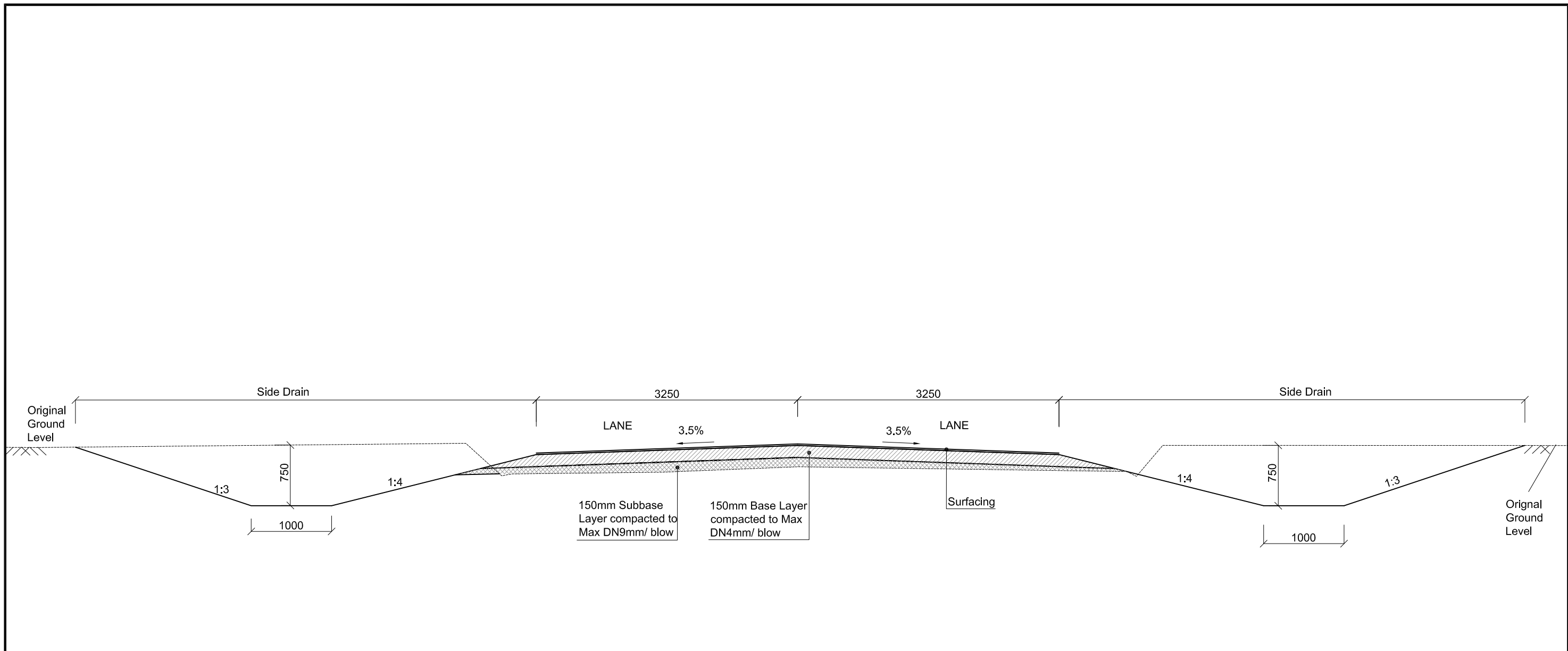
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SUFFIX:	DATE:	REVISION:
A	18-01-2018	Layout Plan amended to show transition from existing to proposed road; distance between road sign marked.
B	30-01-2018	Note Added

NAME:	DRAWN BY:	DATE:	PROJECT No:
DL	DL	30-01-2018	
DL	CHECKED BY:	APPROVED BY:	DRAWING No.
	MP/NS	VA	170308-CI-100B
	SCALE:	Horizontal Scale 1:2000 Vertical Scale 1:200	

PROJECT:  
TRIAL SECTION ON LOW VOLUME ROADS: T002-WATWIKI-0001  
DESIGN, CONSTRUCTION SUPERVISION & BASELINE MONITORING  
OF TRIAL SECTIONS ON LOW VOLUME SEALED ROADS IN ZAMBIA

TITLE:  
ALIGNMENT AND LONG SECTION  
Chainage 3500 to 4000



<p><b>Construction Sequence</b></p> <ol style="list-style-type: none"> <li>Bush Clearing</li> <li>Cut to spoil to construct drains</li> <li>Lightly Scarifying and add up 50mm of imported gravel and compact to form Subbase Layer</li> <li>Import 150mm to form Base Layer</li> <li>Surfacing</li> </ol>	<p>NB. Total thickness of imported material will be 200mm ( 50mm for Subbase and 150mm for base)</p> <p>Remark: In general, the cross sections for the first section do not need benching. If there's need for benching, it will be done on the road bed preparation</p>	<p><b>Surfacing Types</b></p> <p>3 different surfacing types will be used in each trail section:</p> <ul style="list-style-type: none"> <li>20mm Cold Mix Asphalt (CMA)</li> <li>Double Seal Surface Dressing (DSD)</li> <li>Cape Seal (13mm Single Seal + Slurry)</li> </ul>
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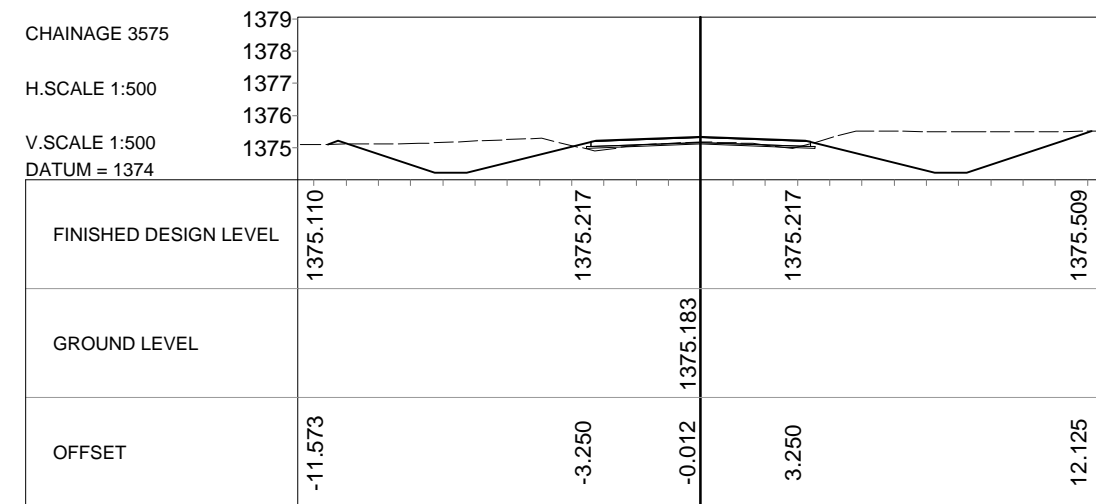
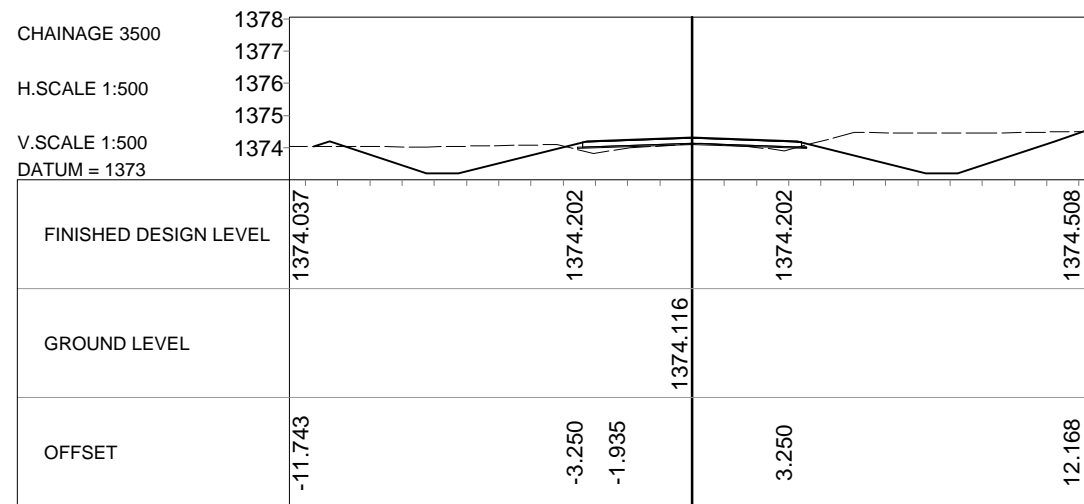
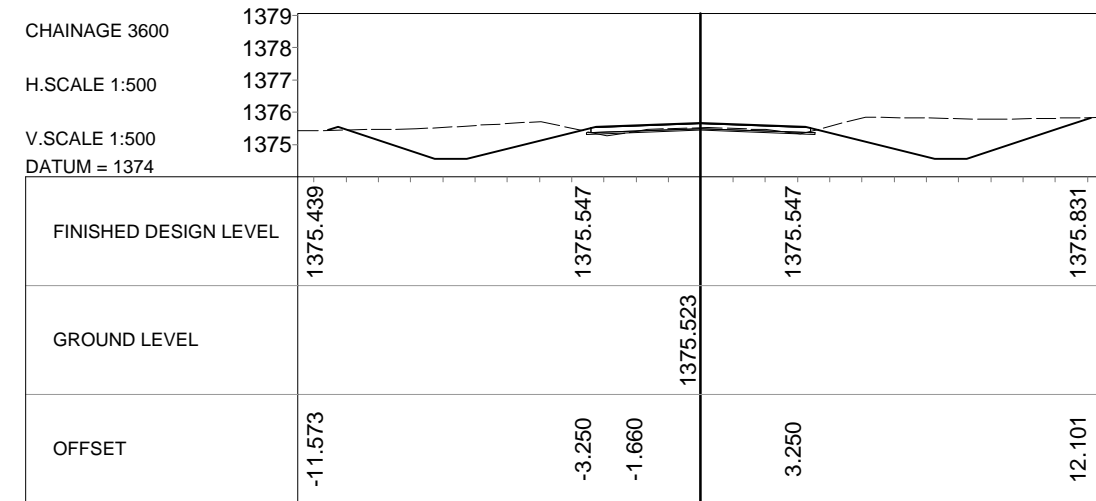
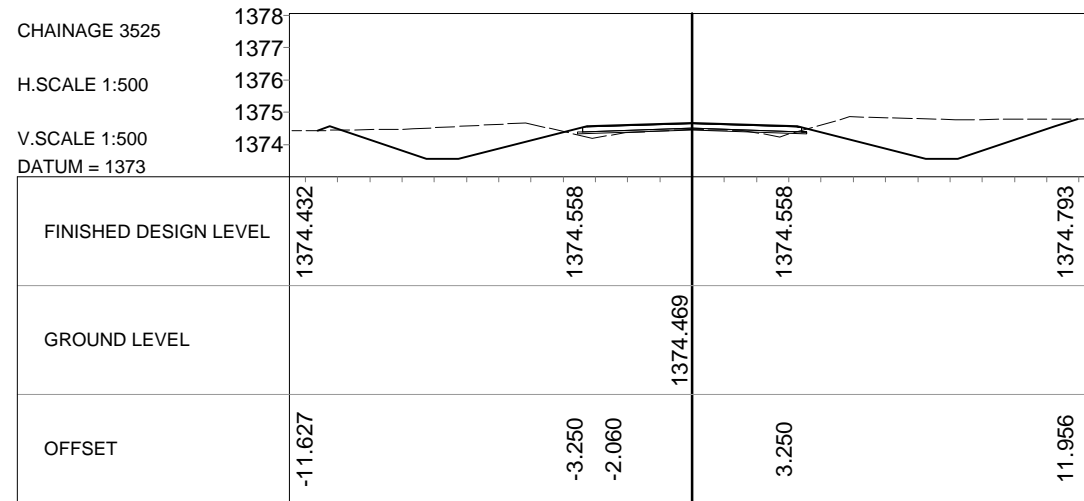
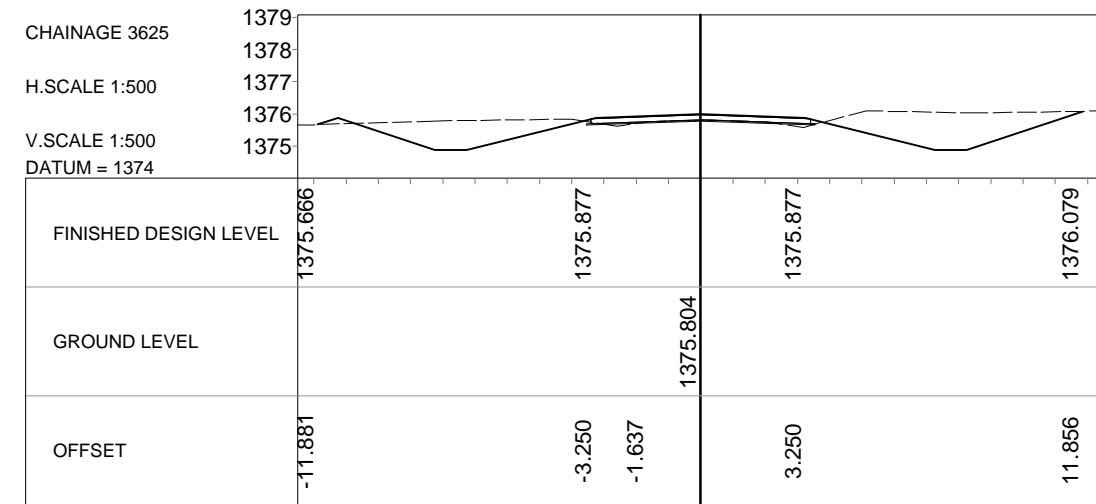
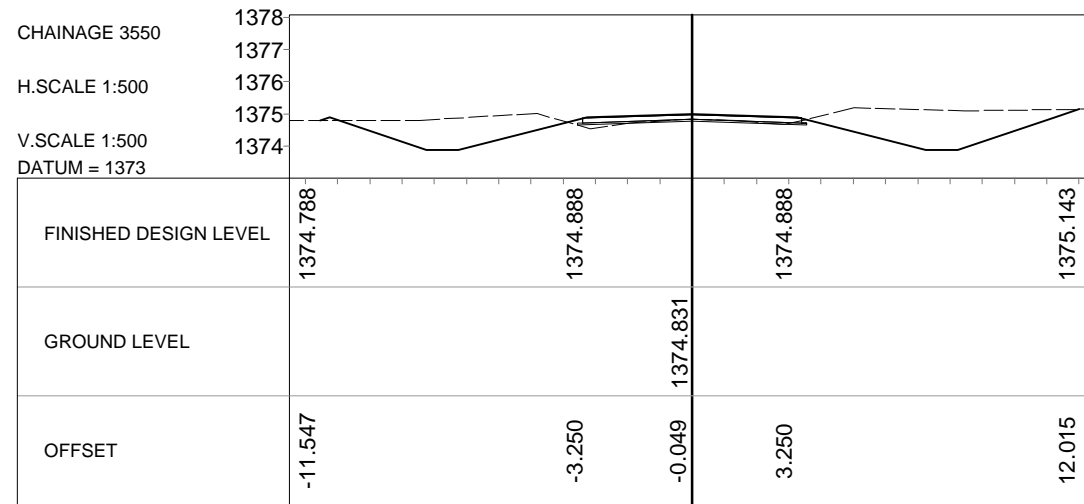
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CHECKED BY: SR	APPROVED BY: VA
FILE:	

PROJECT No: 170308
DRAWING No : 170308-CI-102
SCALE : 1:50

PROJECT : Trial Section on Low Volume Roads  
T002-Waltwika-D001  
Design, Construction Supervision and Baseline Monitoring  
of Trial Sections on Low Volume Sealed Roads in Zambia

TITLE :  
TYPICAL ROAD CROSS SECTION - SECTION 1



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SUFFIX:

DATE:

REVISION:

NAME:

DRAWN BY:

DL

DATE:

27-10-2017

PROJECT No:

170308-CI-103

CHECKED BY:

MP

APPROVED BY:

VA

DRAWING No.

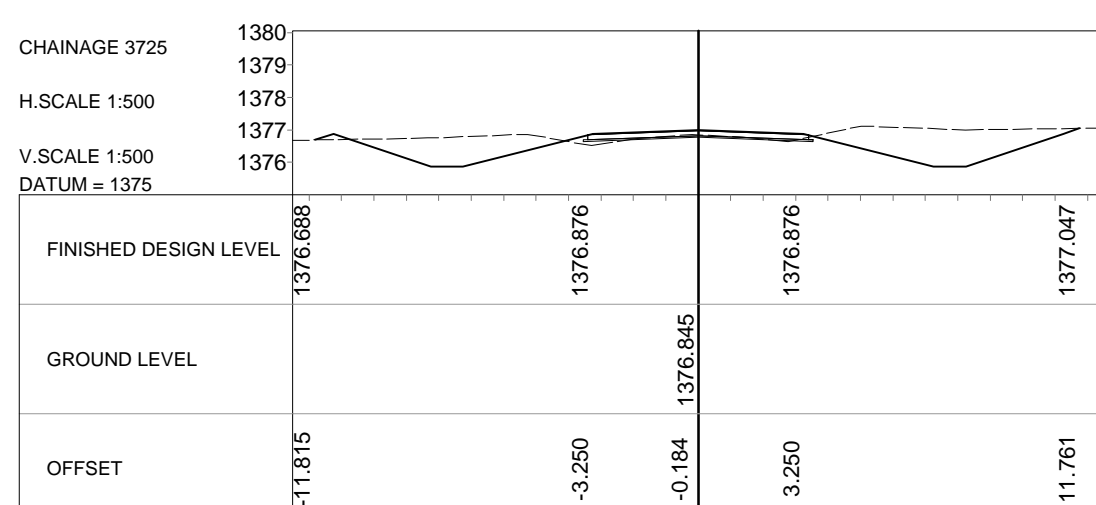
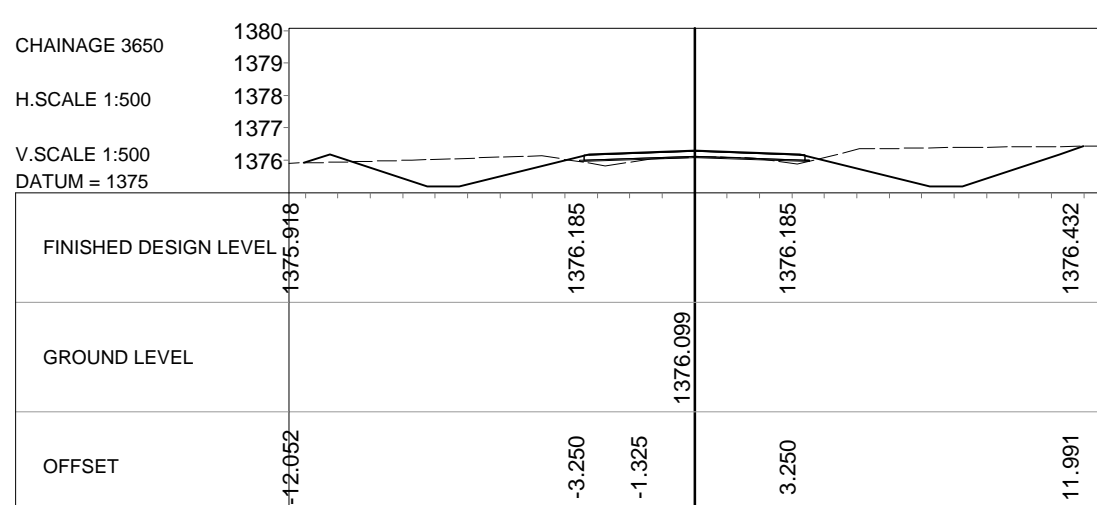
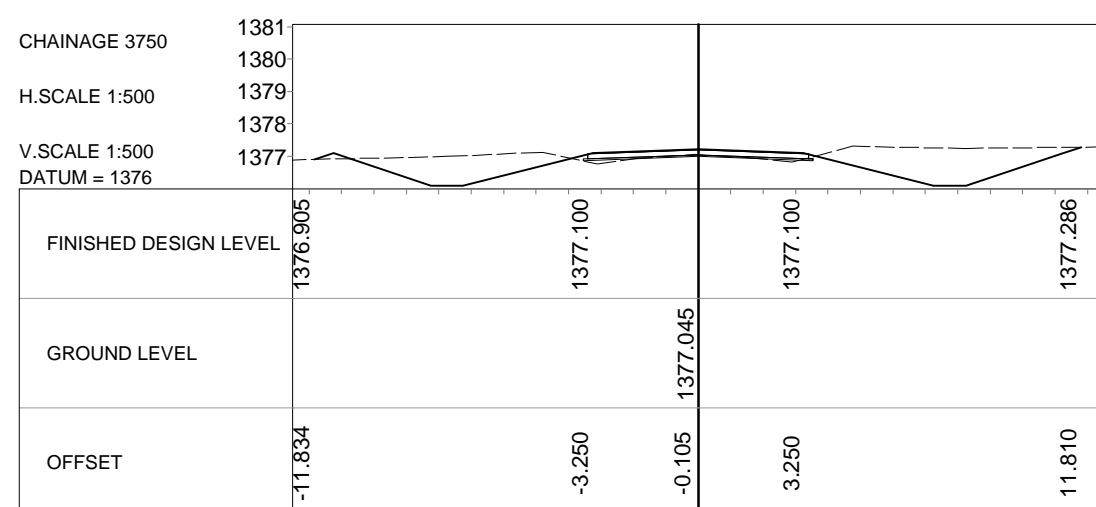
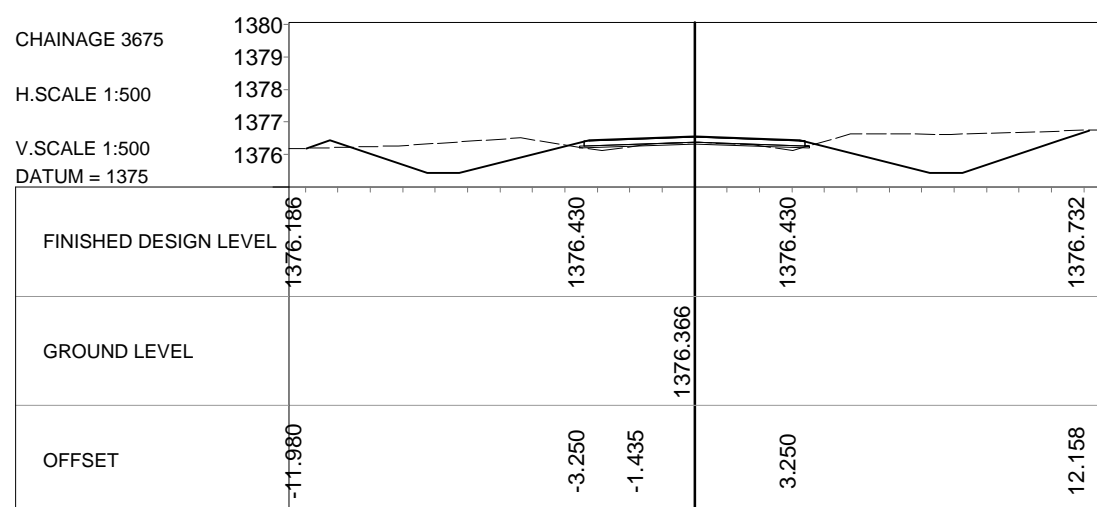
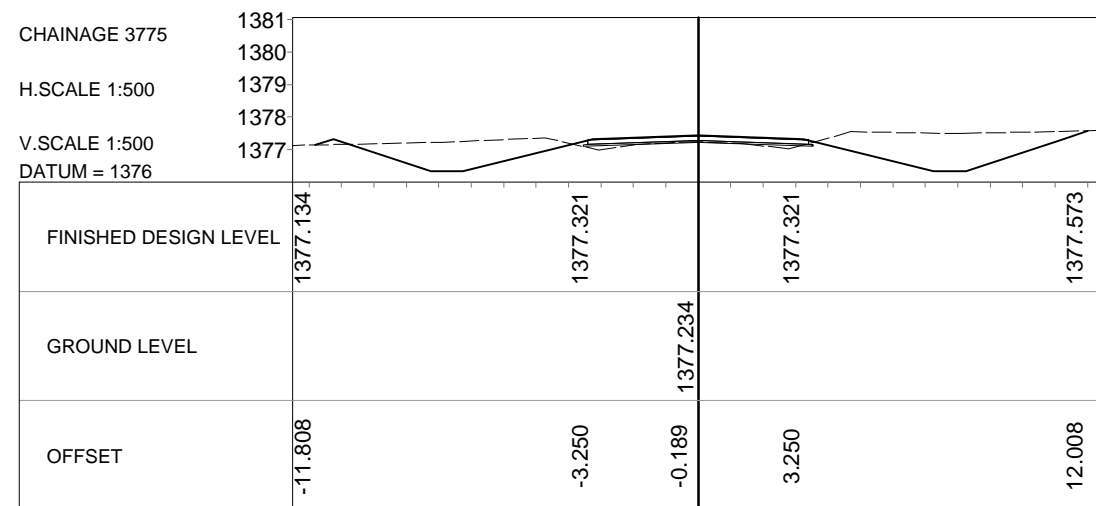
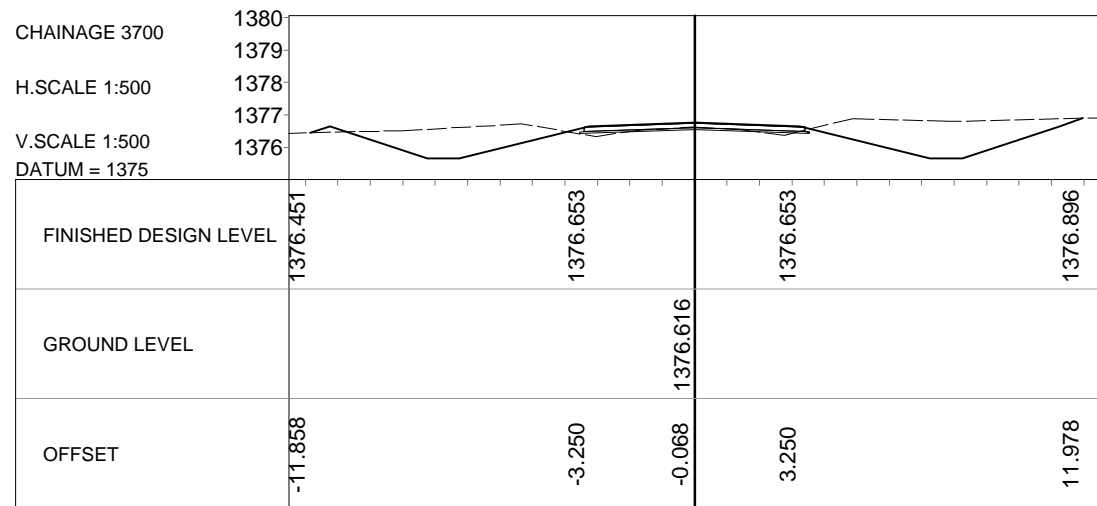
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PROJECT:

TRIAL SECTION ON LOW VOLUME ROADS: T002-WATWIKI-D001  
DESIGN, CONSTRUCTION SUPERVISION & BASELINE  
MONITORING OF TRIAL SECTIONS ON LOW VOLUME SEALED  
ROADS IN ZAMBIA

TITLE:

Cross Section at 25m Intervals - Section 1  
(Sheet 1 of 4)



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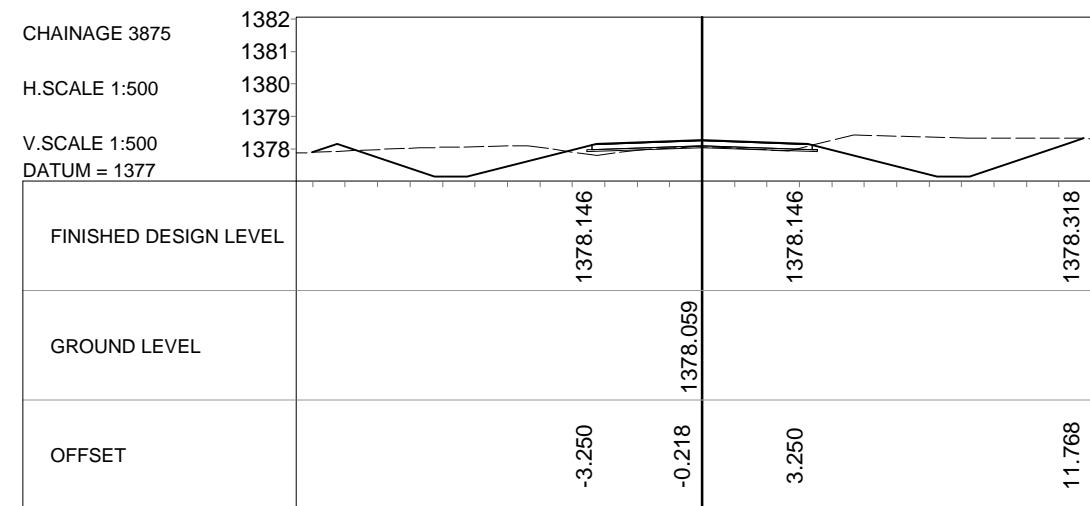
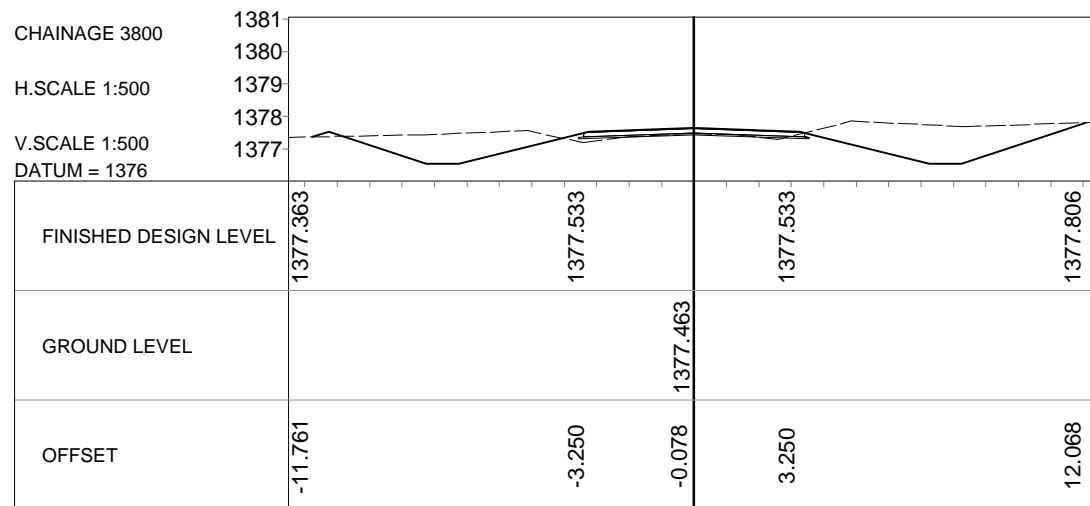
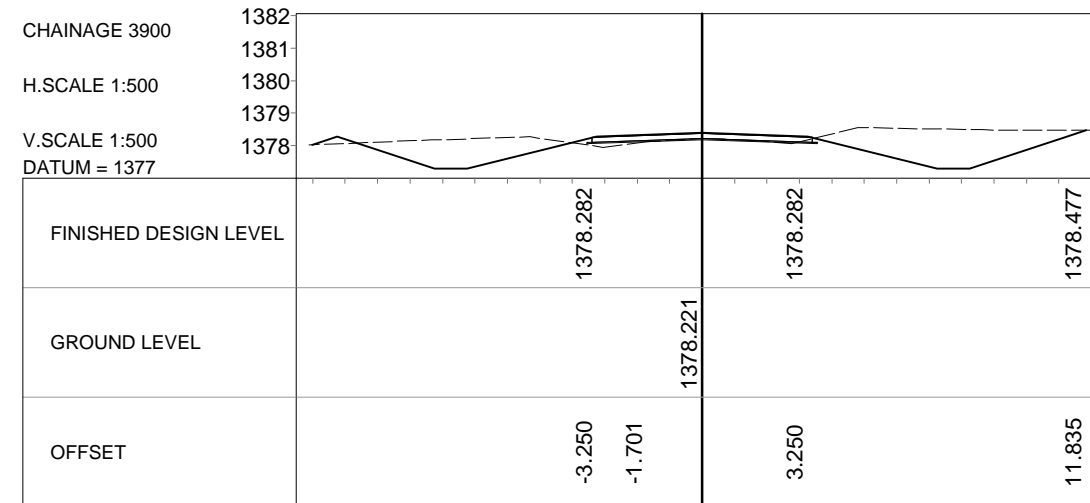
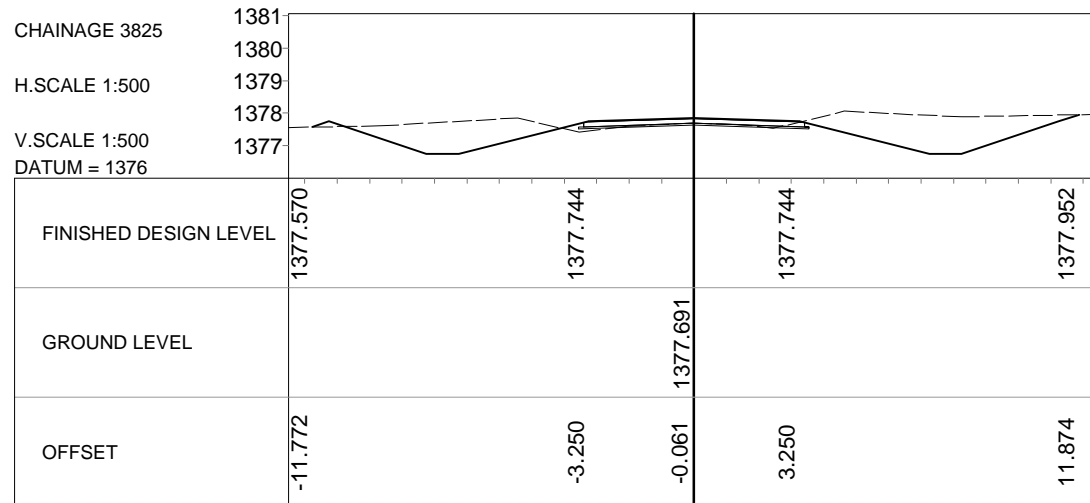
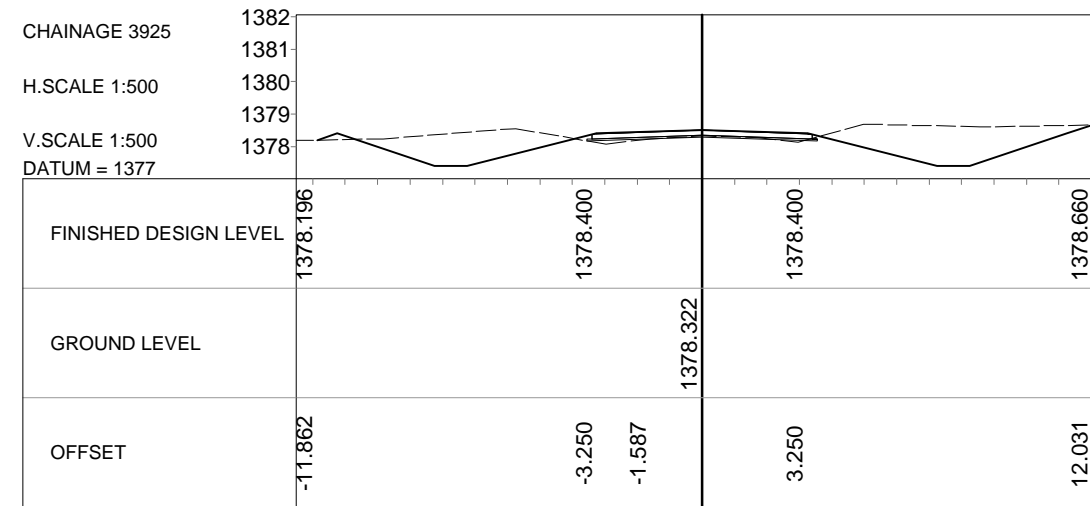
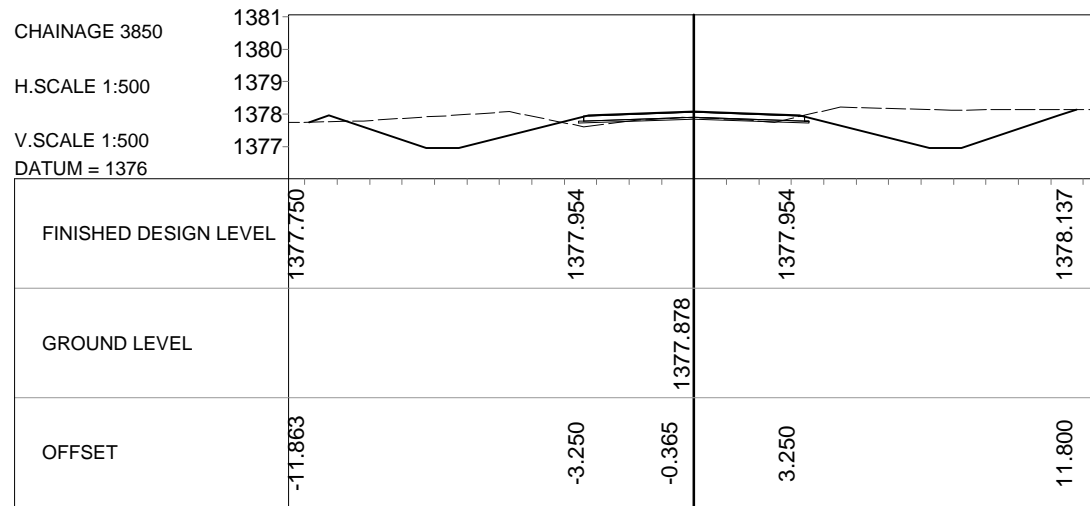
ROAD DEVELOPMENT AGENCY  
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CHECKED BY: MP	APPROVED BY: VA	DRAWING No. 170308-CI-104
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PROJECT:  
**TRIAL SECTION ON LOW VOLUME ROADS: T002-WATWIKI-D001  
DESIGN, CONSTRUCTION SUPERVISION & BASELINE  
MONITORING OF TRIAL SECTIONS ON LOW VOLUME SEALED  
ROADS IN ZAMBIA**

TITLE:  
Cross Section at 25m Intervals - Section 1  
(Sheet 2 of 4)



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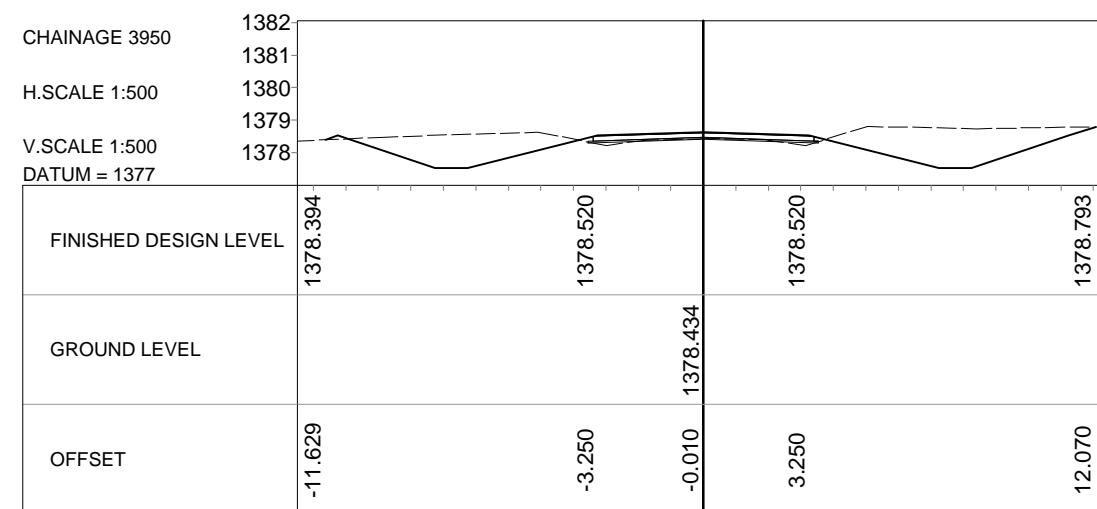
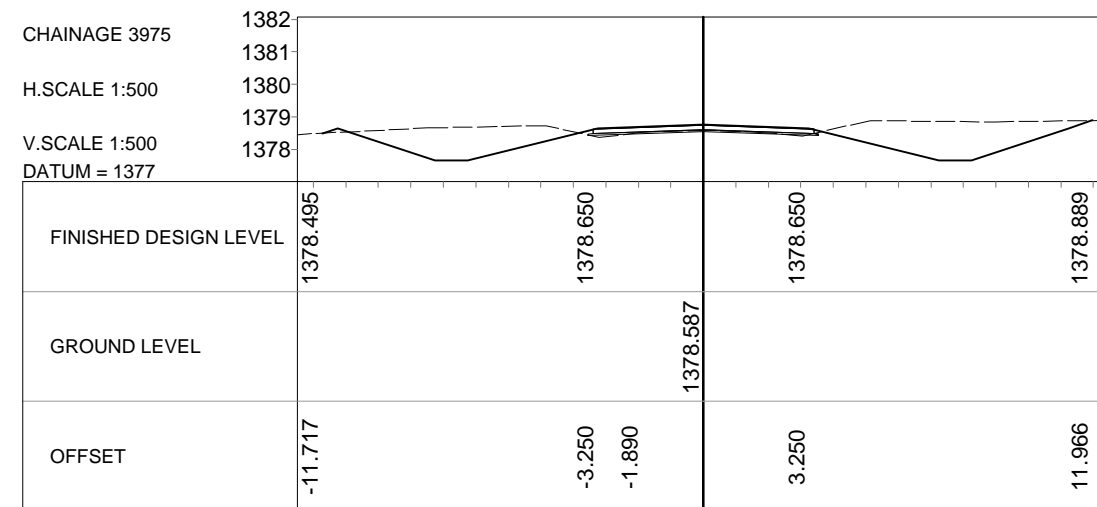
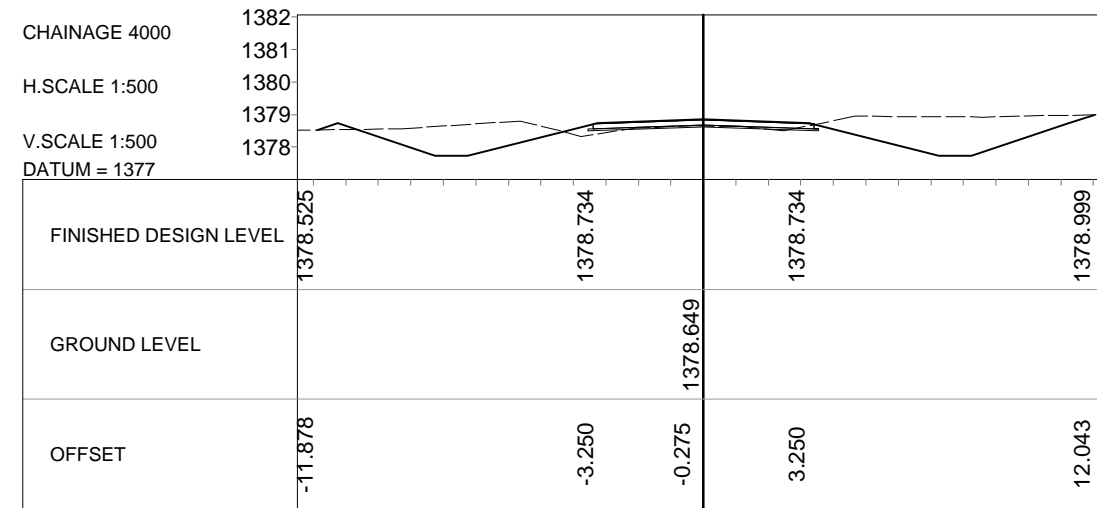
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HEAD QUARTERS, FAIRLEY ROAD  
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DRAWN BY:	DATE:
DL	27-10-2017
CHECKED BY:	APPROVED BY:
MP	VA
SCALE:	

PROJECT No:
DRAWING No.
170308-CI-105
Horizontal Scale 1:500 Vertical Scale 1:500

PROJECT:
TRIAL SECTION ON LOW VOLUME ROADS: T002-WATMIKA-D001 DESIGN, CONSTRUCTION SUPERVISION & BASELINE MONITORING OF TRIAL SECTIONS ON LOW VOLUME SEALED ROADS IN ZAMBIA
TITLE:
Cross Section at 25m Intervals - Section 1 (Sheet 3 of 4)



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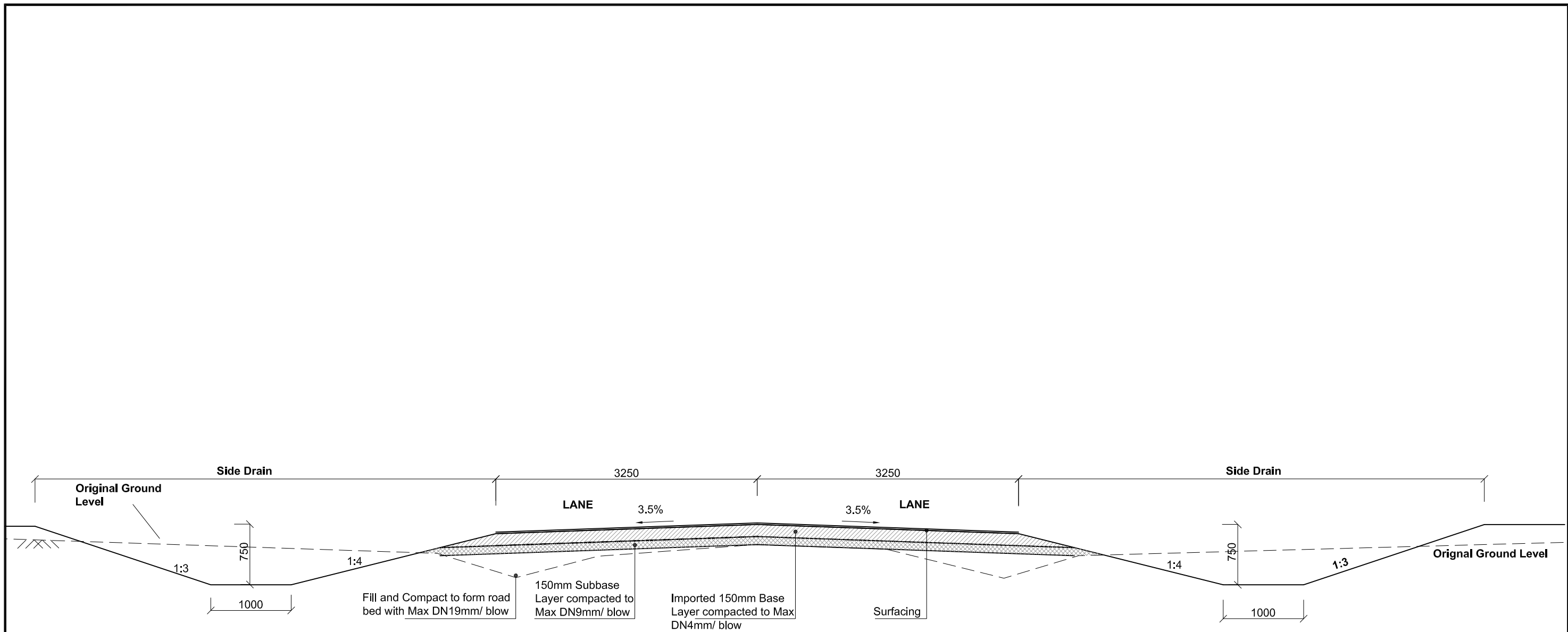
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HEAD QUARTERS, FAIRLEY ROAD  
P. O. BOX 5003, LUSAKA

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CHECKED BY: MP	APPROVED BY: VA	DRAWING No. 170308-CI-106
SCALE:		Horizontal Scale 1:500 Vertical Scale 1:500

PROJECT: TRIAL SECTION ON LOW VOLUME ROADS: T002-WATWIKI-D001 DESIGN, CONSTRUCTION SUPERVISION & BASELINE MONITORING OF TRIAL SECTIONS ON LOW VOLUME SEALED ROADS IN ZAMBIA
TITLE: Cross Section at 25m Intervals - Section 1 (Sheet 4 of 4)





- Surfacing Types**
- 3 different surfacing types will be used in each trail section:
- 20mm Cold Mix Asphalt (CMA)
  - Double Seal Surface Dressing (DSD)
  - Cape Seal (13mm Single Seal + Slurry)

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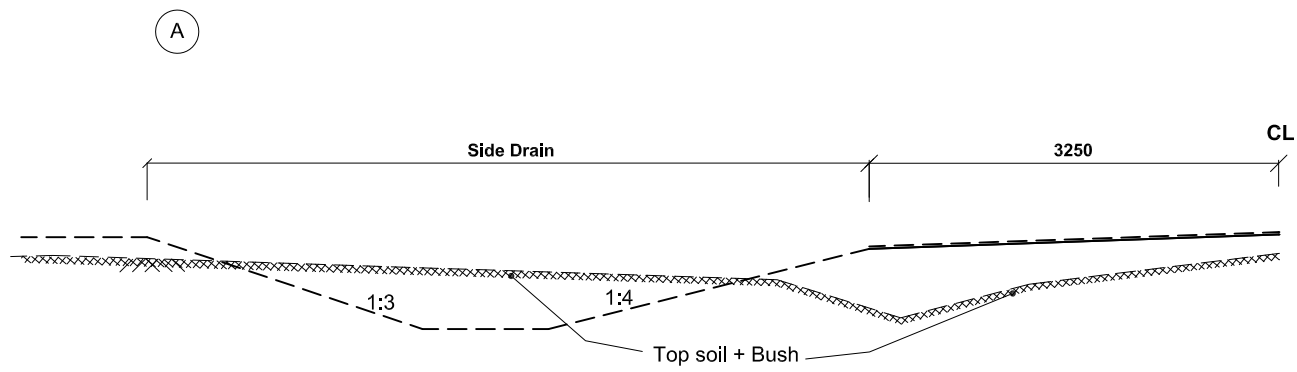
**ROAD DEVELOPMENT AGENCY**

**HEAD QUARTERS, FAIRLEY ROAD**

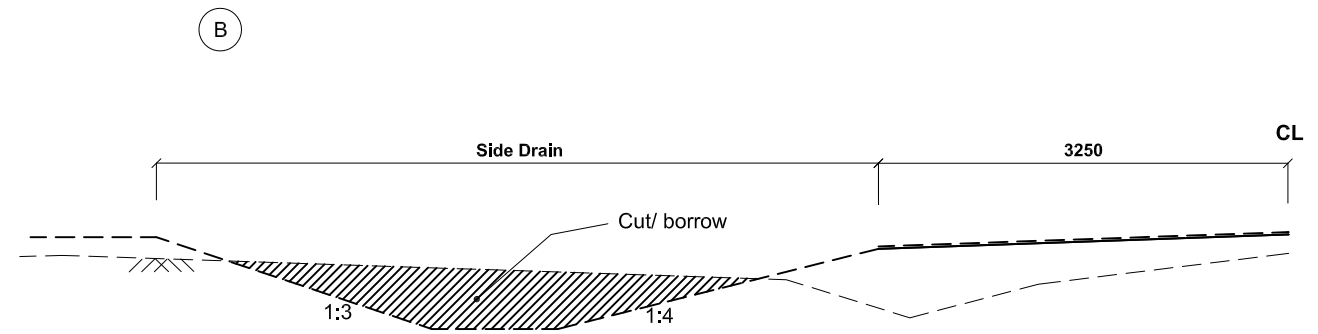
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SUFFIX	DATE:	REVISION:	BY:	DRAWN BY:	DATE:	PROJECT No:	PROJECT :
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				CHECKED BY:	APPROVED BY:	DRAWING No :	Design, Construction Supervision and Baseline Monitoring of Trial Sections on Low Volume Sealed Roads in Zambia
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				FILE:		SCALE :	TYPICAL ROAD CROSS SECTION - SECTION 2
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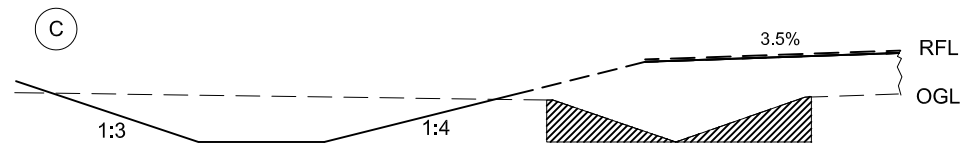
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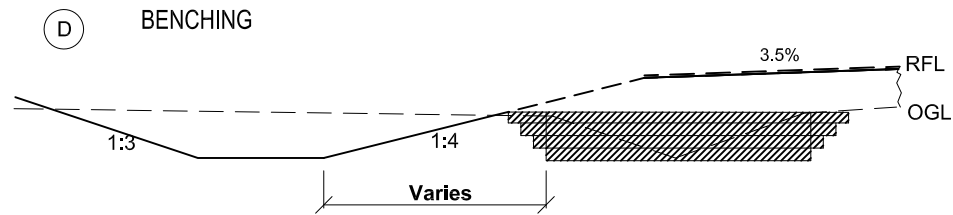
1. Bush Clearing on the entire road perimeter  
Road bed preparation on the existing road width of 6.5m



2. Cut to borrow from the drain materials to form the bench layers

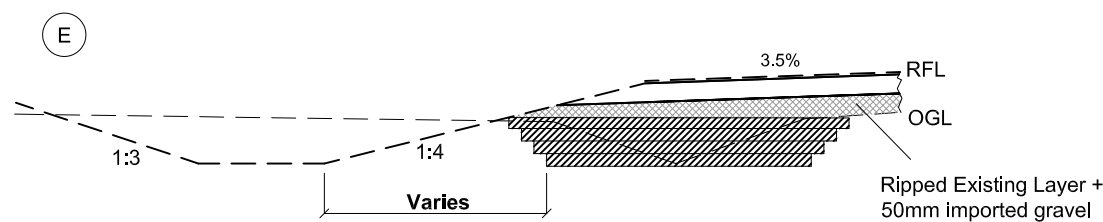


3. Cut to spoil to create the trench to allow equipment to enter
4. Road bed preparation in the trenches (both sides)

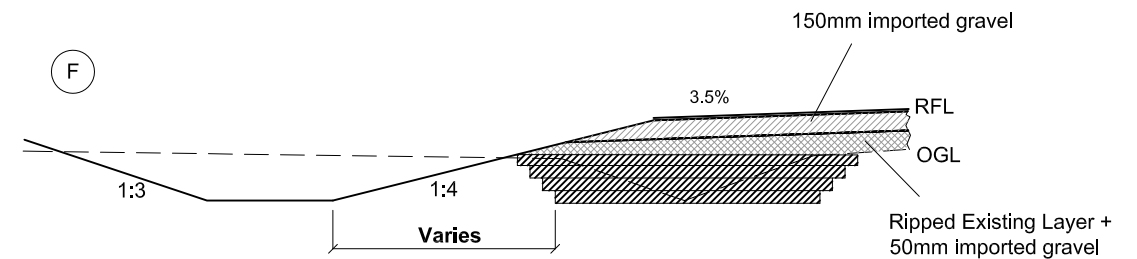


5. Cut to borrow for backfill in benched area from the new drain area
6. All layers should be compacted to refusal

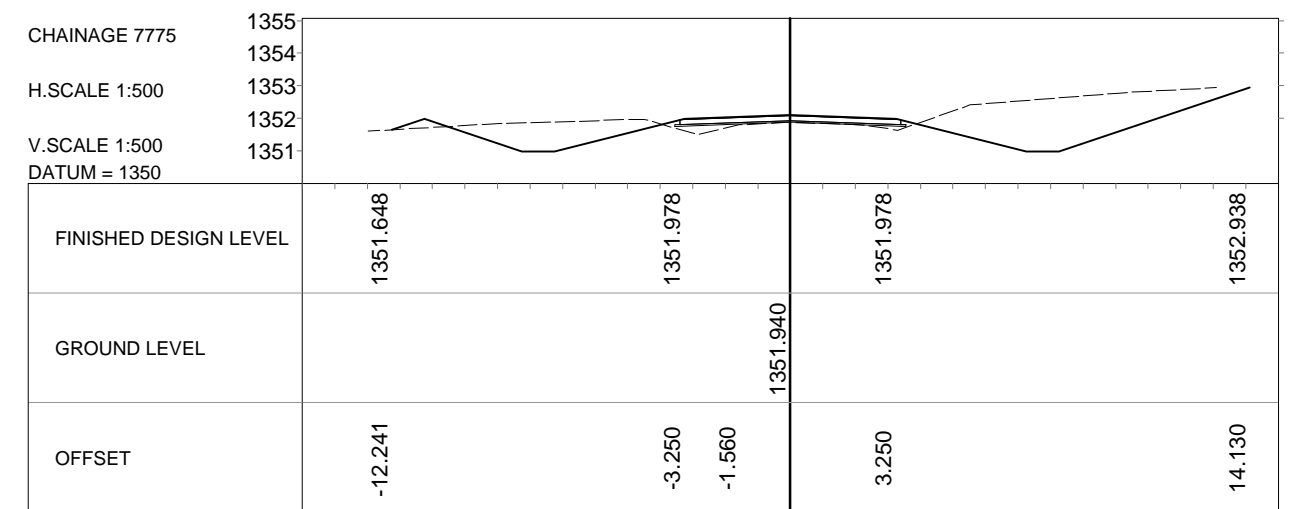
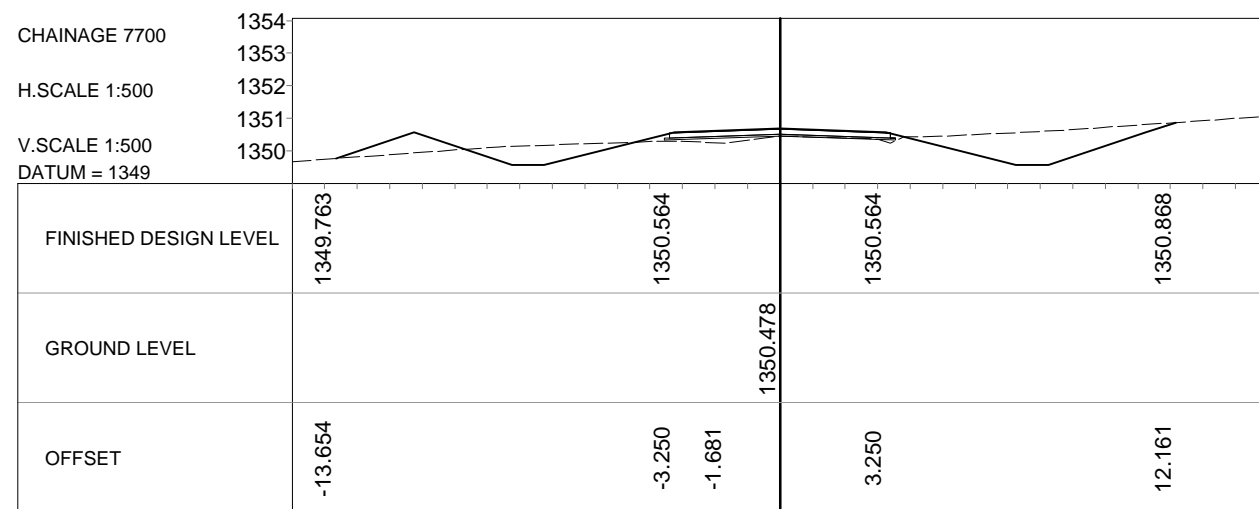
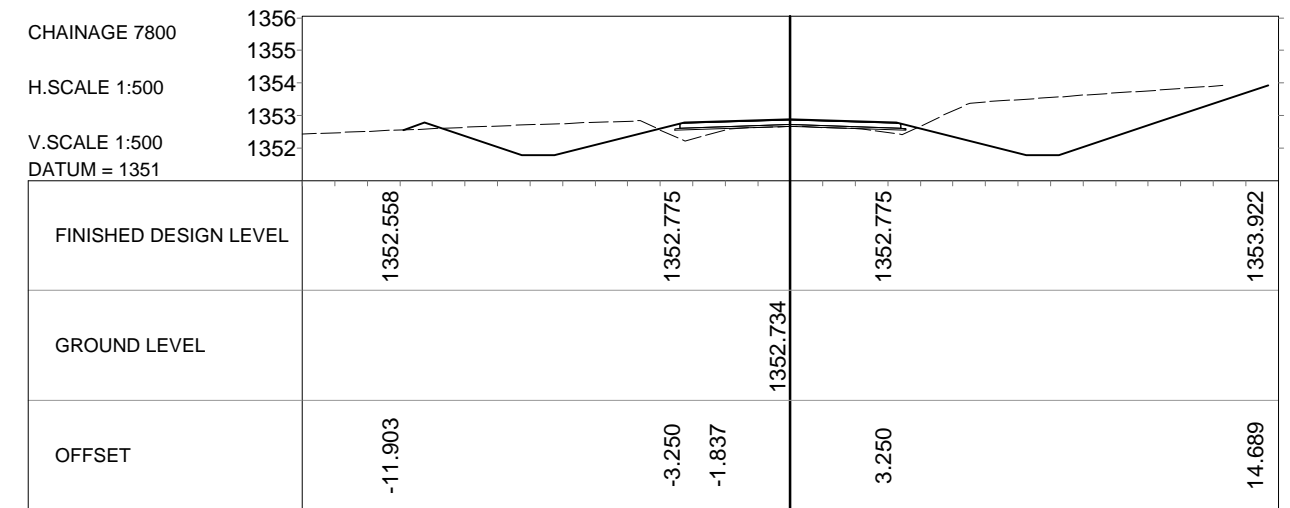
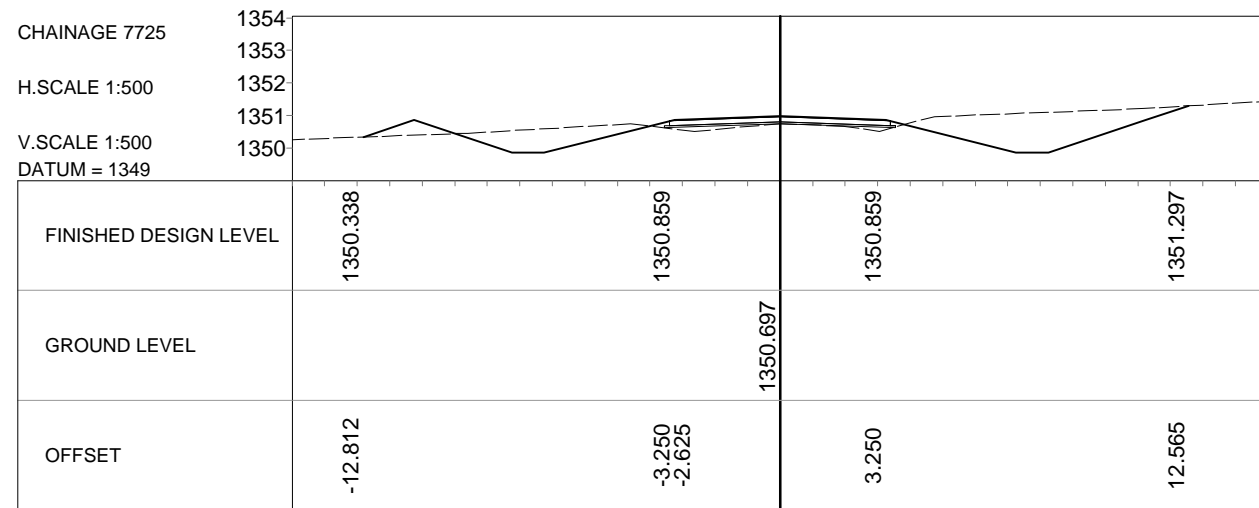
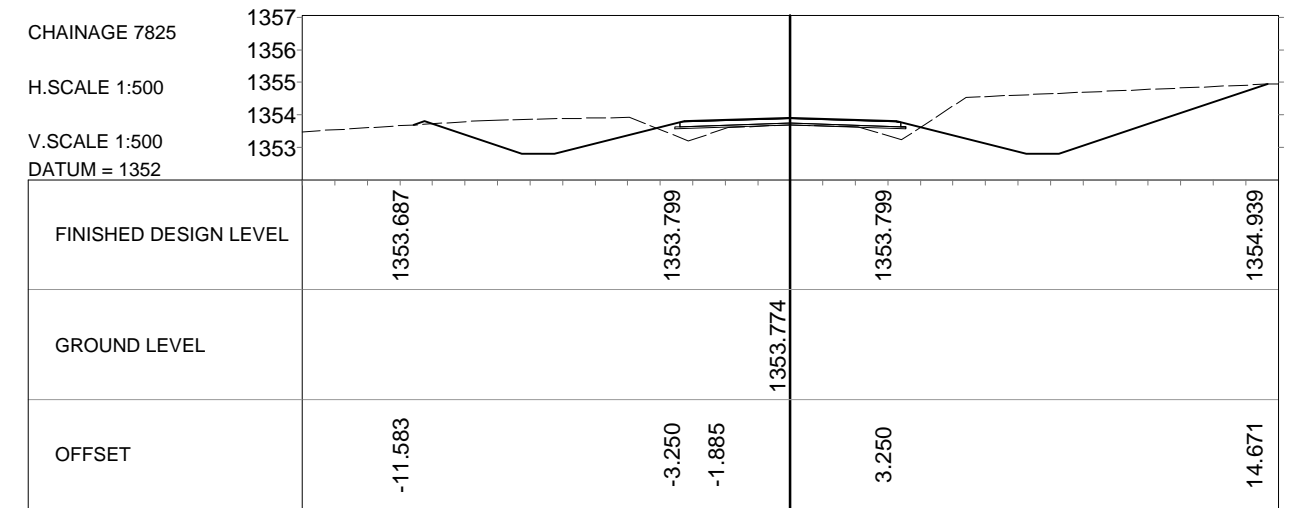
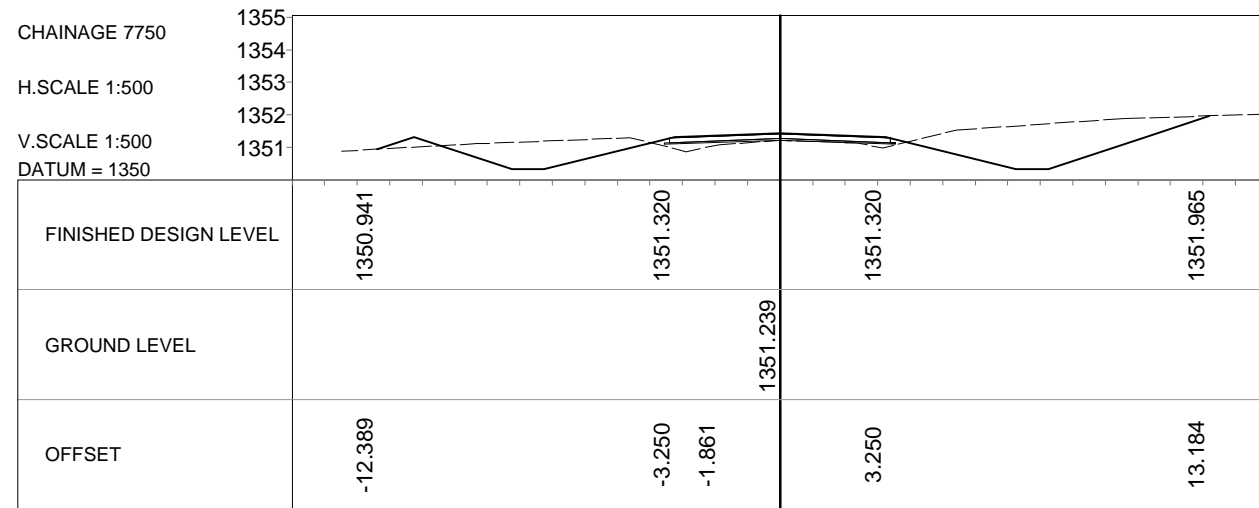
NB: The design is based on the existing road's strength, try to keep the original road intact while benching.



7. Road bed preparation on the existing road width of 6.5m (7m) including the benched top layer
8. Lightly Scarify and add imported 50mm gravel to form Subbase Layer



9. Import 150mm gravel to form Base Layer
10. Apply surface treatment in 3 sections (Surface dressing or Slurry Seal)



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CLIENT:



ROAD DEVELOPMENT AGENCY  
HEAD QUARTERS, FAIRLEY ROAD  
P. O. BOX 5003, LUSAKA

SUFFIX:

DATE:

REVISION:

NAME:

DRAWN BY:

DATE:

PROJECT No:

PROJECT:

DL

27-10-2017

**TRIAL SECTION ON LOW VOLUME ROADS: T002-WATWIKI-D001  
DESIGN, CONSTRUCTION SUPERVISION & BASELINE  
MONITORING OF TRIAL SECTIONS ON LOW VOLUME SEALED  
ROADS IN ZAMBIA**

CHECKED BY:  
MP

APPROVED BY:  
VA

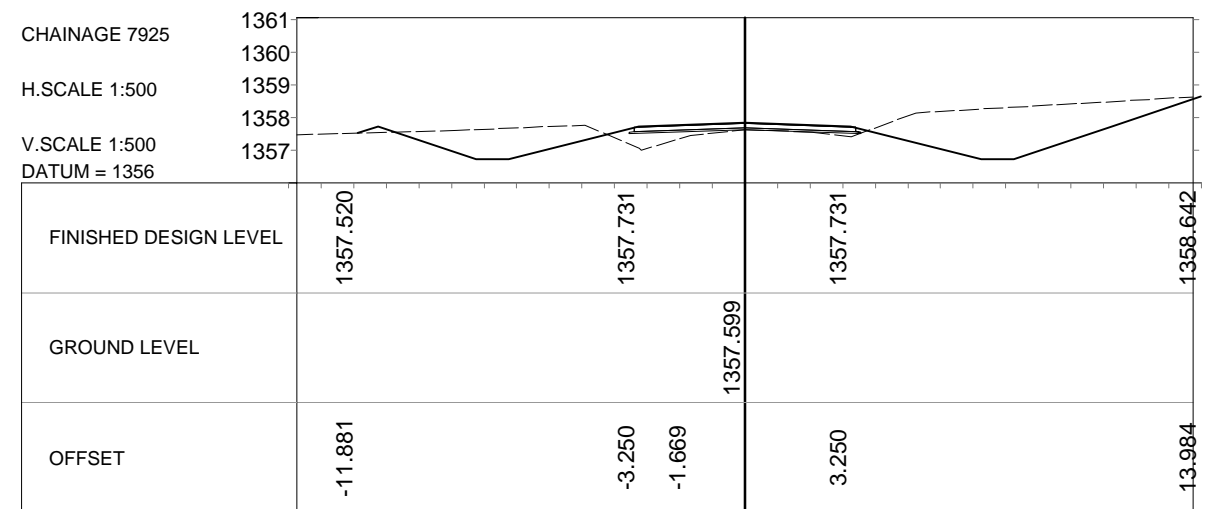
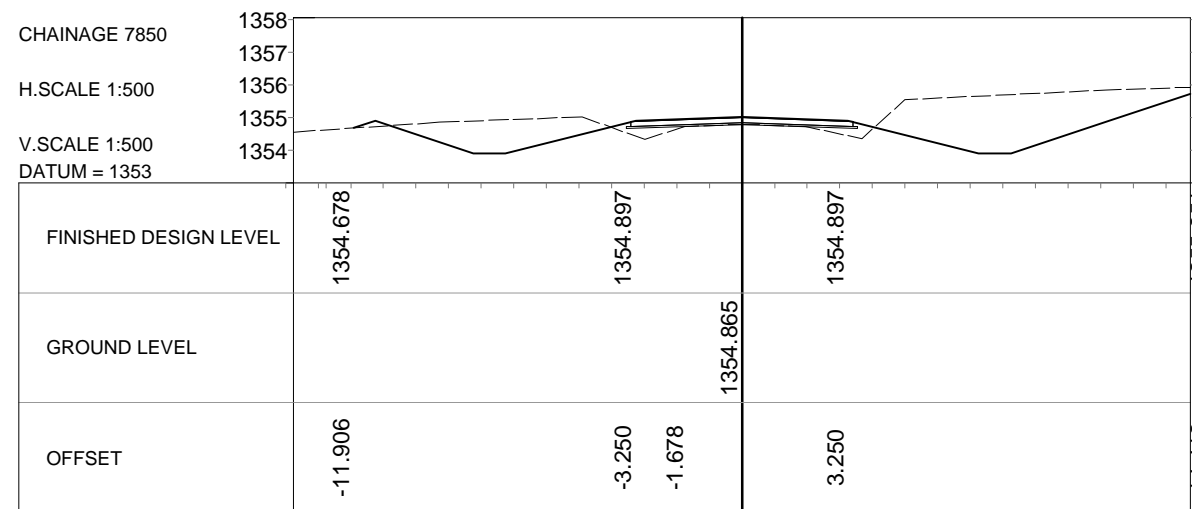
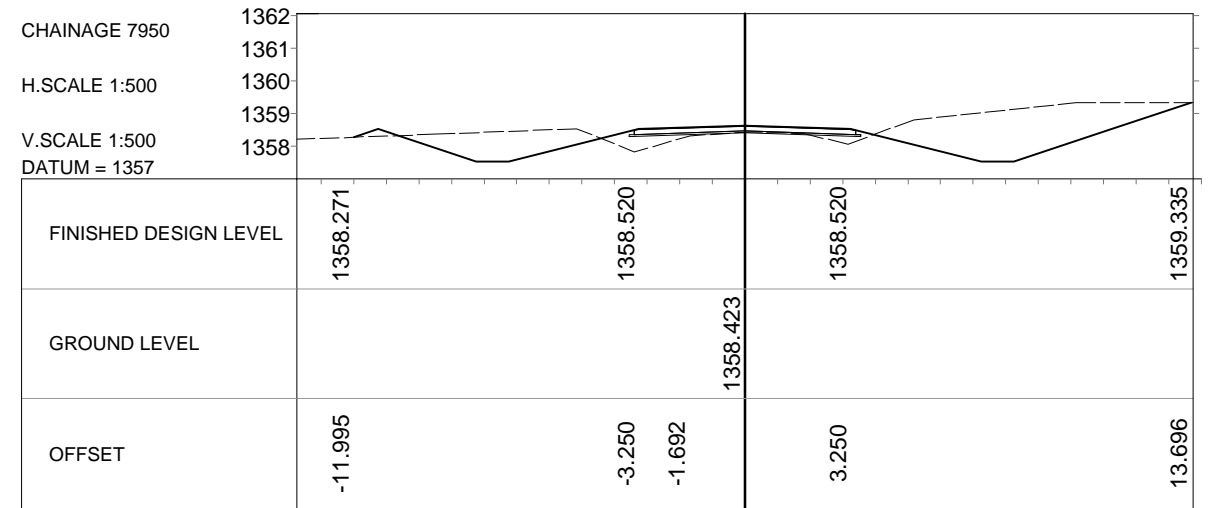
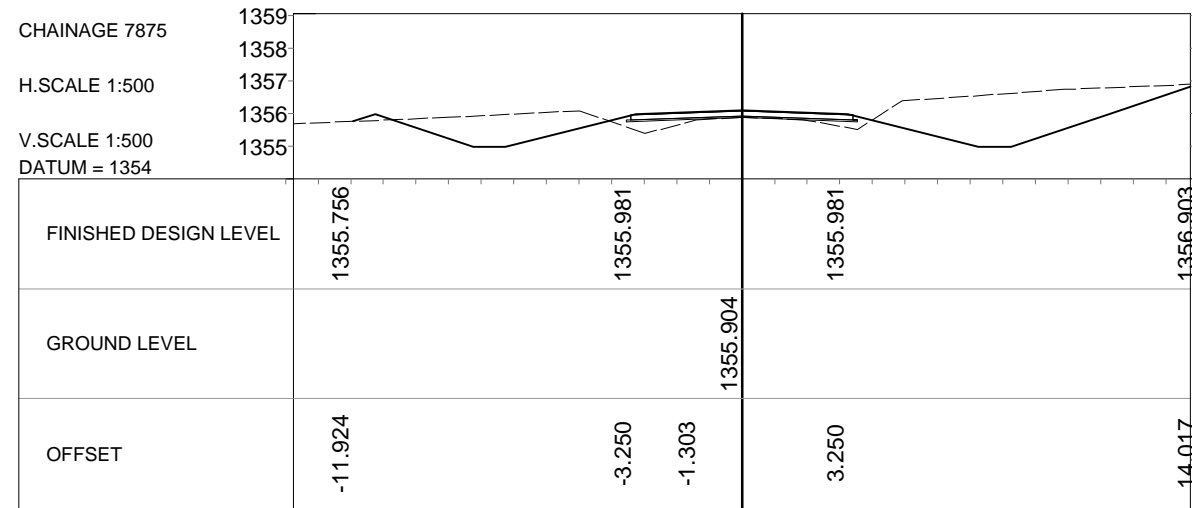
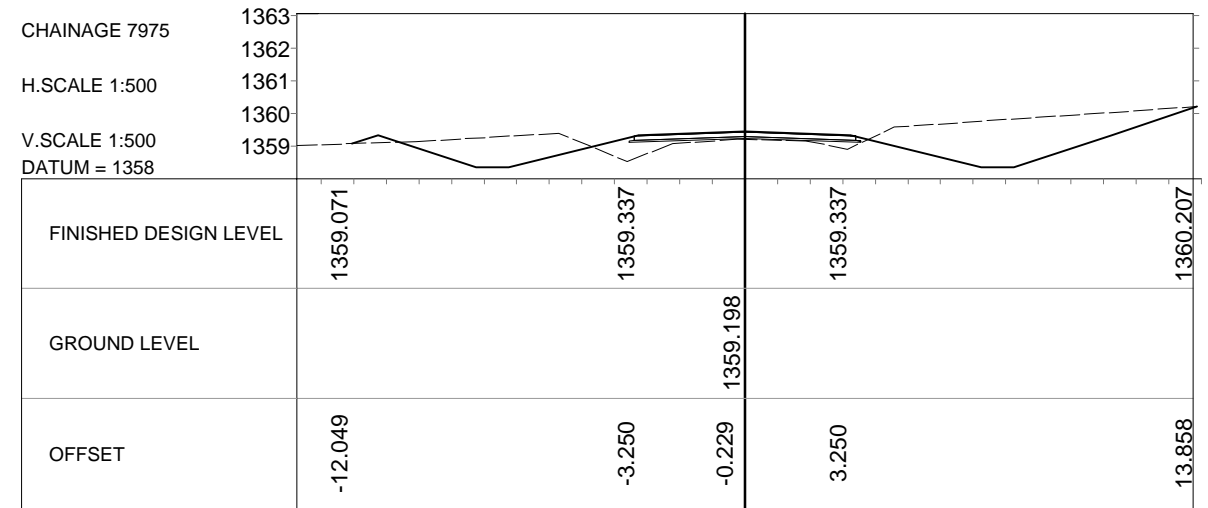
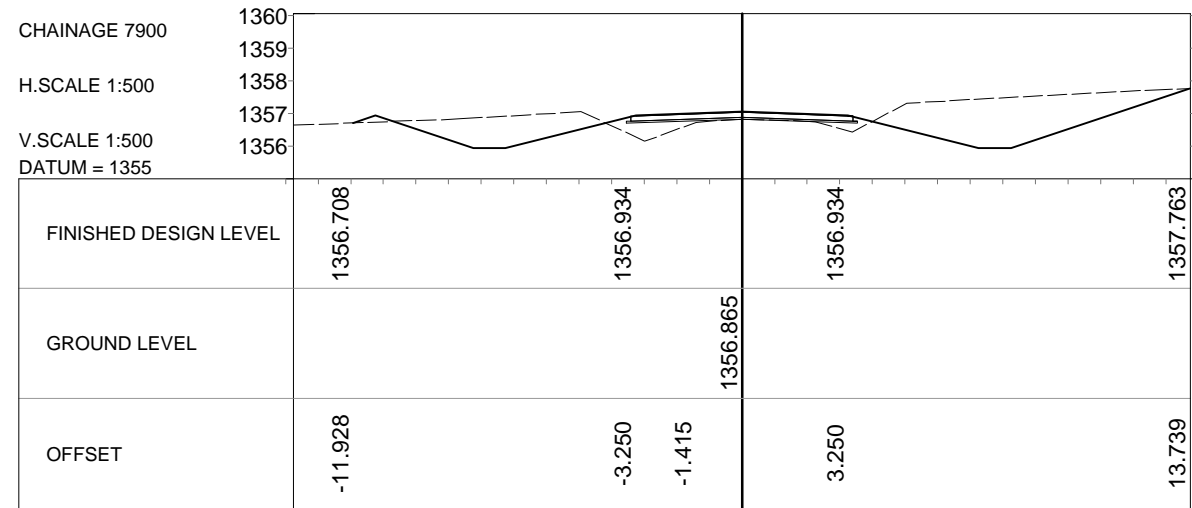
DRAWING No.  
170308-CI-203

TITLE:

SCALE:

Horizontal Scale 1:500  
Vertical Scale 1:500

Cross Section at 25m Intervals - Section 2  
(Sheet 1 of 4)



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P. O. BOX 5003, LUSAKA

SUFFIX:

DATE:

REVISION:

NAME:

DRAWN BY:

DL

DATE:

27-10-2017

PROJECT No:

CHECKED BY:

MP

APPROVED BY:

VA

DRAWING No.

170308-CI-204

SCALE:

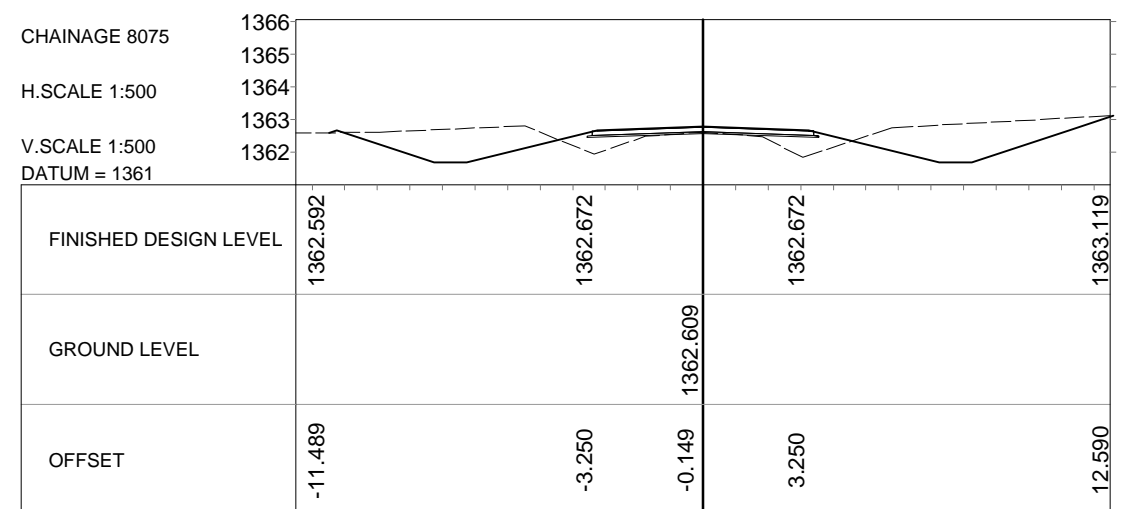
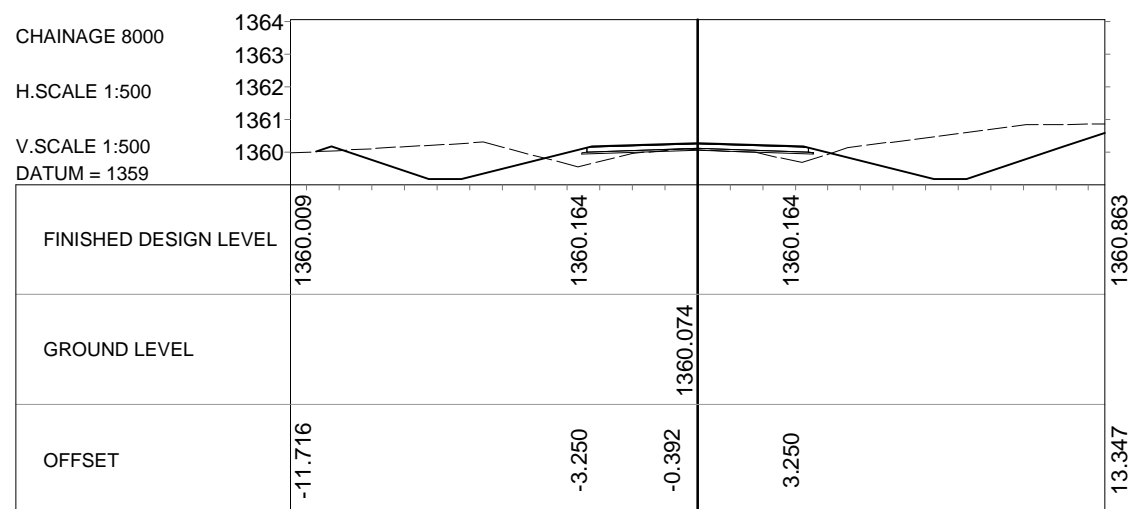
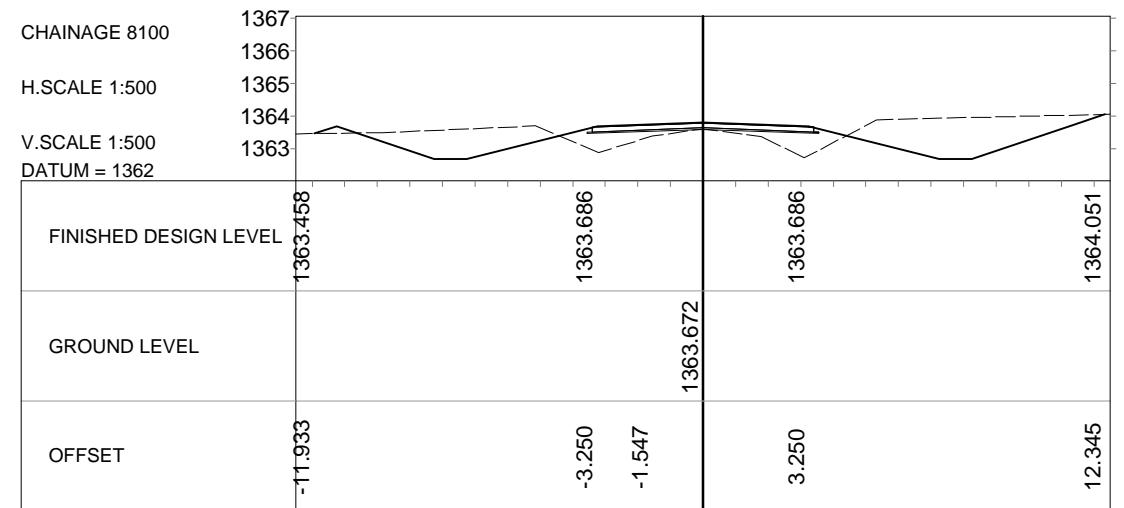
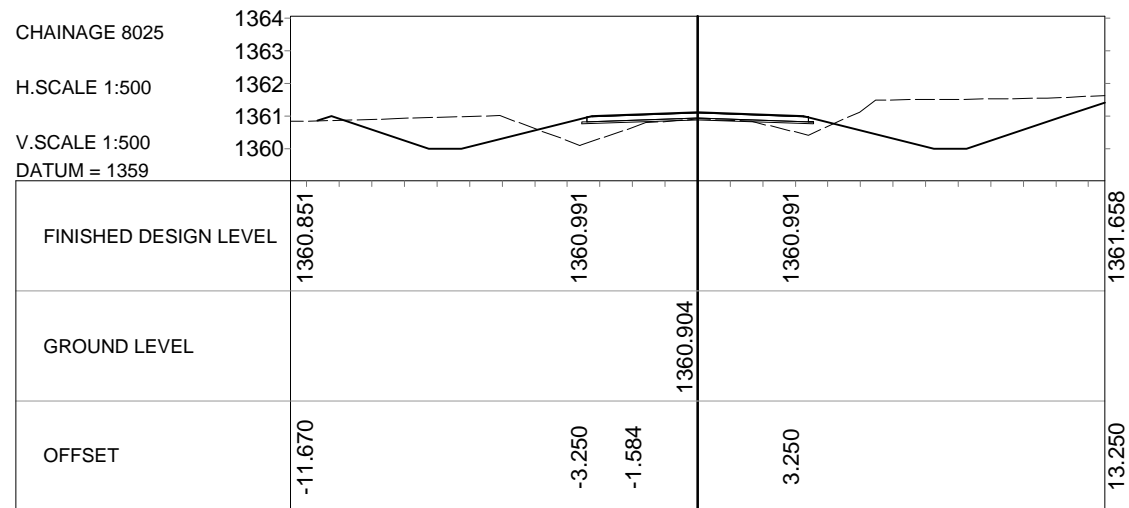
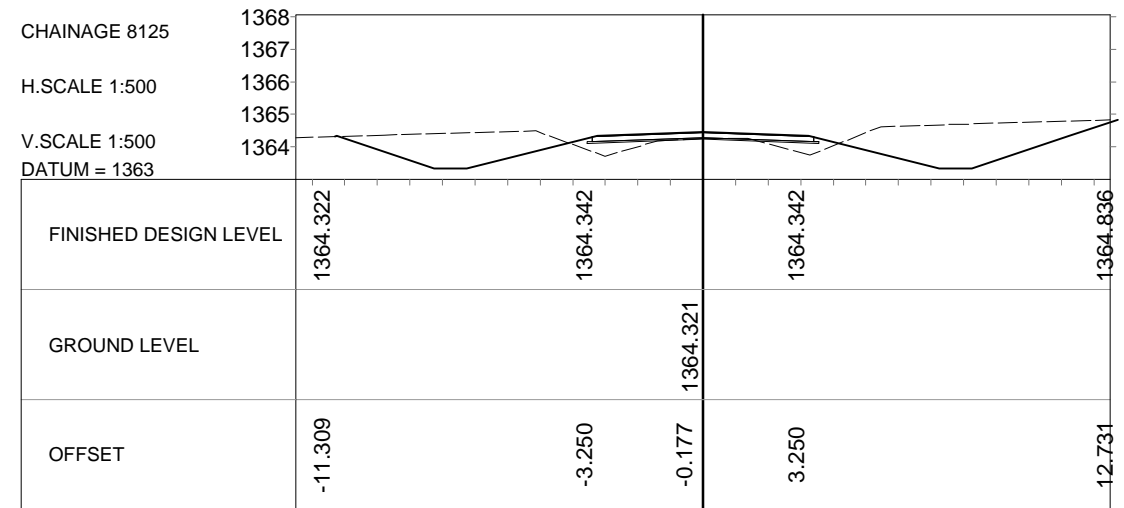
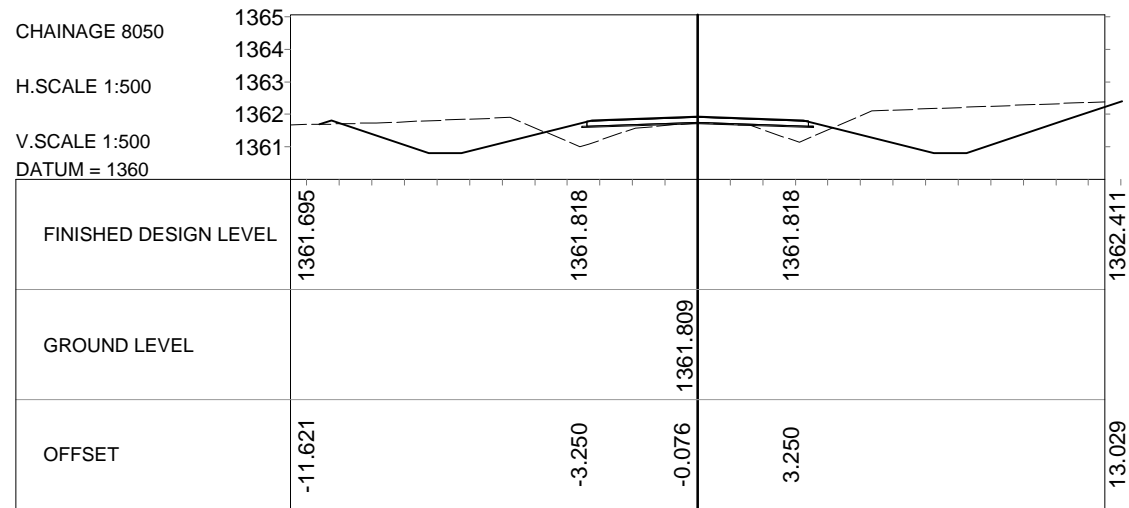
Horizontal Scale 1:500  
Vertical Scale 1:500

PROJECT:

TRIAL SECTION ON LOW VOLUME ROADS: T002-WATWIKI-D00  
DESIGN, CONSTRUCTION SUPERVISION & BASELINE  
MONITORING OF TRIAL SECTIONS ON LOW VOLUME SEALED  
ROADS IN ZAMBIA

TITLE:

Cross Section at 25m Intervals - Section 2  
(Sheet 2 of 4)



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ROAD DEVELOPMENT AGENCY  
HEAD QUARTERS, FAIRLEY ROAD  
P. O. BOX 5003, LUSAKA

SUFFIX:

DATE:

REVISION:

NAME:

DRAWN BY:

DL

DATE:

27-10-2017

PROJECT No:

DRAWING No.

170308-CI-205

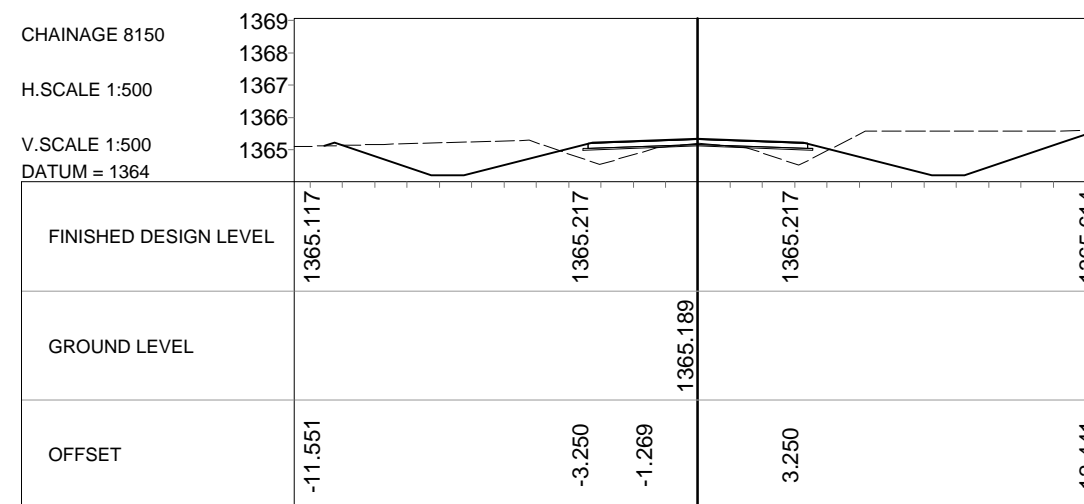
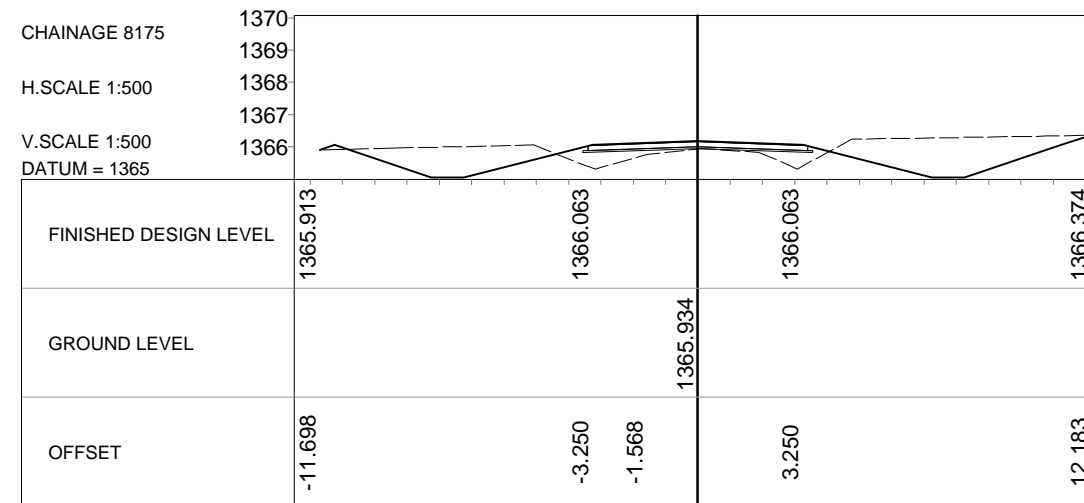
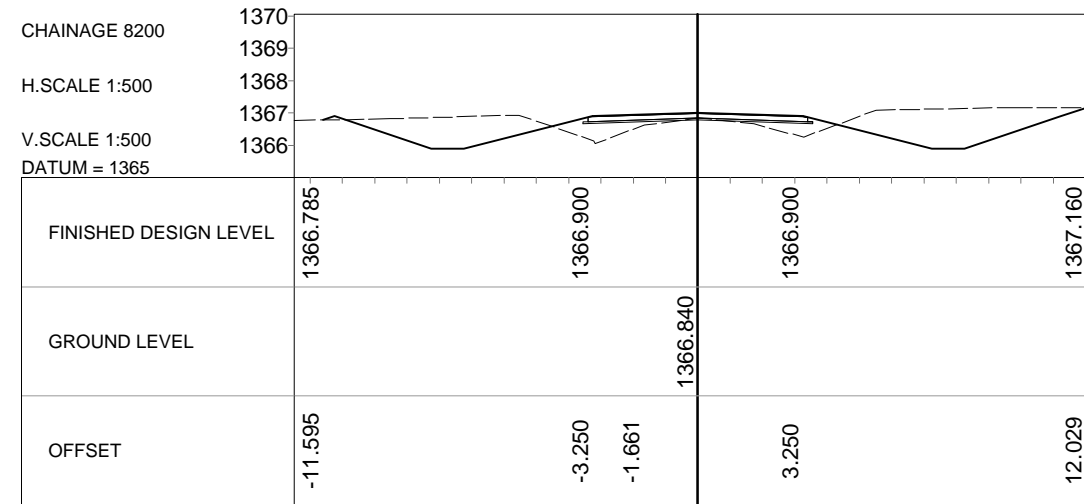
PROJECT:

TRIAL SECTION ON LOW VOLUME ROADS: T002-WATWIKA-D001  
DESIGN, CONSTRUCTION SUPERVISION & BASELINE  
MONITORING OF TRIAL SECTIONS ON LOW VOLUME SEALED  
ROADS IN ZAMBIA

TITLE:

Cross Section at 25m Intervals - Section 2  
(Sheet 3 of 4)

Horizontal Scale 1:500  
Vertical Scale 1:500



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CLIENT:

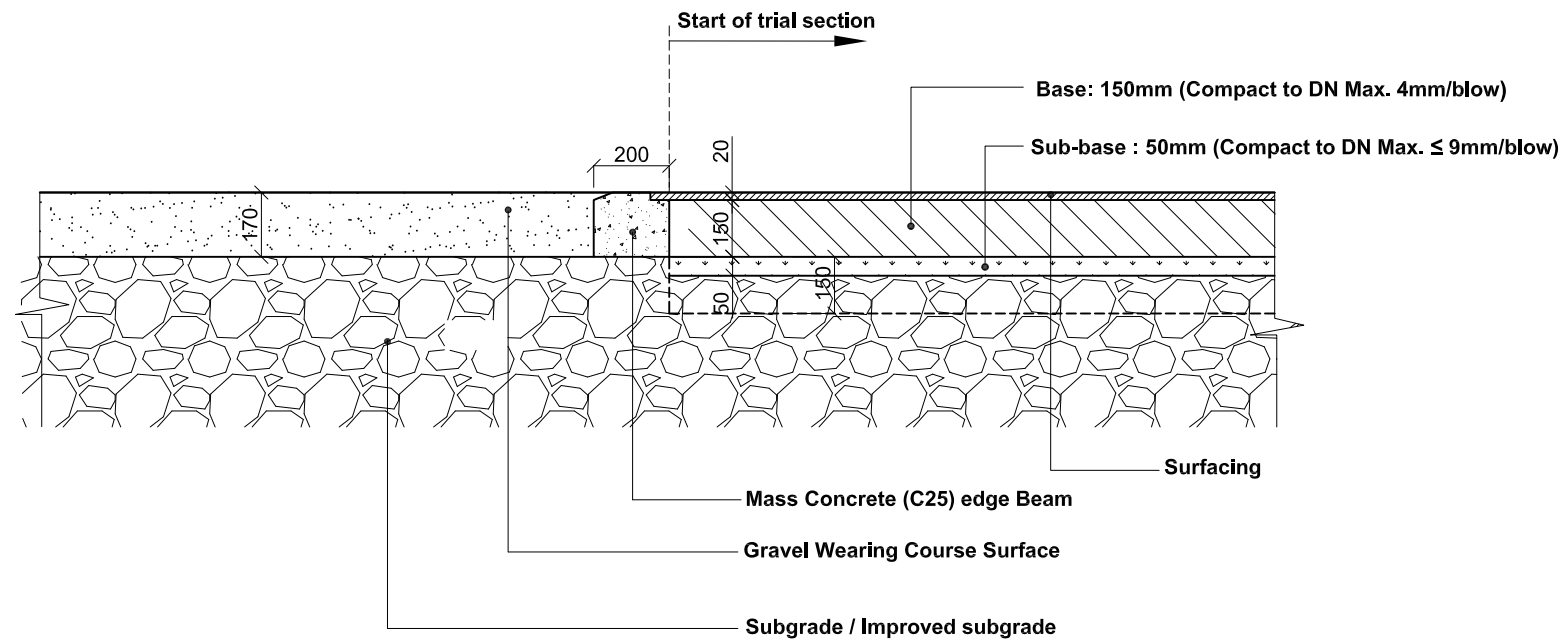


ROAD DEVELOPMENT AGENCY  
HEAD QUARTERS, FAIRLEY ROAD  
P. O. BOX 5003, LUSAKA

SUFFIX:	DATE:	REVISION:	NAME:

DRAWN BY:	DATE:	PROJECT No:
DL	27-10-2017	
CHECKED BY:	APPROVED BY:	DRAWING No.
MP	VA	170308-CI-206
SCALE:		Horizontal Scale 1:500 Vertical Scale 1:500

PROJECT:
TRIAL SECTION ON LOW VOLUME ROADS: T002-WATWIKI-0001 DESIGN, CONSTRUCTION SUPERVISION & BASELINE MONITORING OF TRIAL SECTIONS ON LOW VOLUME SEALED ROADS IN ZAMBIA
TITLE:
Cross Section at 25m Intervals - Section 2 (Sheet 4 of 4)



Detail of Transition between Bituminous and Gravel Section



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CLIENT:

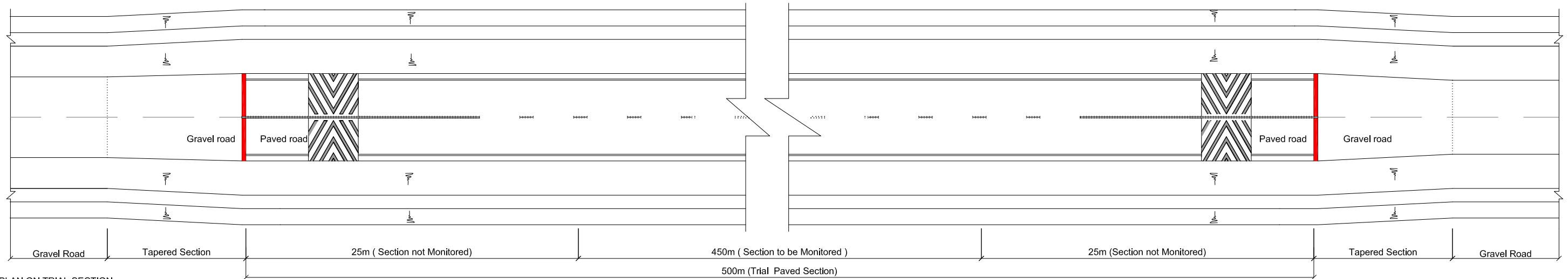


ROAD DEVELOPMENT AGENCY  
HEAD QUARTERS, FAIRLEY ROAD  
P. O. BOX 5003, LUSAKA

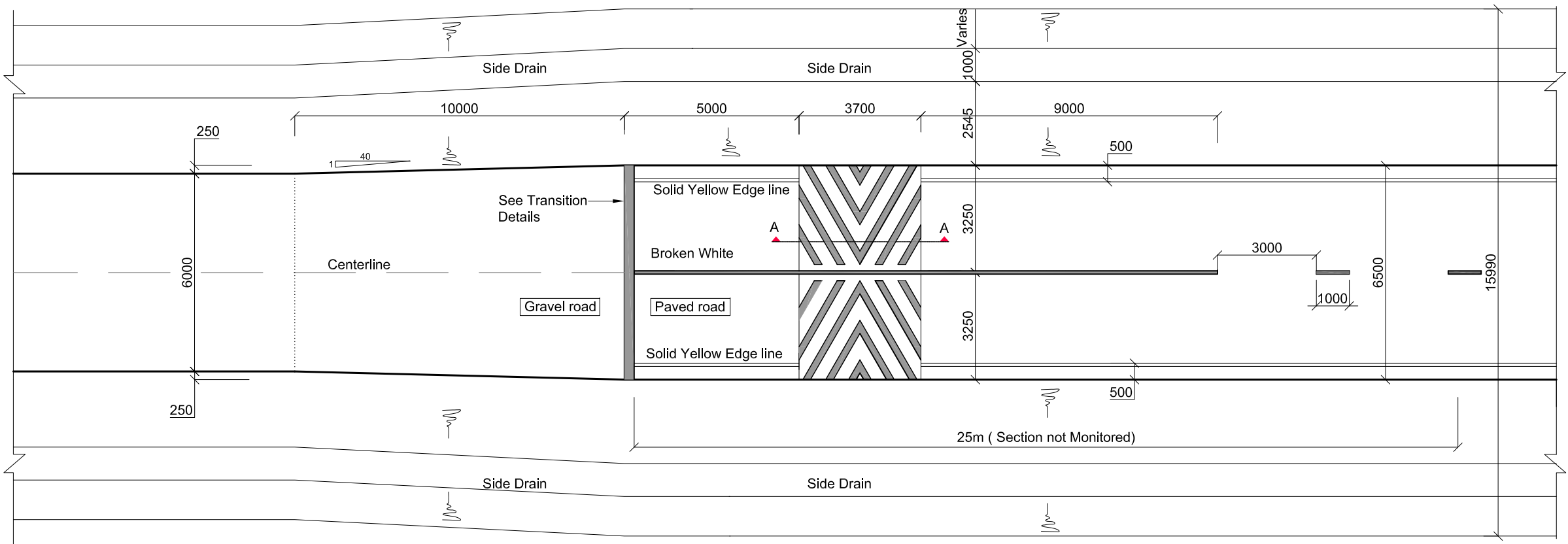
SUFFIX	DATE	REVISION	BY:
A	31-10-17	Edge beam included	NS

DRAWN BY:	DATE:
NS	31-10-2017
CHECKED BY:	APPROVED BY:
SR	VA
FILE:	

PROJECT No:	PROJECT :
170308	Trial Section on Low Volume Roads T002-Waitwika-D001
DRAWING No :	Design, Construction Supervision and Baseline Monitoring of Trial Sections on Low Volume Sealed Roads in Zambia
170308-CI-002	TITLE :
SCALE :	Typical Transition between Bituminous and Gravel
AS SHOWN	

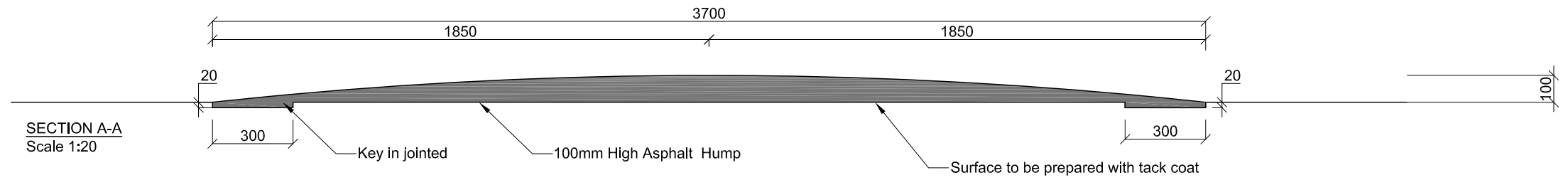


PLAN ON TRIAL SECTION  
Scale 1:300



SPEED HUMP DETAIL  
Scale 1:150

- NOTES:**
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED
  - ALL ROAD MARKING TO BE IN ACCORDANCE WITH SADC ROAD TRAFFIC SIGNS MANUAL



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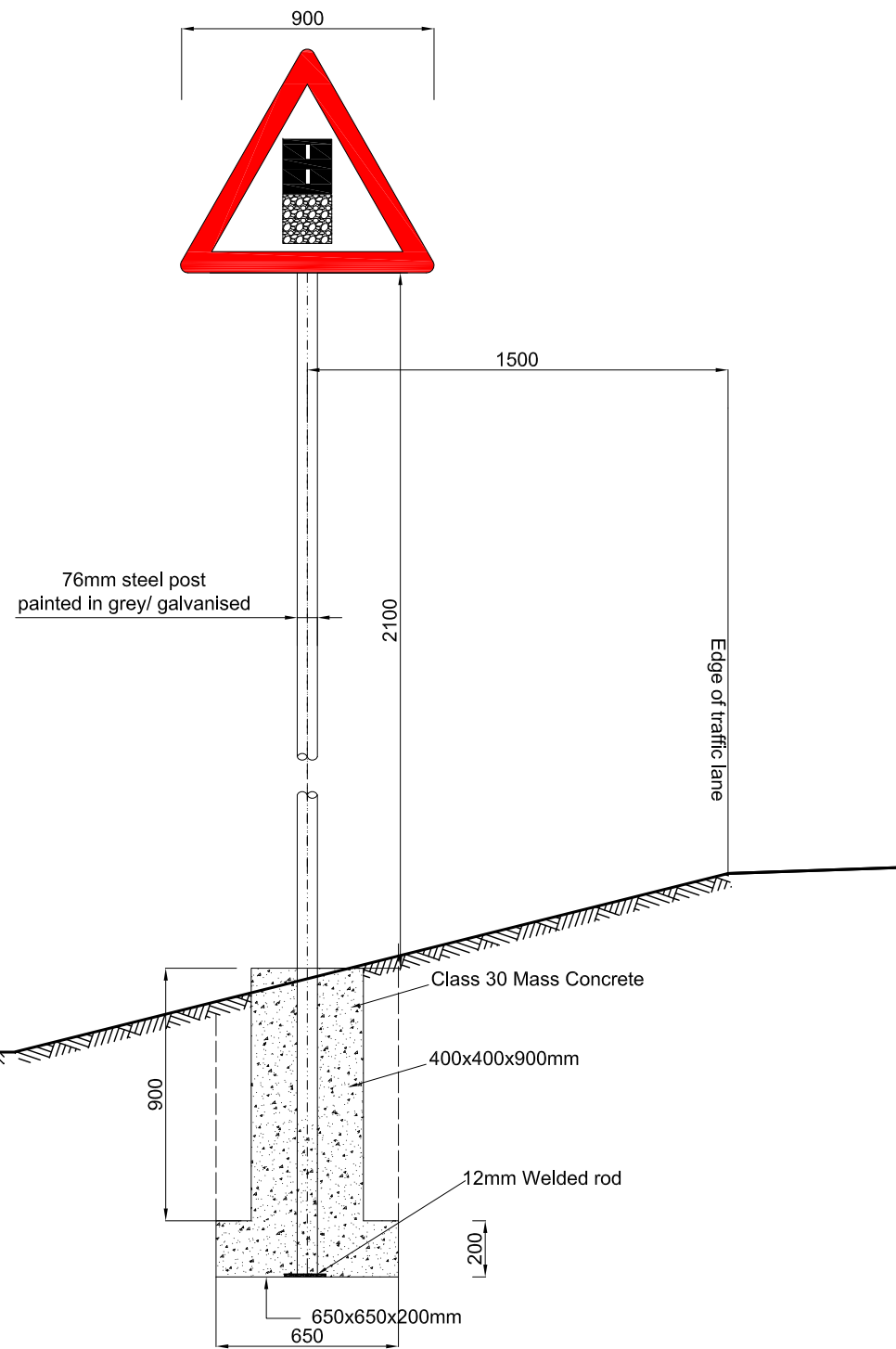
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**ROAD DEVELOPMENT AGENCY**  
HEAD QUARTERS, FAIRLEY ROAD  
P. O. BOX 5003, LUSAKA

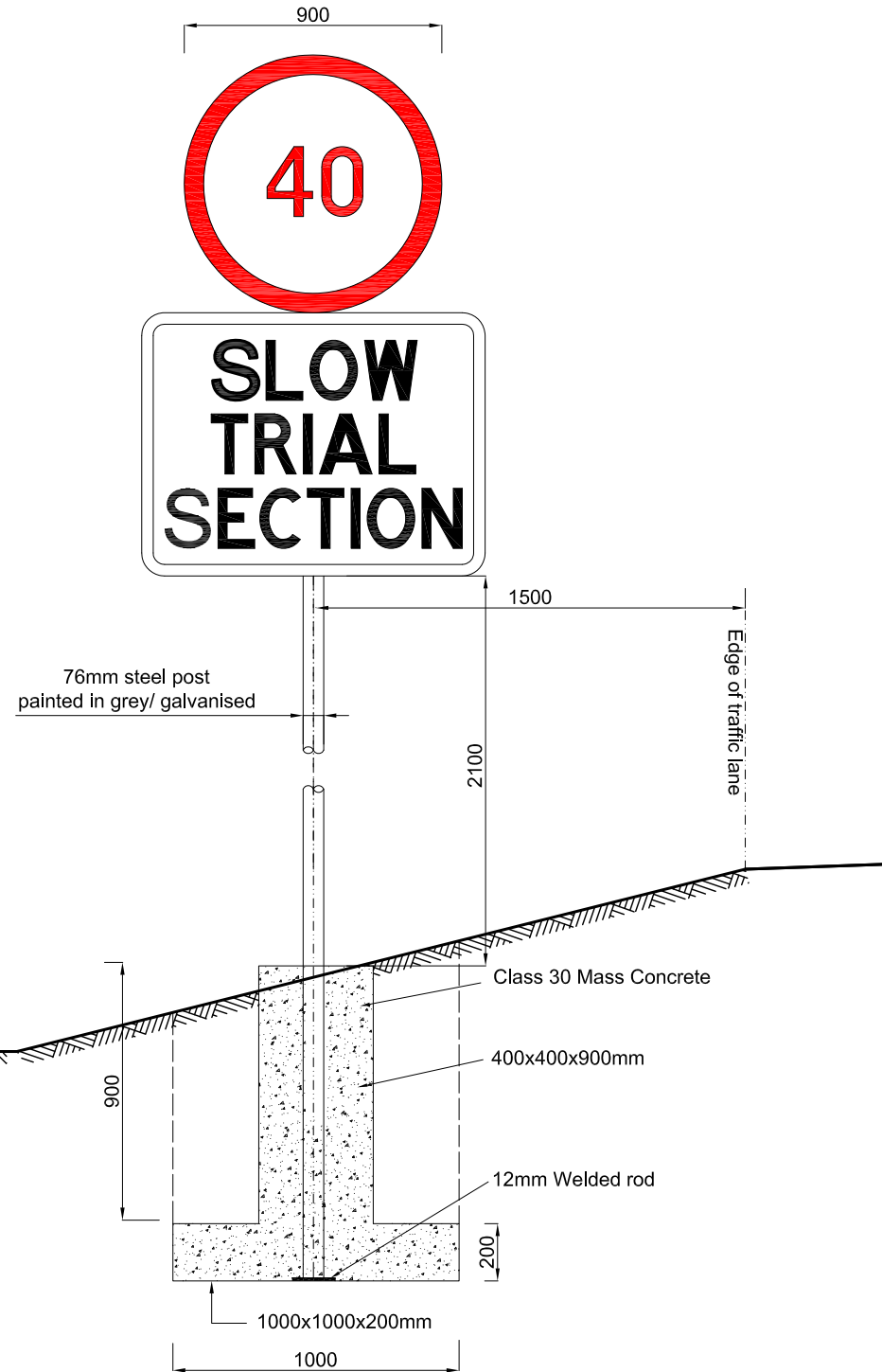
SUFFIX	DATE	REVISION:	BY:
A	17/01/2017	Road Tapered from 5.5m to 6.5m added	NS
B	30/01/2017	Road Tapered from 6.0m to 6.5m added	NS

BY:	NS	DATE:	30-01-2018
CHECKED BY:	SR	APPROVED BY:	VA
FILE:	FILE:	SCALE:	SCALE:
NAME:		AS SHOWN	

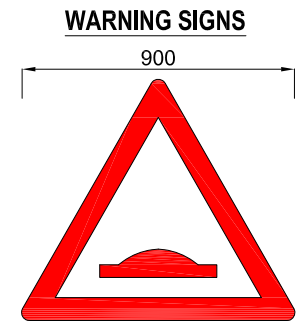
PROJECT No:	170308
DRAWING No :	170308-CI-003B
PROJECT :	Trial Section on Low Volume Roads T002-Waitwika-D001 Design, Construction Supervision and Baseline Monitoring of Trial Sections on Low Volume Sealed Roads in Zambia
TITLE :	Typical Hump Details, Plan location Section and Marking Details



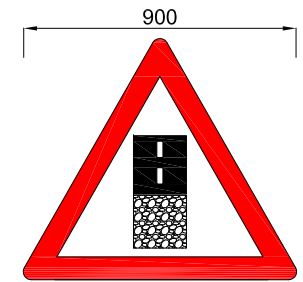
Regular Sign Post Details  
Scale 1:25



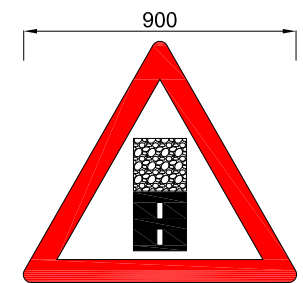
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Scale 1:25



W332

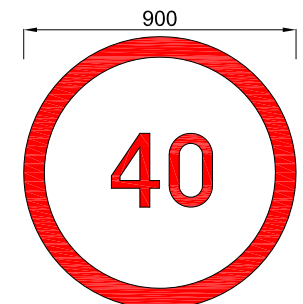


W363



W325

**REGULATORY SIGNS**



R201

**GUIDANCE SIGNS**



GA7P

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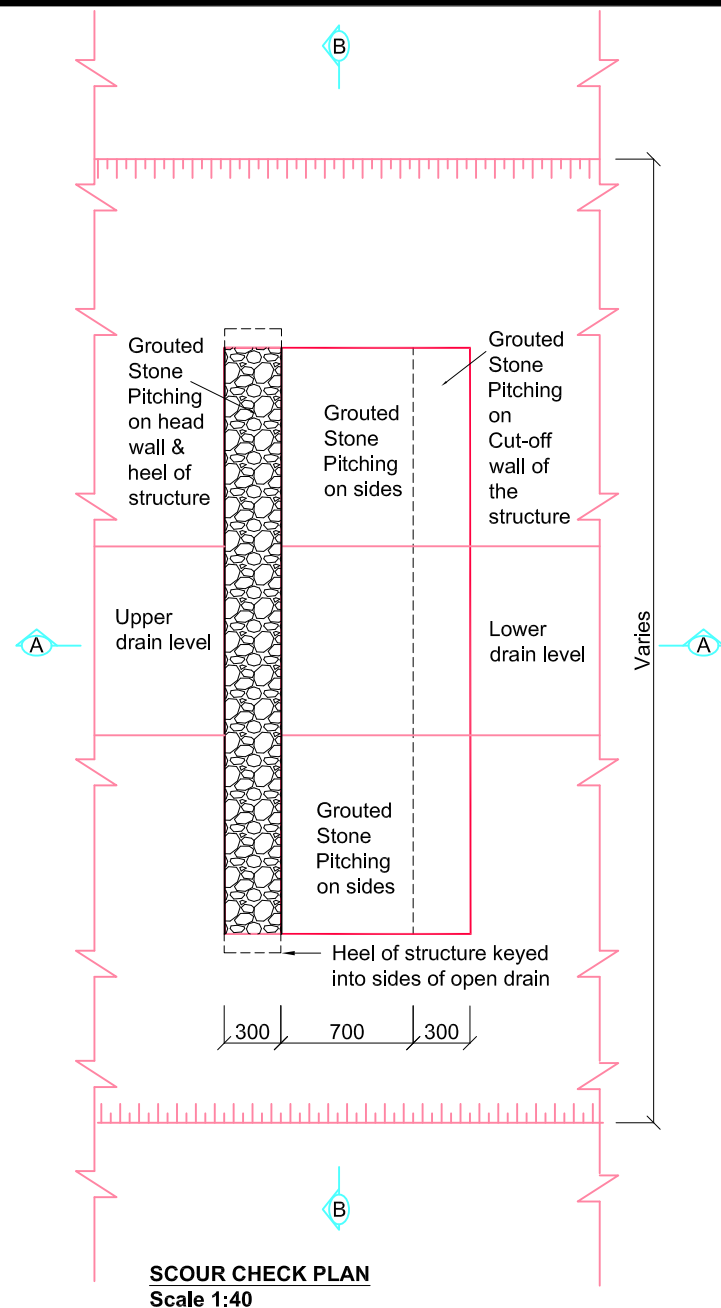
E-mail: rankin@rankinengineering.com

CLIENT:

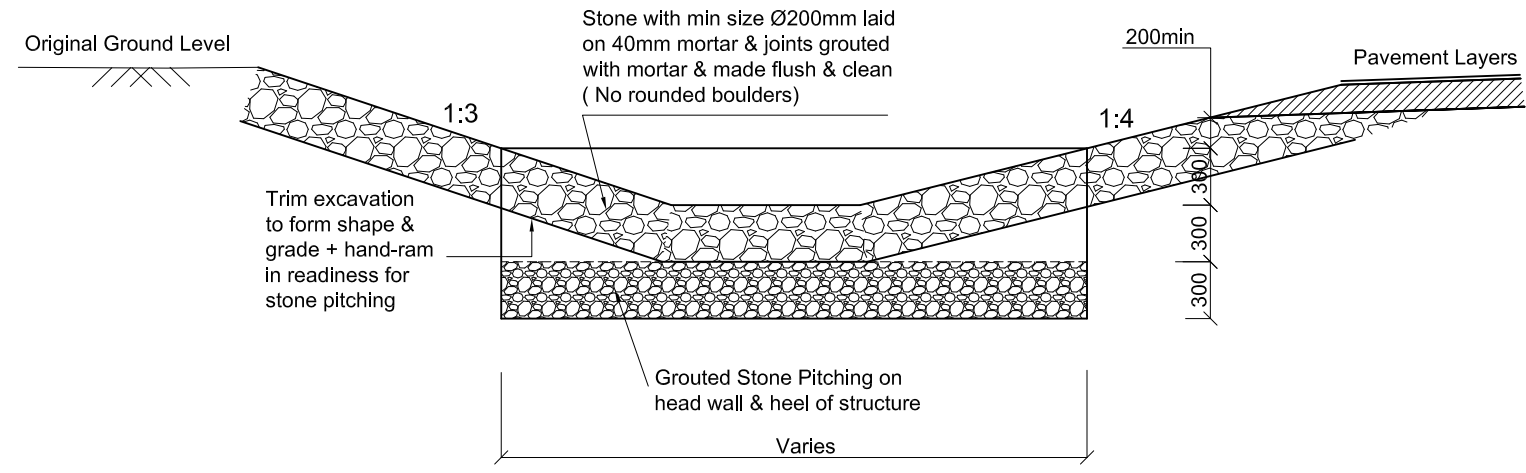


**ROAD DEVELOPMENT AGENCY**  
HEAD QUARTERS, FAIRLEY ROAD  
P. O. BOX 5003, LUSAKA

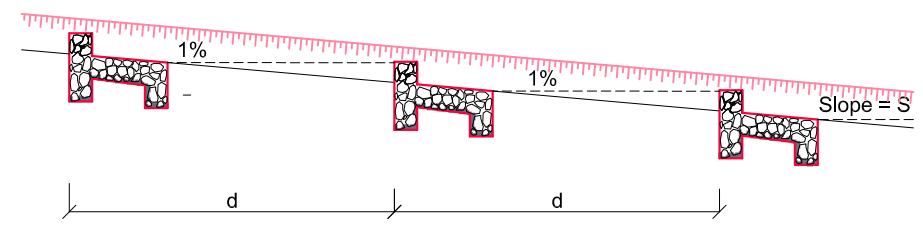
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A	17-01-2018	Sign Details Ammended	DL	NS	17-01-2018		170308	Trial Section on Low Volume Roads T002-Waitwika-D001
				CHECKED BY:	APPROVED BY:		DRAWING No :	Design, Construction Supervision and Baseline Monitoring of Trial Sections on Low Volume Sealed Roads In Zambia
				SR	VA		170308-CI-004A	TITLE :
				FILE:			SCALE : SCALE:	Typical Sign Details 1
							AS SHOWN	



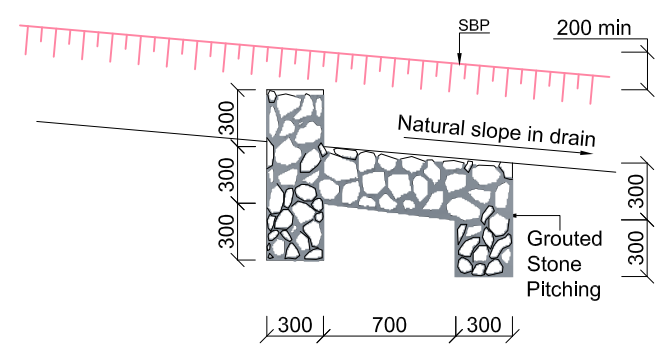
**SCOUR CHECK PLAN**  
Scale 1:40



**SECTION B-B**  
Scale 1:40



**SCOUR CHECK LONG SECTION**  
Scale 1:100



**SECTION A-A**  
Scale 1:40

Slope (S) %	Distance (d) m
$S \geq 2\%$	30
$3.5\% > S \geq 2.5\%$	15
$4\% > S \geq 3.5\%$	10
$S \geq 4\%$	Lined drain

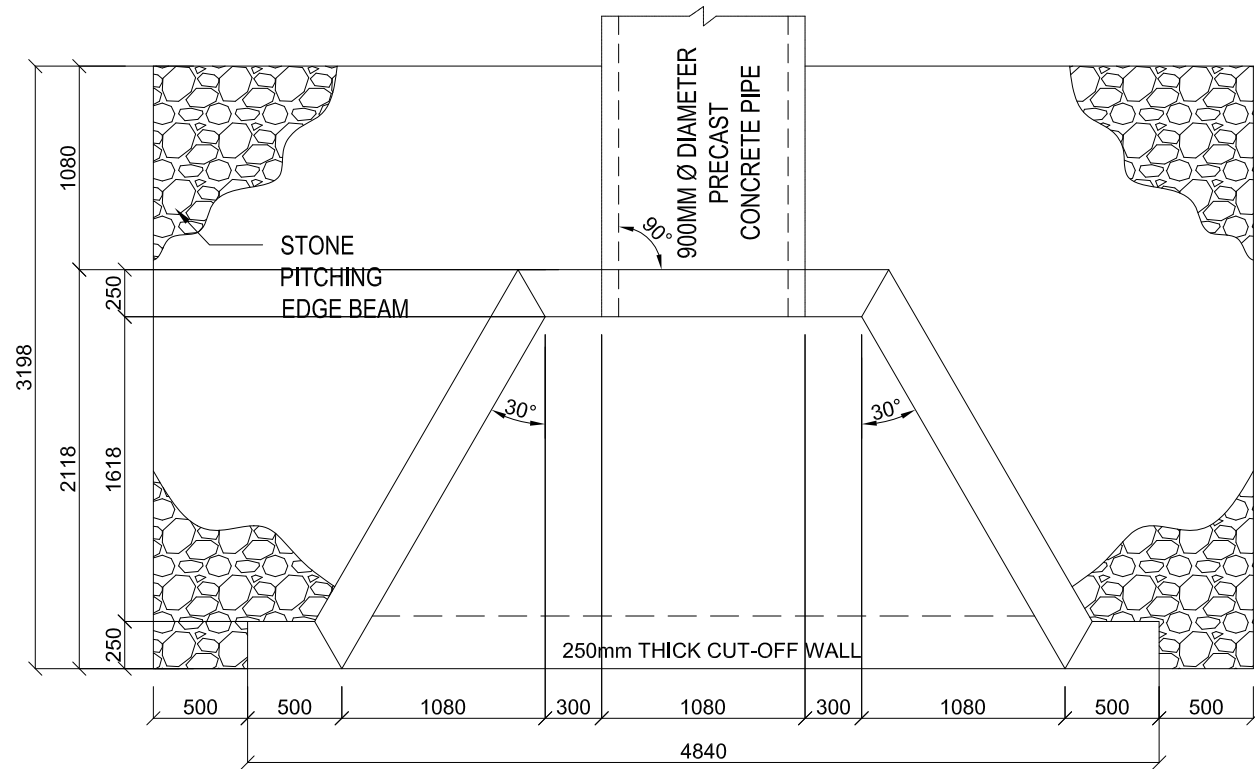
**RANKIN**  
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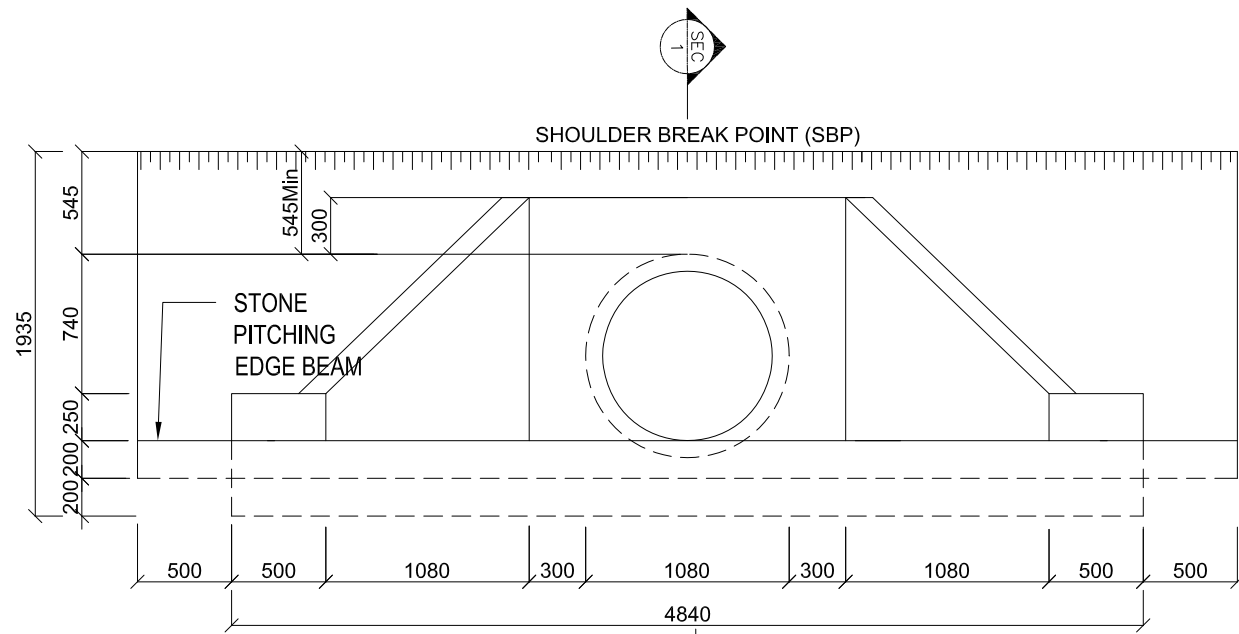
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**ROAD DEVELOPMENT AGENCY**  
HEAD QUARTERS, FAIRLEY ROAD  
P. O. BOX 5003, LUSAKA

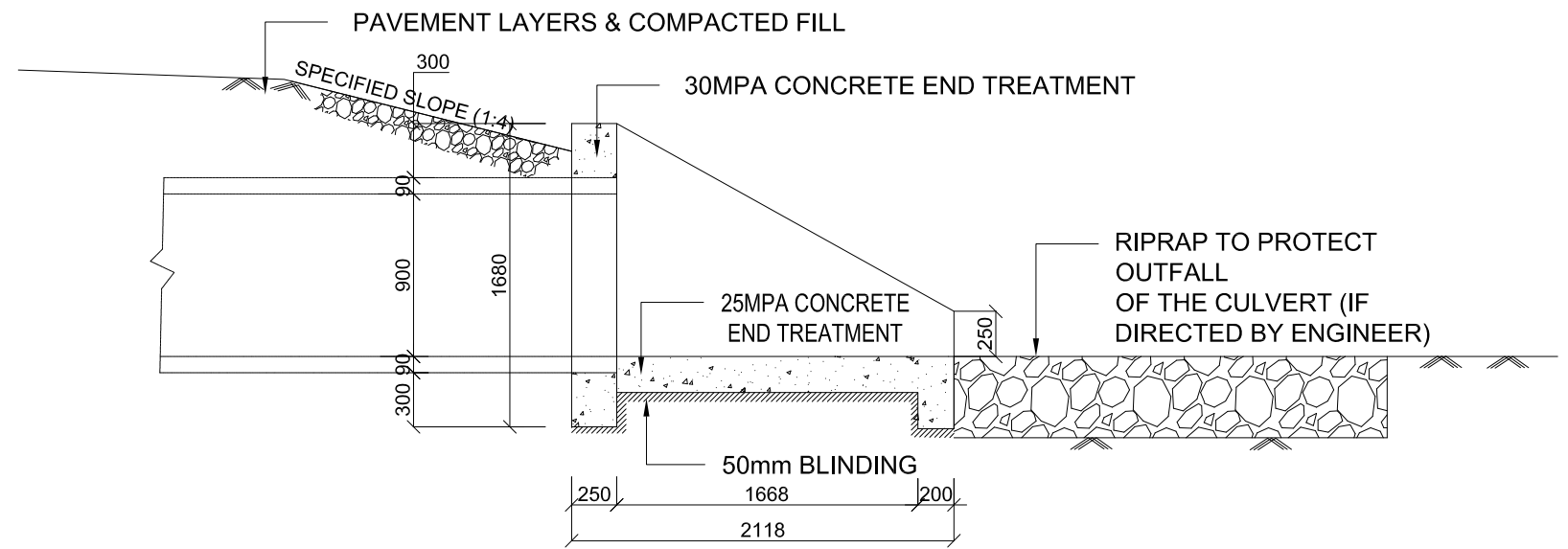
SUFFIX	DATE	REVISION	BY	DRAWN BY:	DATE:	PROJECT No:	PROJECT :
				NS	16-10-2017	170308	Trial Section on Low Volume Roads T002-Waltwika-D001
				CHECKED BY:	APPROVED BY:	DRAWING No :	Design, Construction Supervision and Baseline Monitoring of Trial Sections on Low Volume Sealed Roads In Zambia
				SR	VA	170308-CI-005	TITLE :
				FILE:		SCALE :	TYPICAL SCOUR CHECK DETAILS
						As Shown	



**PLAN**  
SCALE 1:40



**ELEVATION**  
SCALE 1:40



**SECTION 1-1**  
SCALE 1:40



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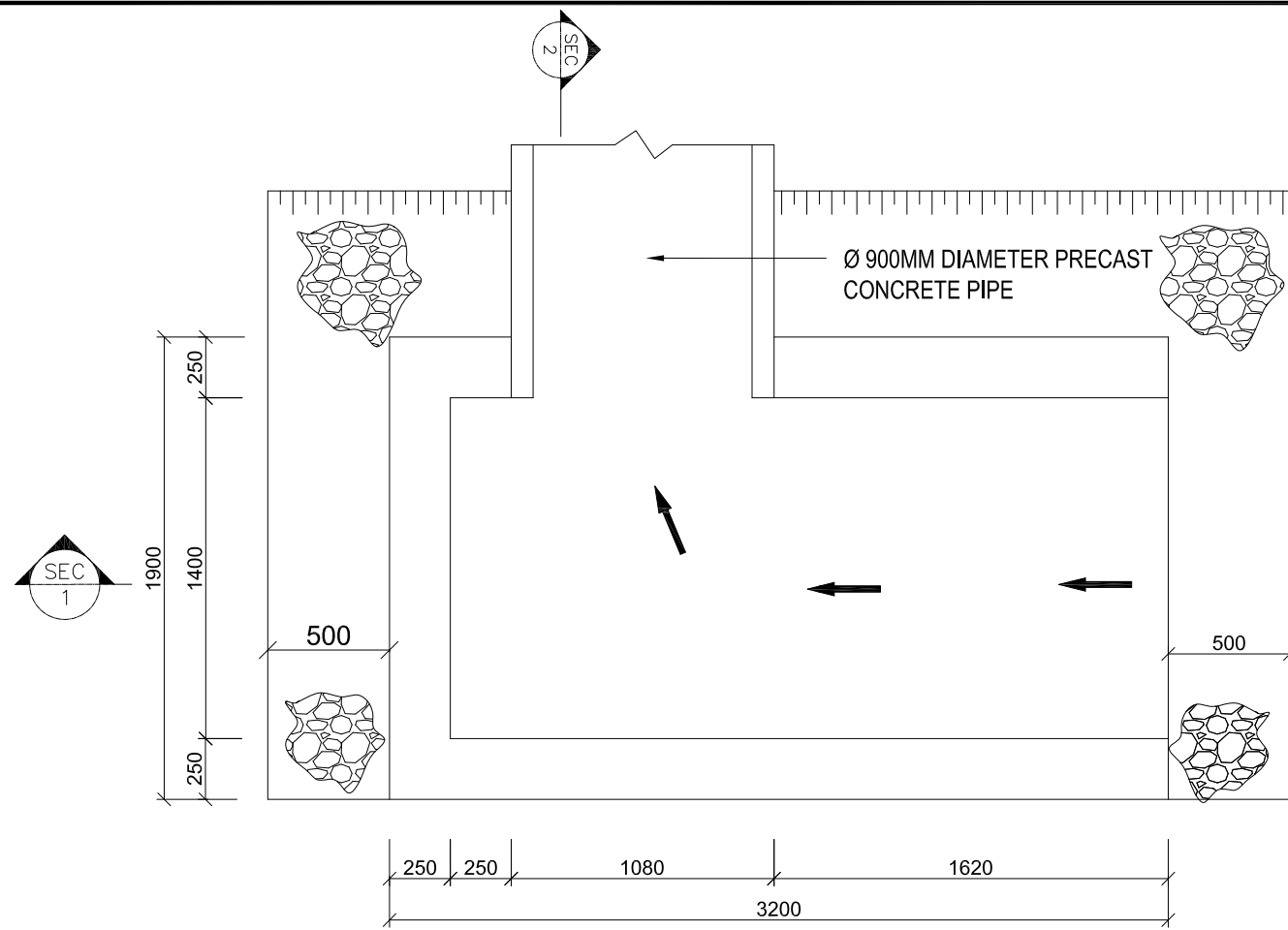
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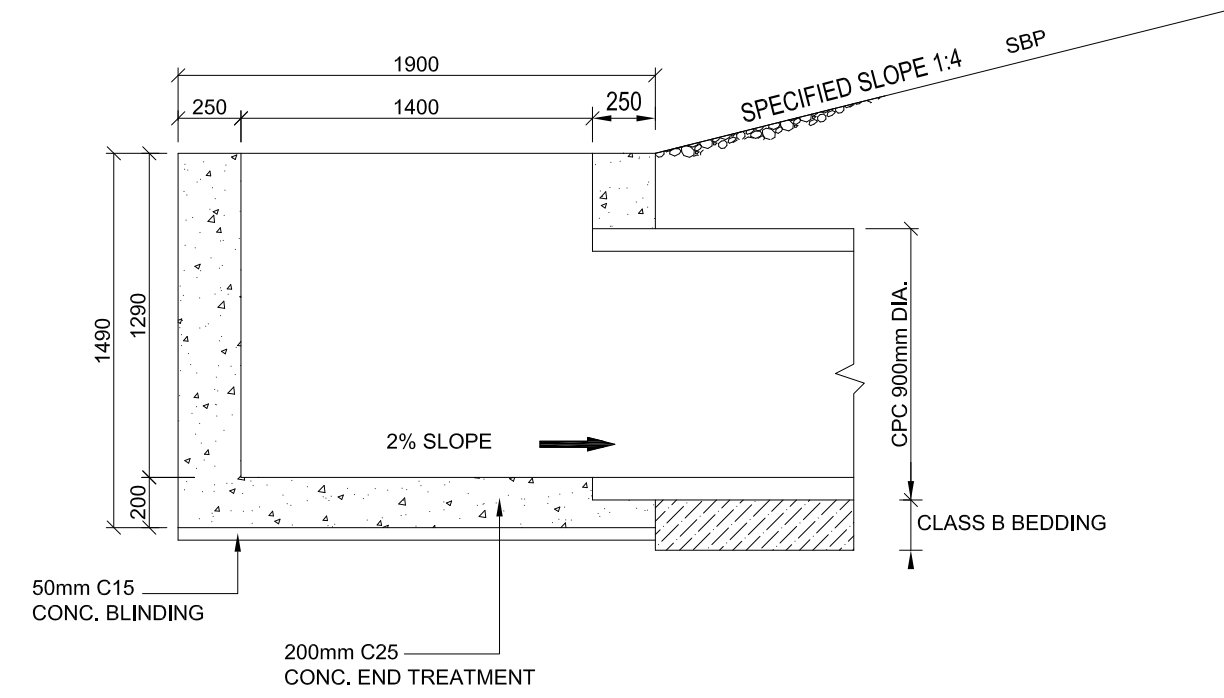
**ROAD DEVELOPMENT AGENCY**  
HEAD QUARTERS, FAIRLEY ROAD  
P. O. BOX 5003, LUSAKA

SUFFIX	DATE	REVISION:	BY:	DRAWN BY:	DATE:	DATE:	PROJECT No:	PROJECT:
				NS	16-10-2017		170308	Trial Section on Low Volume Roads T002-Waltwika-D001 Design, Construction Supervision and Baseline Monitoring of Trial Sections on Low Volume Sealed Roads in Zambia
				CHECKED BY: SR	APPROVED BY: VA		DRAWING No : 170308-CI-006	
				FILE:	FILE:		SCALE : AS SHOWN	TITLE : <b>Cross Culvert at ch 7+650 General Arrangements</b>
				NAME:				

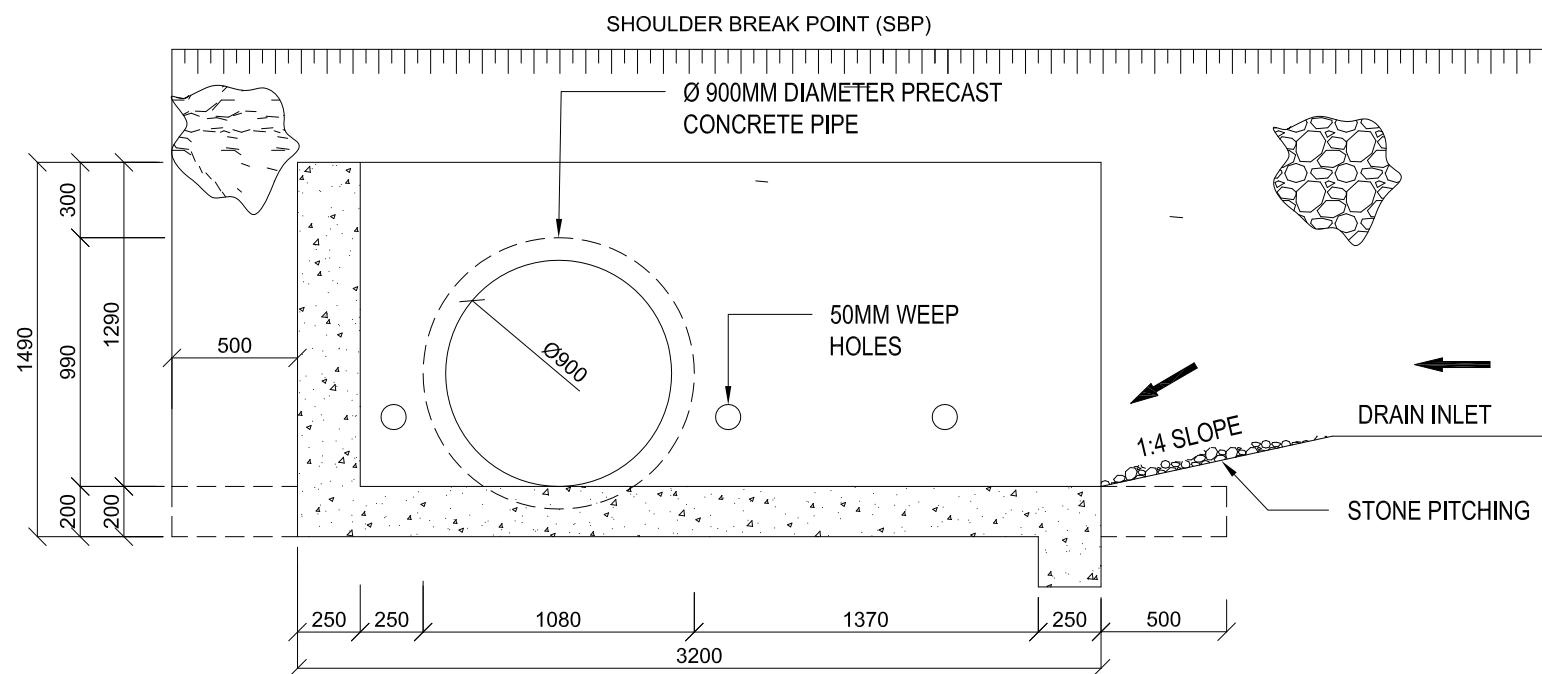




**CATCH PIT INLET STRUCTURE**  
SCALE 1:30



**SECTION 2-2 CATCH PIT DETAIL**  
SCALE 1:30



**SECTION 1-1**  
SCALE 1:30



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**ROAD DEVELOPMENT AGENCY**  
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SUFFIX	DATE	REVISION	BY

DRAWN BY: NS	DATE: 16-10-2017
CHECKED BY: SR	APPROVED BY: VA
FILE: NAME:	FILE:

PROJECT No: 170308	DRAWING No : 170308-CI-008
SCALE : AS SHOWN	SCALE:

PROJECT : Trial Section on Low Volume Roads T002-Waitwika-D001 Design, Construction Supervision and Baseline Monitoring of Trial Sections on Low Volume Sealed Roads in Zambia
TITLE : <b>Cross Culvert at ch 7+650 - Catch pit details</b>



1x900mm BENDING SCHEDULE


LOCATION	BAR MARK (SEE DRAWINGS)	TYPE AND SIZE	TOTAL NUMBER	CUTTING LENGTH (mm)	SHAPE CODE	REINFORCEMENT DRAWINGS	ALL BENDING DIMENSIONS(mm)					SPACING (mm)	UNIT MASS (Kg/m)	TOTAL LENGTH (m)	TOTAL MASS (Kg)
							A	B	C	D	E/r				
Head Wall	H1	Y12	8	2570	35		2370					0.888	20.560	18.257	
Head Wall	H1	Y12	4	1470	38		940	150	940			0.888	5.880	5.221	
Head Wall	H1	Y12	2	1270	38		840	150	840			0.888	2.540	2.256	
Head Wall	H2	Y12	12	1880	35		1680					0.888	22.560	20.033	
Head Wall	H2	Y12	4	990	38		500	150	500			0.888	3.960	3.516	
Head Wall	H2	Y12	6	670	38		340	150	340			0.888	4.020	3.570	
Head Wall	H3	Y12	8	900	49		200	500	200			0.888	7.200	6.394	
APRON	A1	Y12	4	780	61		280	150	280	150		0.888	3.120	2.771	
APRON	A1	Y10	2	1400	55		640	280	150	280	150	0.888	2.800	2.486	
APRON	A1	Y10	2	1840	55		1080	280	150	280	150	0.888	3.680	3.268	
APRON	A1	Y10	2	2270	55		1510	280	150	280	150	0.888	4.540	4.032	
APRON	A1	Y10	2	2700	55		1940	280	150	280	150	0.888	5.400	4.795	
APRON	A1	Y10	7	2780	55		2020	280	150	280	150	0.888	19.460	17.280	
APRON	A2	Y12	1	3030	20		3030					0.888	3.030	2.691	
APRON	A2	Y12	1	2920	20		2920					0.888	2.920	2.593	
APRON	A2	Y12	1	3710	20		3710					0.888	3.710	3.294	
APRON	A2	Y12	1	4000	20		4000					0.888	4.000	3.552	
APRON	A2	Y12	1	4280	20		4280					0.888	4.280	3.801	
APRON	A2	Y12	1	4570	20		4570					0.888	4.570	4.058	
APRON	A2	Y12	1	4860	20		4860					0.888	4.860	4.316	
CUT-OFF WALL	C1	Y12	4	5740	20		5740					0.888	22.960	20.388	

WINGWALL	W1	Y12	4	1220	62		300	920				0.888	4.880	4.333
WINGWALL	W1	Y12	4	1930	62		300	1630				0.888	7.720	6.855
WINGWALL	W1	Y12	4	2410	62		300	2110				0.888	9.640	8.560
WINGWALL	W2	Y12	2	2020	38		150	1250	680			0.888	4.040	3.588
WINGWALL	W2	Y12	2	1900	38		150	1130	680			0.888	3.800	3.374
WINGWALL	W2	Y12	2	1780	38		150	1010	680			0.888	3.560	3.161
WINGWALL	W2	Y12	2	1650	38		150	880	680			0.888	3.300	2.930
WINGWALL	W2	Y12	2	1530	38		150	760	680			0.888	3.060	2.717
WINGWALL	W2	Y12	2	1410	38		150	640	680			0.888	2.820	2.504
WINGWALL	W2	Y12	2	1290	38		150	520	680			0.888	2.580	2.291
WINGWALL	W2	Y12	2	1170	38		150	400	680			0.888	2.340	2.078
WINGWALL	W3	Y12	2	1868	54		150	1250	480			0.888	3.736	3.318
WINGWALL	W3	Y12	2	1748	54		150	1130	480			0.888	3.496	3.104
WINGWALL	W3	Y12	2	1628	54		150	1010	480			0.888	3.256	2.891
WINGWALL	W3	Y12	2	1498	54		150	880	480			0.888	2.996	2.660
WINGWALL	W3	Y12	2	1378	54		150	760	480			0.888	2.756	2.447
WINGWALL	W3	Y12	2	1258	54		150	640	480			0.888	2.516	2.234
WINGWALL	W3	Y12	2	1138	54		150	520	480			0.888	2.276	2.021
WINGWALL	W3	Y12	2	1018	54		150	400	480			0.888	2.036	1.808
WINGWALL	W4	Y12	4	2510	62		2360	150				0.888	10.040	8.916

WINGWALL	W4	Y12	4	2510	62		2360	150				0.888	10.040	8.916
CATCHPIT	P1	Y12	20	3300	35		3100					0.888	66.000	58.608
CATCHPIT	P1	Y12	4	1780	34		1680					0.888	7.120	6.323
CATCHPIT	P1	Y12	4	1620	34		1520					0.888	6.480	5.754
CATCHPIT	P1	Y12	2	1130	38		520	150	520			0.888	2.260	2.007
CATCHPIT	P1	Y12	2	930	38		420	150	420			0.888	1.860	1.652
CATCHPIT	P2	Y12	1	580	38		480	150	480			0.888	0.580	0.515
CATCHPIT	P2	Y12	12	4520	38		1390	1800	1390			0.888	54.240	48.165
CATCHPIT	P2	Y12	28	1760	37		1390	400				0.888	49.280	43.761
CATCHPIT	P2	Y12	4	3160	37		1390	1800				0.888	12.640	11.224
CATCHPIT	P2	Y12	28	750	38		300	150	300			0.888	21.000	18.648
CATCHPIT	P2	Y12	2	590	38		220	150	220			1.888	1.180	2.228
CATCHPIT	P2	Y12	2	710	38		280	150	280			2.888	1.420	4.101
CATCHPIT	P3/H3	Y12	8	900	49		200	500	200			0.888	7.200	6.394
CATCHPIT	P4	Y12	12	2000	35		1800					0.888	24.000	21.312
CATCHPIT	P5	Y12	5	2178	54		150	1390	650			0.888	10.890	9.670
CATCHPIT	P5	Y12	5	2328	54		150	1390	800			0.888	11.640	10.336
CATCHPIT	P6	Y12	5	3480	55		2930	180	150	180	150	0.888	17.400	15.451
CATCHPIT	P6	Y12	4	1010	55		350	180	150	180	150	0.888	4.040	3.588
CUT-OFF WALL	P7	Y12	2	1800	20		1800					0.888	3.600	3.197
<b>TOTALS</b>													<b>534.888</b>	<b>479.001</b>



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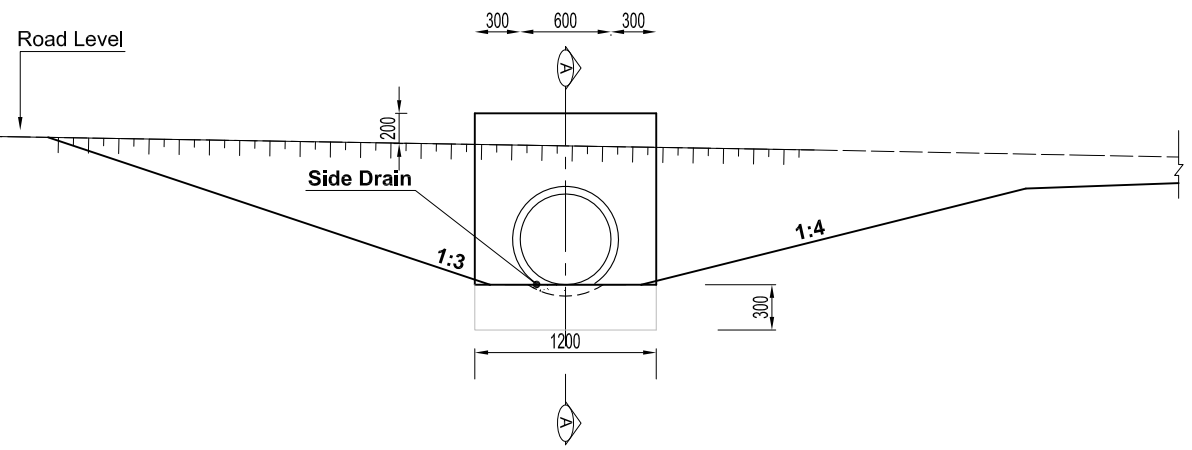
CLIENT:   
**ROAD DEVELOPMENT AGENCY**  
 HEAD QUARTERS, FAIRLEY ROAD  
 P. O. BOX 5003, LUSAKA

SUFFIX	DATE	REVISION	BY

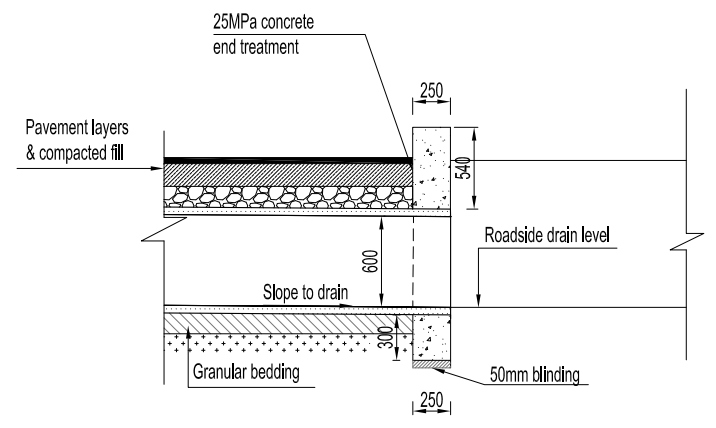
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CHECKED BY: SR	APPROVED BY: VA
FILE:	FILE:
NAME:	

PROJECT No: 170308	SCALE: AS SHOWN
DRAWING No: 170308-CI-010	

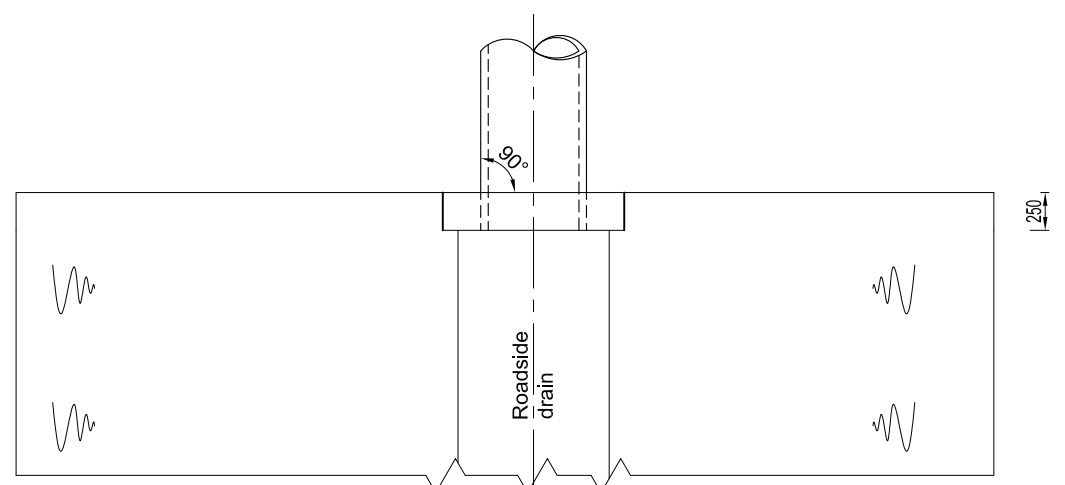
PROJECT: Trial Section on Low Volume Roads T002-Waitwika-D001  
 Design, Construction Supervision and Baseline Monitoring of Trial Sections on Low Volume Sealed Roads in Zambia  
 TITLE: **Cross Culvert at ch 7+ 650 Bending Schedule**



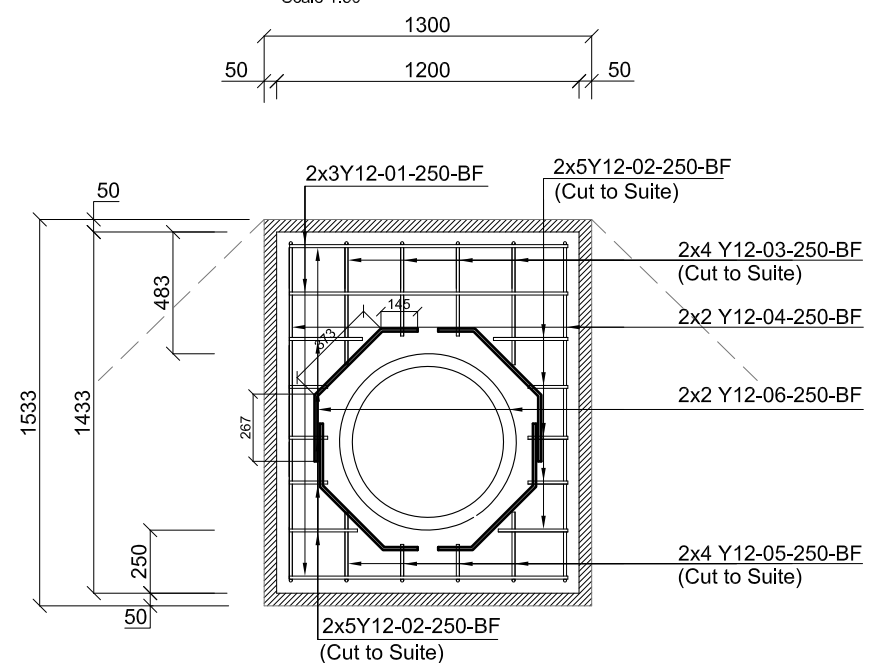
**ELEVATION**  
Scale 1:50



**SECTION A-A**  
Scale 1:50



**PLAN ON PIPE OUTLET**  
Scale 1:50



**PLAN OF HEADWALL REINFORCEMENT**  
SCALE 1:30

**HEADWALL BENDING SCHEDULE**

BAR MARK	TYPE & SIZE	NUMBER OF GROUPS	NUMBER IN EACH	TOTAL NUMBER	LENGTH OF EACH BAR	SHAPE CODE	DIMENSIONS			SKETCH	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL MASS (kg)
							A	B	C				
01	Y12	2	6	12	1340	38	150	1100	150		0.888	16.80	14.918
02	Y12	2	20	40	415	37	150	295			0.888	16.6	14.74
03	Y12	2	8	16	600	37	150	480			0.888	9.60	8.525
04	Y12	2	8	16	1573	38	150	1333	150		0.888	25.168	22.349
05	Y12	2	8	16	390	37	150	270			0.888	6.24	5.541
06	Y12	2	8	16	785	49	267	373	145		0.888	12.56	11.153

- Notes:**
- Concrete Class 15 for blinding
  - Concrete Class 25 throughout for end treatments
  - Concrete Cover = 50mm
  - Steel Reinforcement = High Tensile Steel 450MPa
  - Concrete Finishes:
    - Formed Surfaces - Class F1 - Unexposed
    - Class F2 - exposed
    - Unformed Surfaces - Class U1 - Unexposed
    - Class U2 - Exposed
  - Cutoff wall to be cast integrally with apron
  - Riprap to be placed in all locations where slope exceeds 2%
  - Typical length of access culvert is 4800mm for private properties and 10800mm for roads and filling stations

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SUFFIX	DATE	REVISION	BY

DRAWN BY:	DATE:	DATE:
NS	19-10-2017	
CHECKED BY:	APPROVED BY:	
SR	VA	
FILE:	FILE:	
NAME:		

PROJECT No:	DRAWING No :	SCALE :
170308	170308-CI-011	AS SHOWN

PROJECT :  
Trial Section on Low Volume Roads  
T002-Waitwika-D001  
Design, Construction Supervision and Baseline Monitoring  
of Trial Sections on Low Volume Sealed Roads in Zambia

TITLE :  
**Access Culvert - General  
Arrangement and Reinforcement  
Details and Bending Schedule**