



MINISTRY OF TRANSPORT &
COMMUNICATIONS
SULTANATE OF OMAN



JAPAN INTERNATIONAL
COOPERATION AGENCY

THE STUDY
ON
ROAD NETWORK DEVELOPMENT
IN
THE SULTANATE OF OMAN

FINAL REPORT

DRAWINGS

MARCH 2005



KATAHIRA & ENGINEERS INTERNATIONAL

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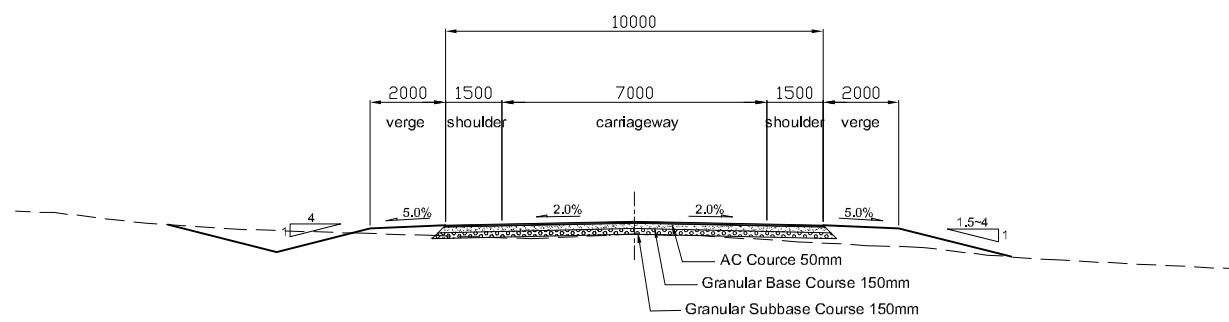
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I. STANDARD

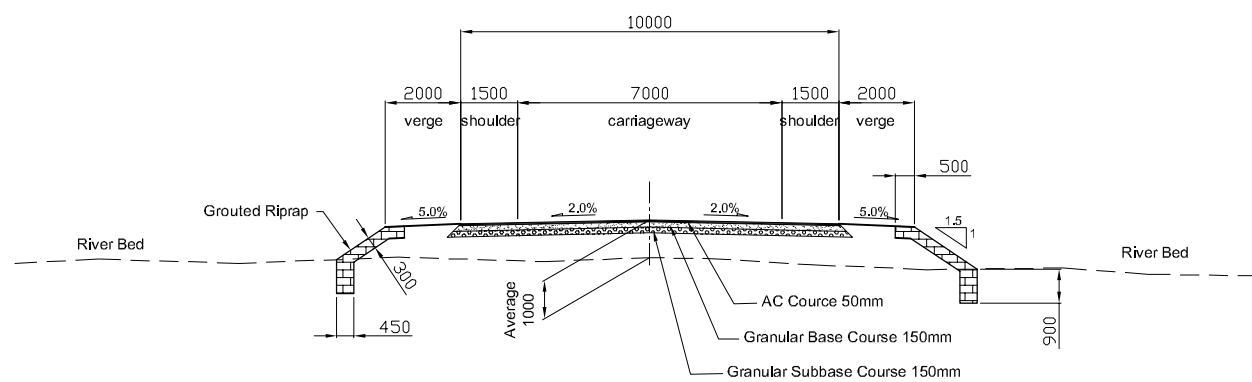
I. STANDARD

CUT SLOPE GRADIENT		
CLASSIFICATION	DEPTH	CUT SLOPE (H : V)
EARTH	0.00 ~ 3.00	2 : 1
	3.00 ~ 6.00	VARIABLE WITH SLOPE STAKE AT 6.00m FROM DITCH INVERT
	> 6.00	1 : 1
MEDIUM HARD	0.00 ~ 2.00	2 : 1
	2.00 ~ 8.00	VARIABLE WITH SLOPE STAKE AT 4.00m FROM DITCH INVERT
	> 8.00	0.5 : 1
SOLID ROCK	0.00 ~ 1.50	2 : 1
	1.50 ~ 6.00	VARIABLE WITH SLOPE STAKE AT 1.50m FROM DITCH INVERT
	> 6.00	0.25 : 1

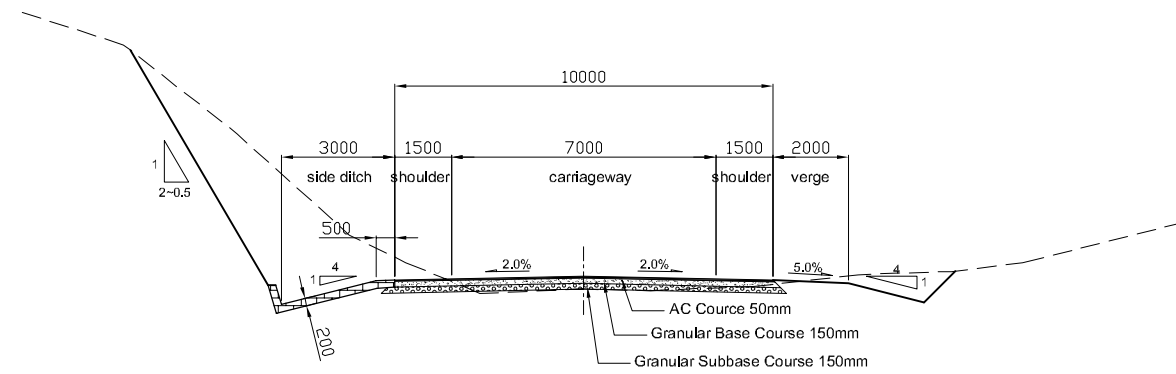
FILL SLOPE GRADIENT	
FILL HEIGHT (m)	FILL SLOPE (H : V)
UPTO 1.50	4 : 1
1.50 ~ 3.00	TOE FIXED AT 6.0m
OVER 3.00	1.5 : 1



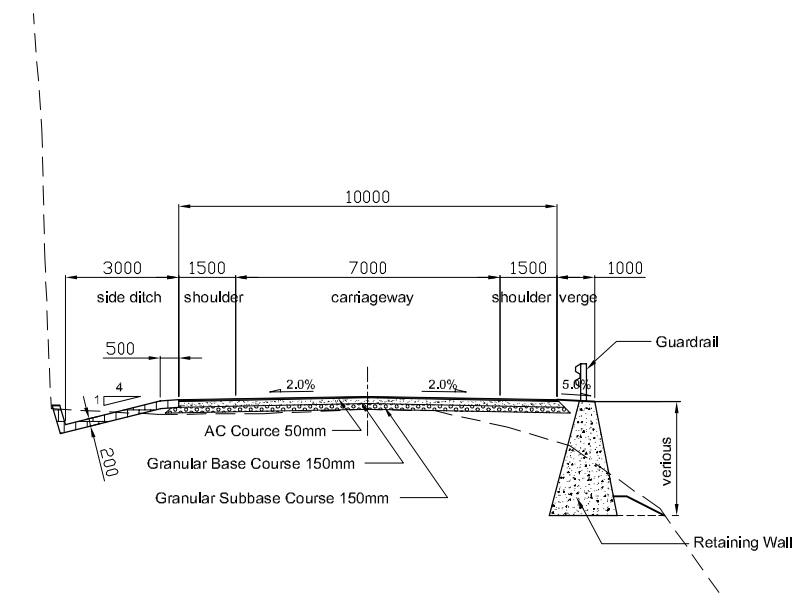
TYPICAL CROSS SECTION TYPE-I
(Normal Flat Terrain)



TYPICAL CROSS SECTION TYPE-II
(Inside Wadi Terrain)



TYPICAL CROSS SECTION TYPE-III
(Rolling Terrain)



TYPICAL CROSS SECTION TYPE-IV
(Mountainous & Cliff Terrain)



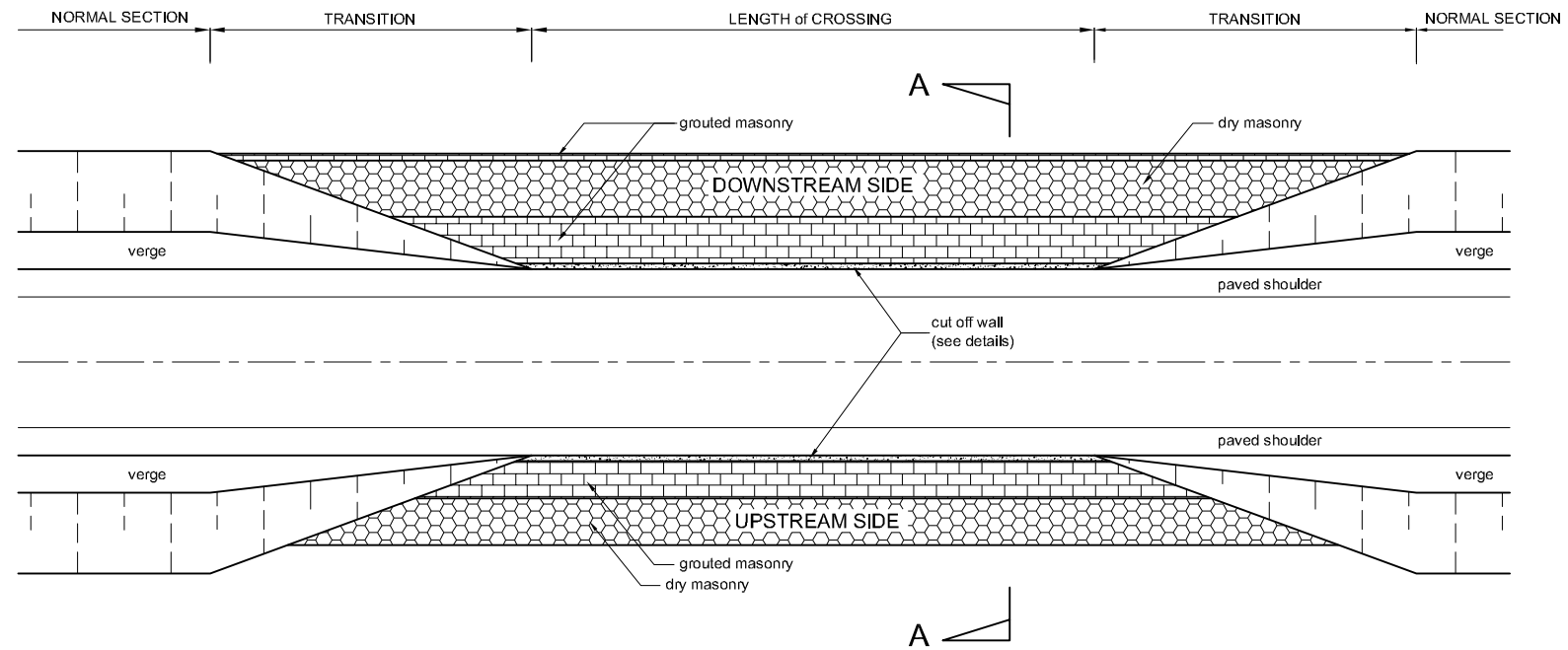
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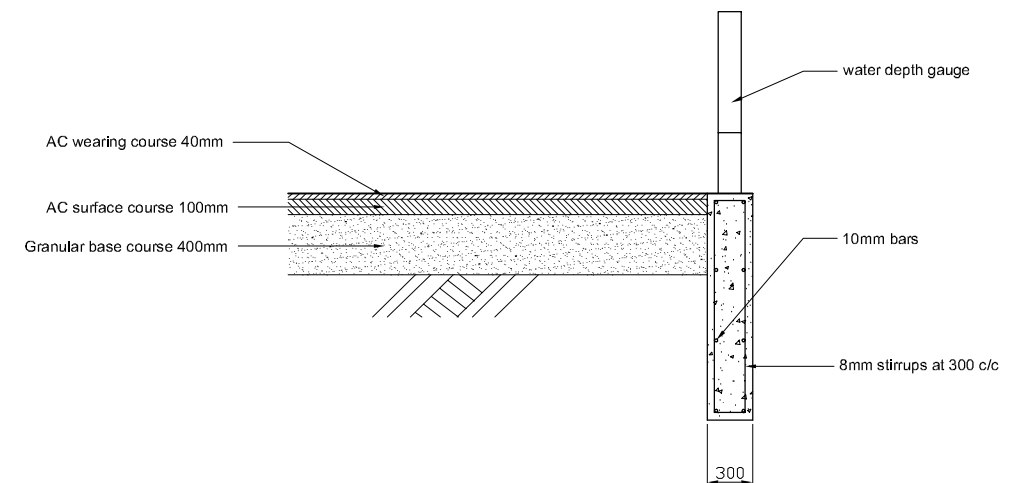
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IN THE SULTANATE OF OMAN

Typical Cross Section

Dwg No.	S-1
Scale	1 : 200
Date	Nov. 2004



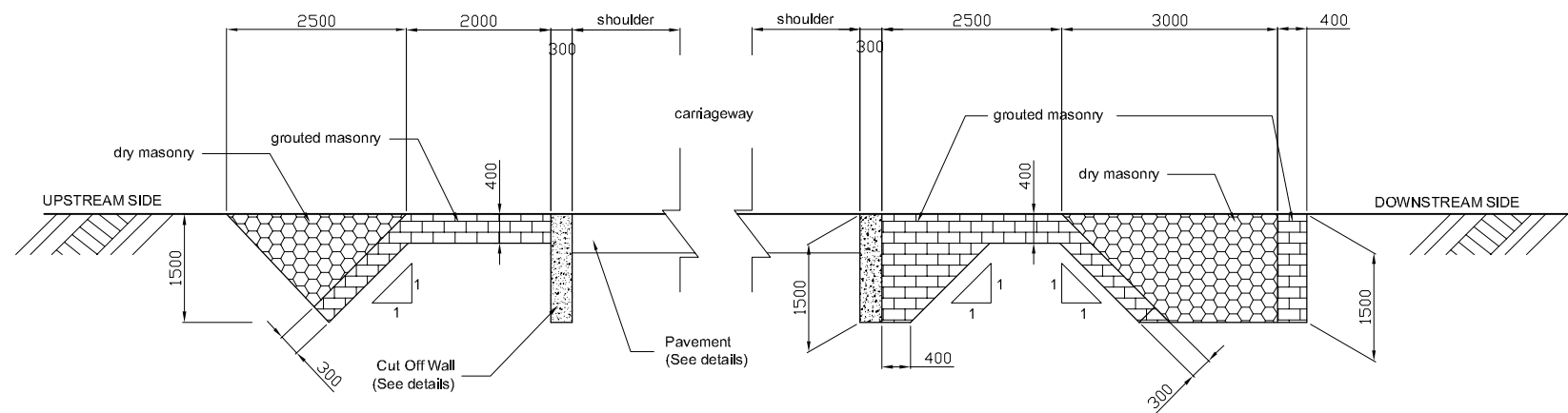
PLAN no scale



CUT OFF WALL & PAVEMENT s=1/50

NOTES :

1. EXPANSION JOINTS SHALL BE PROVIDED IN GROUDED MASONRY AT LEAST EVERY 10 METER.
2. EXPANSION JOINTS SHALL BE PROVIDED IN CUT OFF WALL AT LEAST EVERY 10 METER.
3. EXPANSION JOINTS IN GROUDED MASONRY AND CUT OFF WALL SHALL BE FORMED WITH 20mm THICK JOINT FILLER. THE TOP SURFACE SHALL BE SEALED WITH 20 x 20 HOT Poured JOINT SEALANT.



SECTION A - A s=1/100



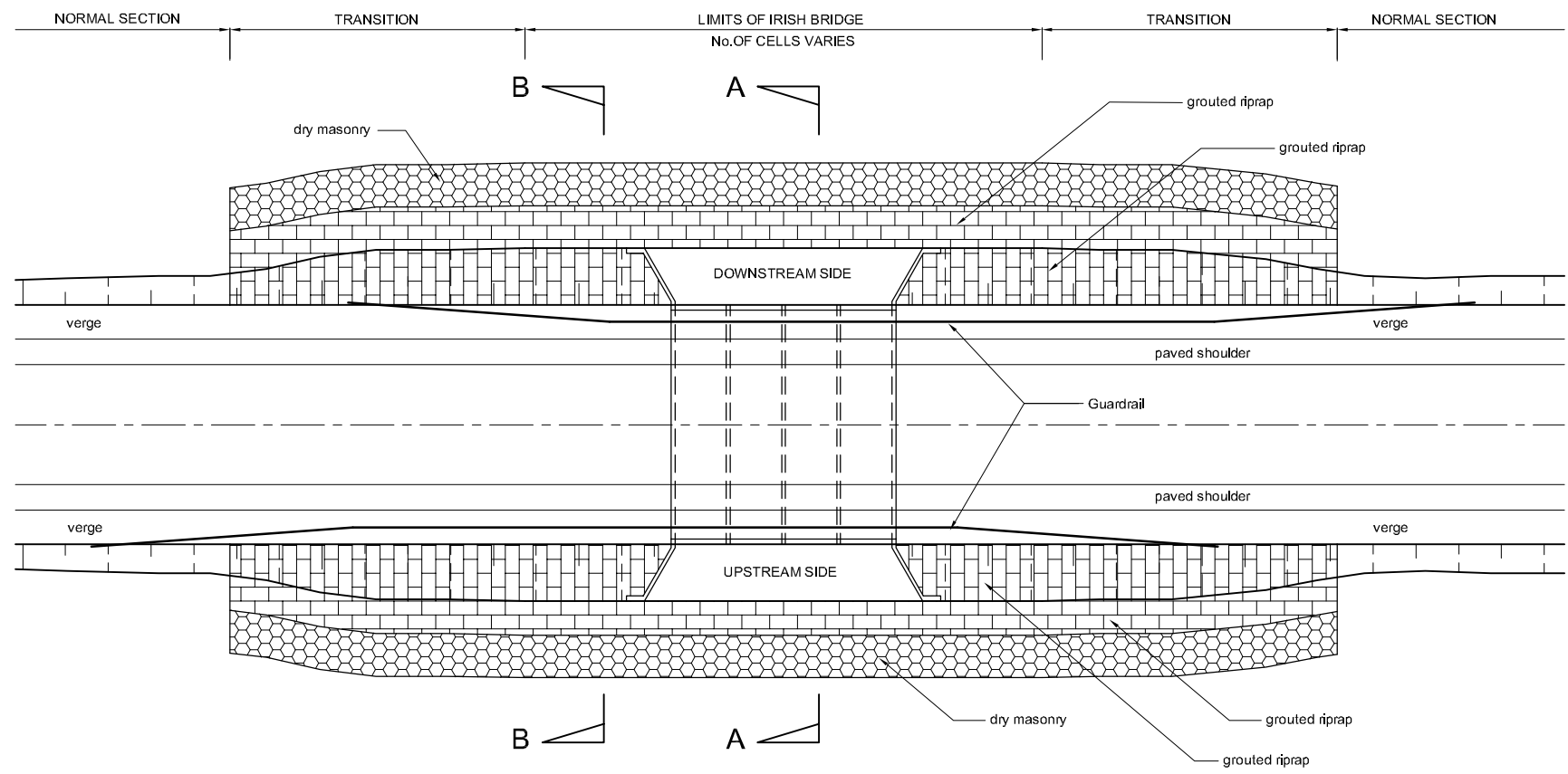
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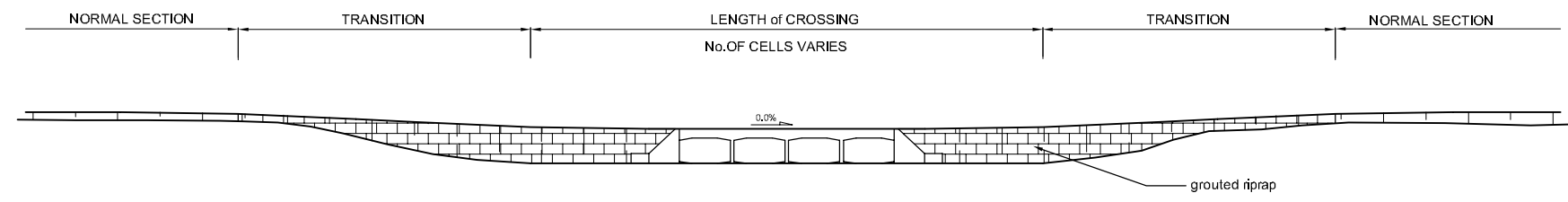
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Standard Irish Crossing

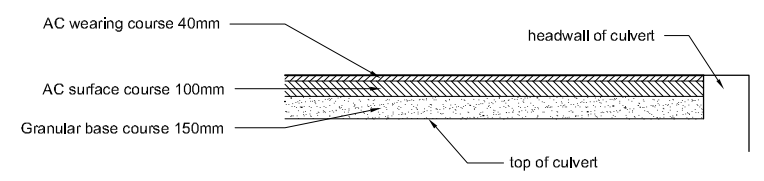
Dwg No.	S-2
Scale	as shown
Date	Nov. 2004



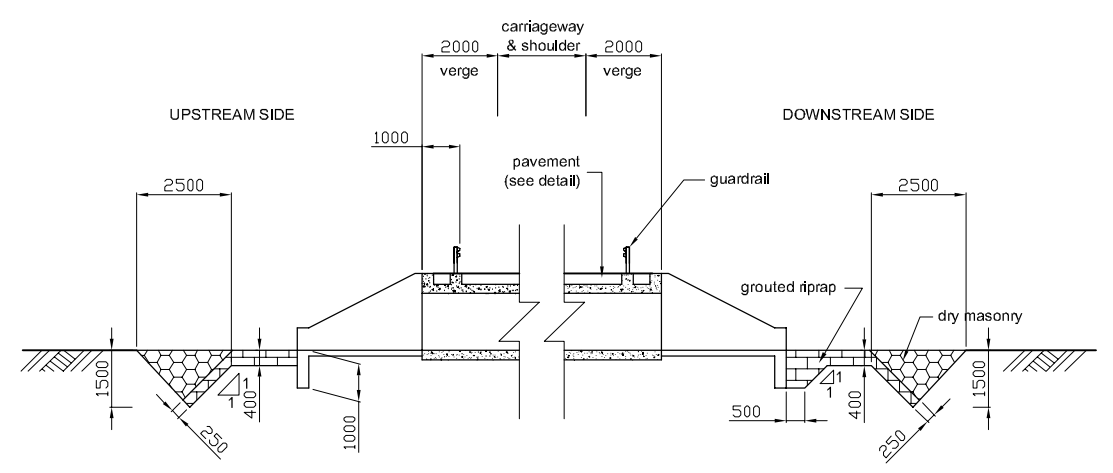
PLAN no scale



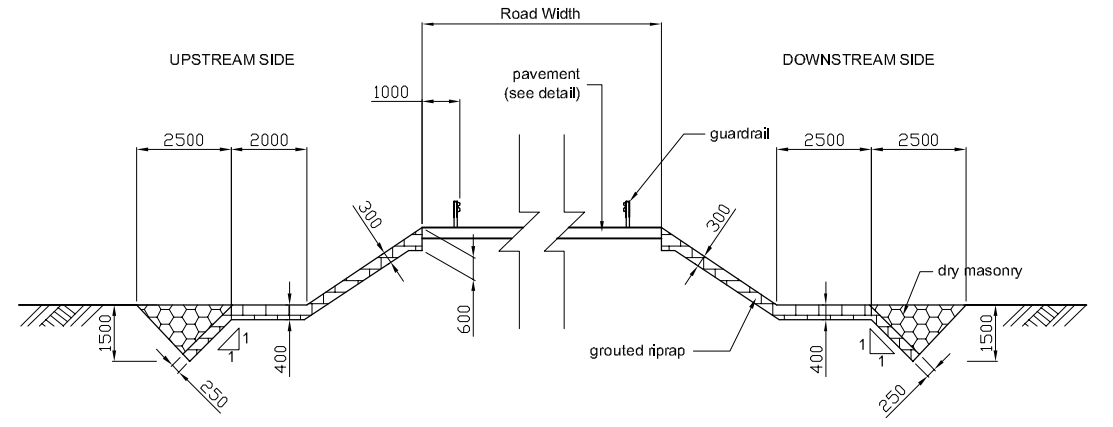
ELEVATION no scale



PAVEMENT ON IRISH BRIDGE no scale



SECTION A - A s=1/200



SECTION B - B s=1/200

- NOTES :**
1. EXPANSION JOINTS SHALL BE PROVIDED IN GROUDED RIPRAP AT LEAST EVERY 10 METER.
 2. EXPANSION JOINTS SHALL BE PROVIDED IN HEADWALL AT LEAST EVERY 10 METER.
 3. EXPANSION JOINTS IN GROUDED RIPRAP AND HEADWALL SHALL BE FORMED WITH 20mm THICK JOINT FILLER. THE TOP SURFACE SHALL BE SEALED WITH 20 x 20 HOT POUDED JOINT SEALENT.



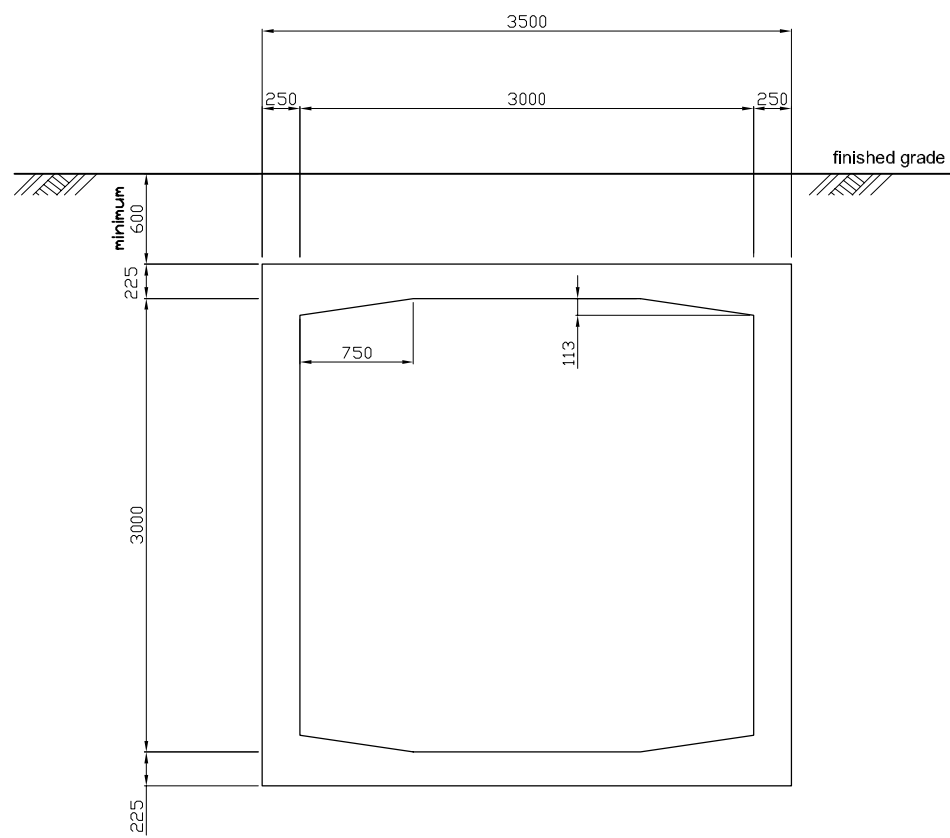
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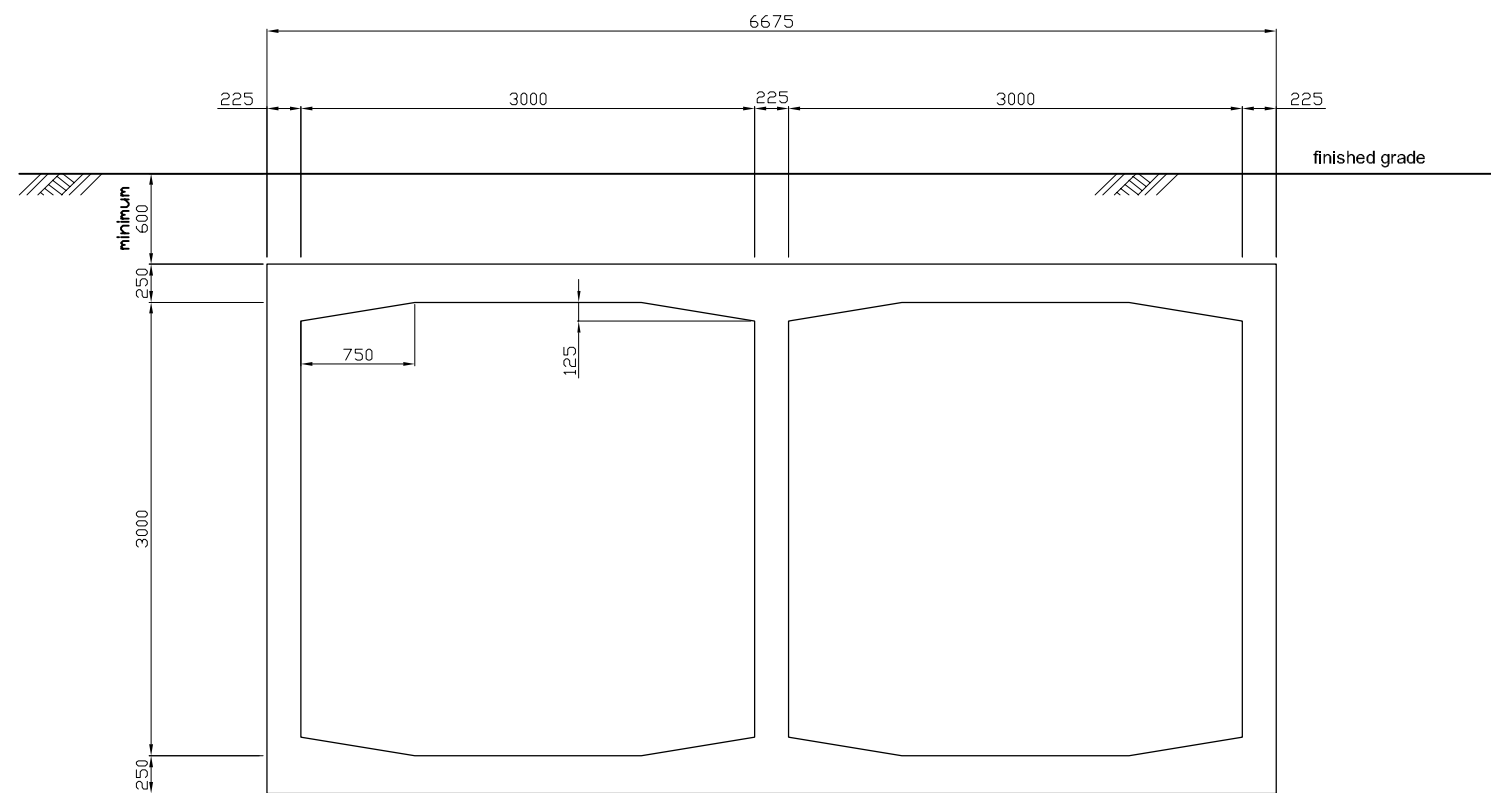
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Standard Irish Bridge

Dwg No.	S-3
Scale	as shown
Date	Nov. 2004



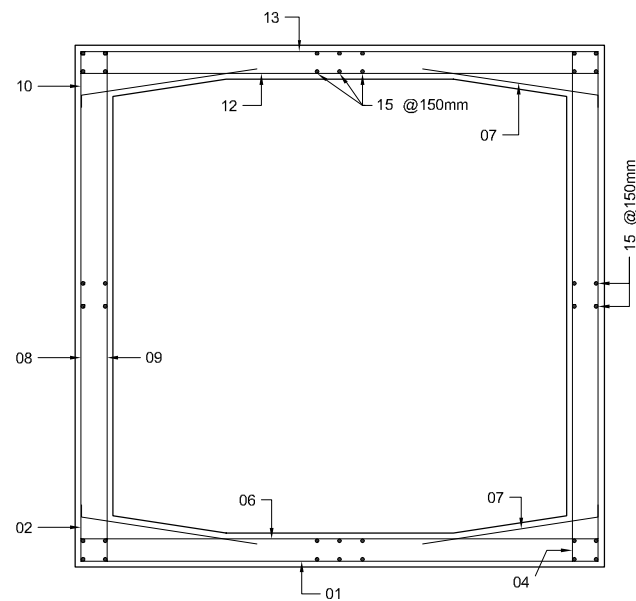
DIMENSIONS OF 1 CELL CULVERT



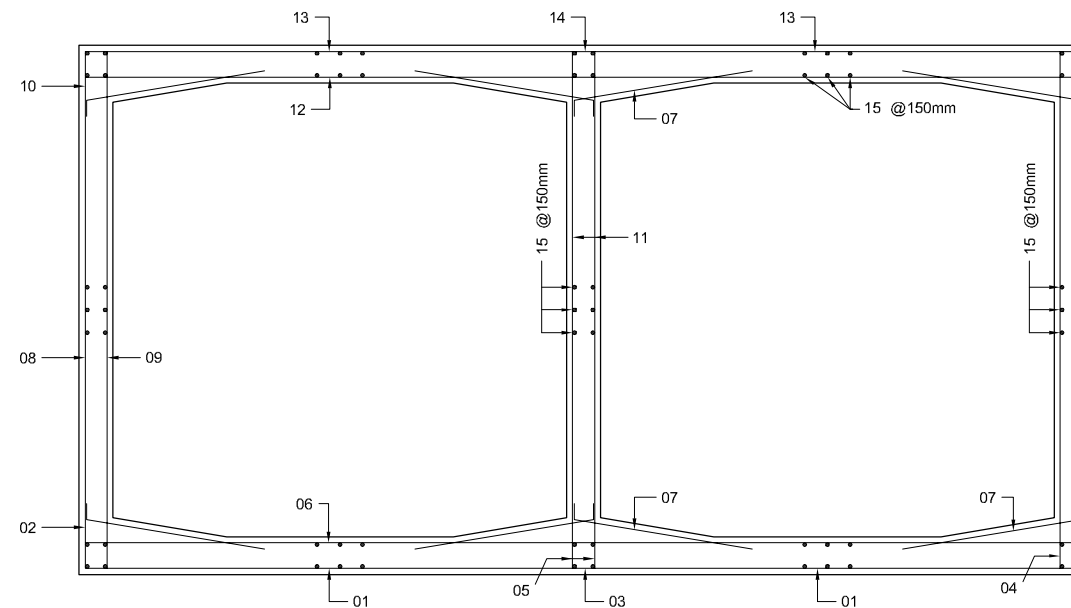
DIMENSIONS OF 2 CELL CULVERT

NOTES :

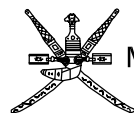
1. FOR BAR SIZE SPACING AND BENDING DIMENTIONS REFER TO STANDARD DRAWINGS SHEET DS2-62 TO DS2-83.
2. COVER REINFORCEMENT TO BE 40MM.



ARRANGEMENT OF REINFORCEMENT FOR 1 CELL



ARRANGEMENT OF REINFORCEMENT FOR 2 CELL



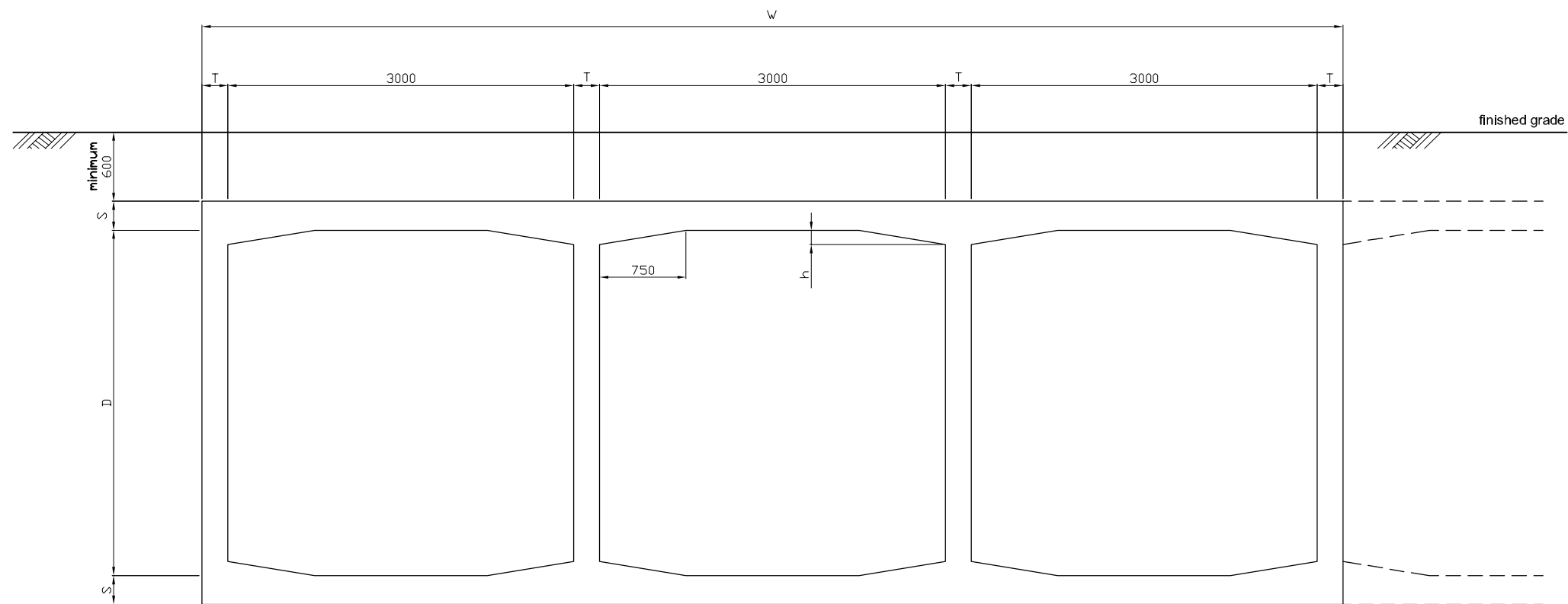
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Standard Box Culverts
 1 Cell 3000 x 3000
 2 Cell 3000 x 3000

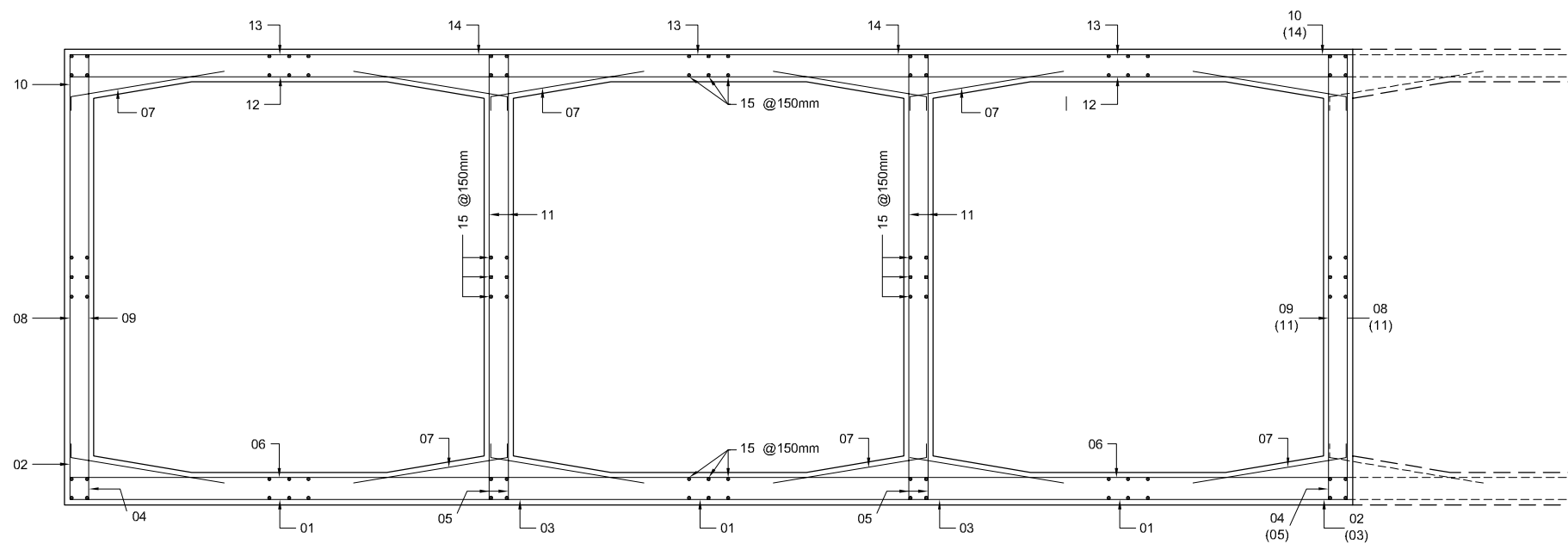
Dwg No.	S-4
Scale	1 : 50
Date	Nov. 2004



DIMENSIONS OF MULTI CELL CULVERT no scale

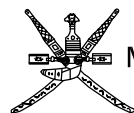
NOTES :

1. FOR BAR SIZE SPACING AND BENDING DIMENSIONS REFER TO STANDARD DRAWINGS SHEET DS2-62 TO DS2-83.
2. COVER REINFORCEMENT TO BE 40MM.



ARRANGEMENT OF REINFORCEMENT FOR MULTI CELL no scale

DIMENSIONS OF MULTI CELL BOX CULVERT					
No. of CELL	W (mm)	D (mm)	T (mm)	S (mm)	h (mm)
3 CELL	9 800	1 500	200	250	125
	9 900	3 000	225	250	125
4 CELL	13 000	1 500	200	250	125
	13 125	3 000	225	250	125
5 CELL	16 200	1 500	200	250	125
	16 350	3 000	225	250	125
6 CELL	19 400	1 500	200	250	125
	19 575	3 000	225	250	125



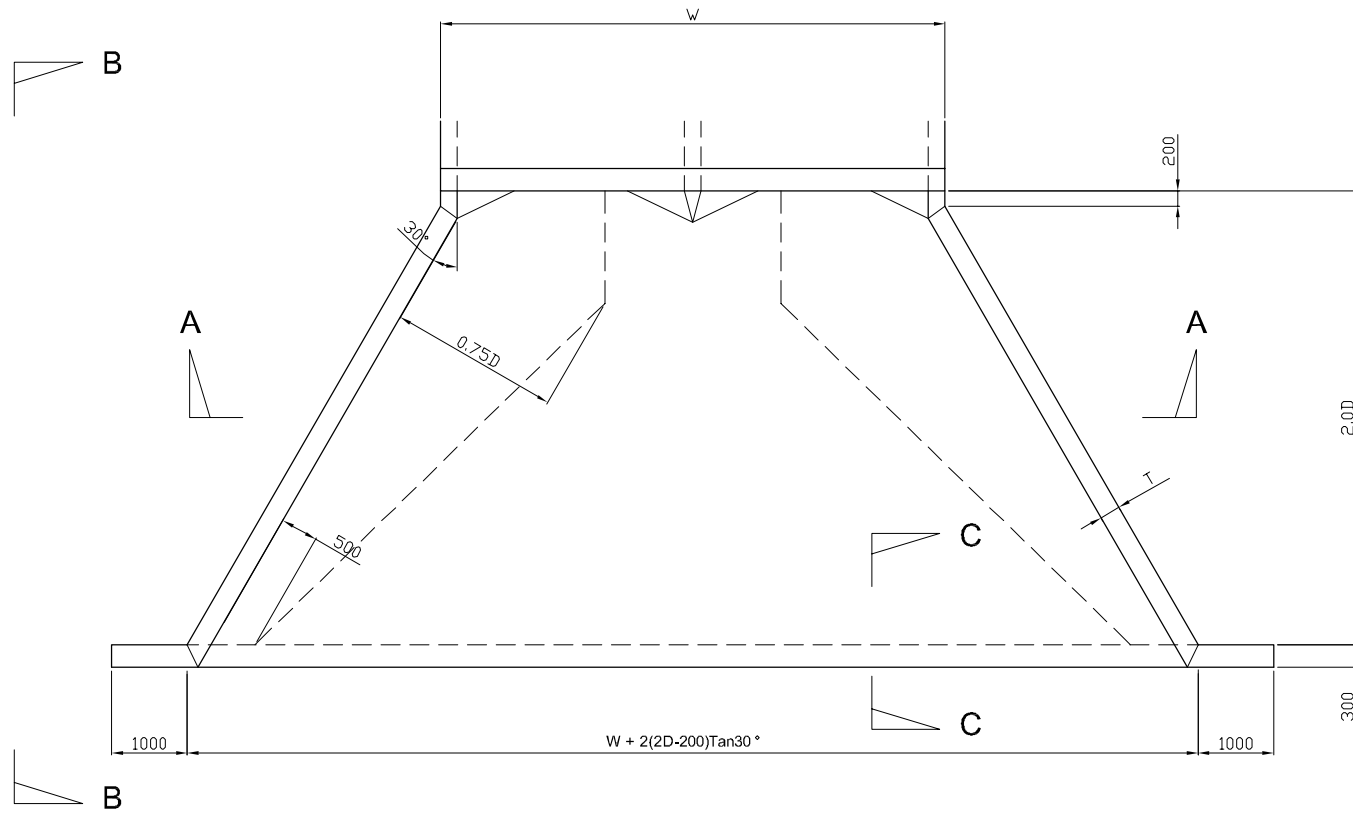
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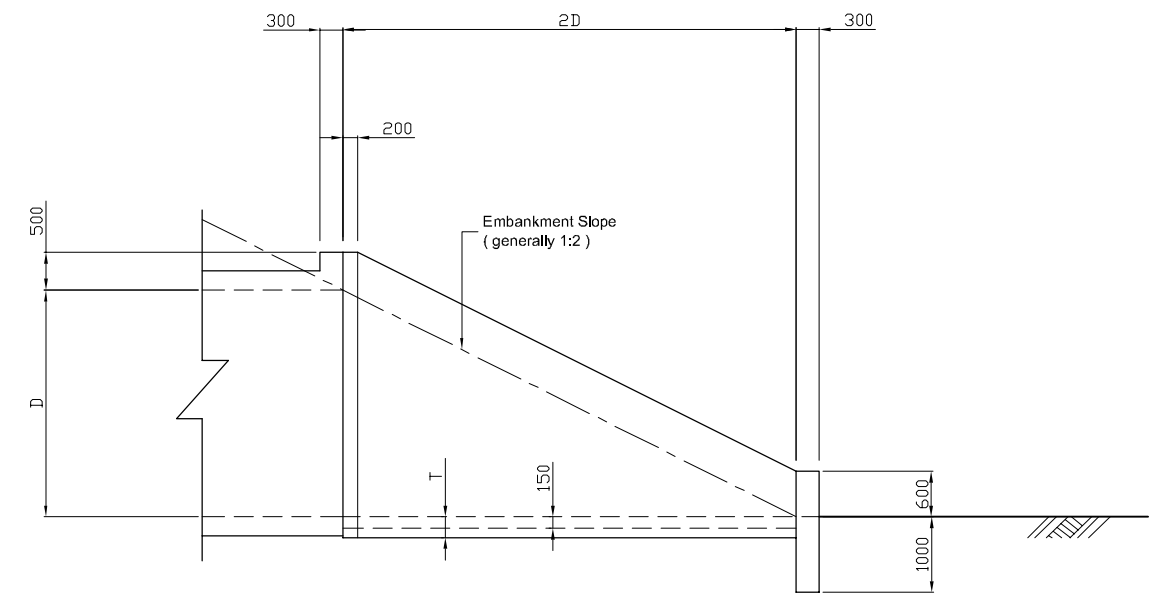
THE STUDY ON
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Standard Box Culverts
Multi Cell 3000 x 1500
Multi Cell 3000 x 3000

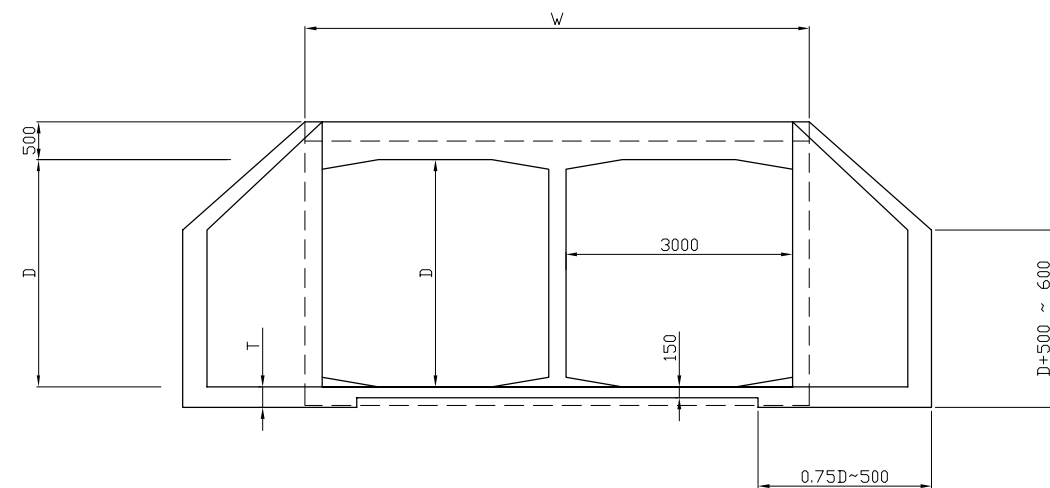
Dwg No.	S-5
Scale	1 : 50
Date	Nov. 2004



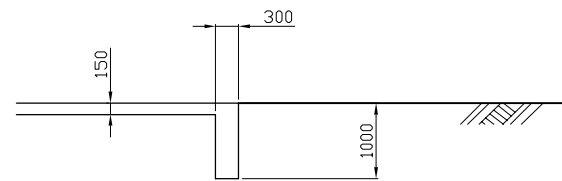
PLAN no scale



SECTION B - B no scale



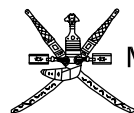
SECTION A - A no scale



SECTION C - C s= 1/100

No. of CELL	DIMENSIONS OF HEADWALL & WINGWALL			
	D (mm)	T (mm)	CONCRETE VOLUME	REINFORCING BAR
1 CELL	3 000	275	23.342 m ³	1 964.48 kg
2 CELL	3 000	275	25.256 m ³	1 852.82 kg
3 CELL	1 500	200	12.270 m ³	678.80 kg
	3 000	275	29.186 m ³	2 051.49 kg
4 CELL	1 500	200	14.926 m ³	785.17 kg
	3 000	275	33.315 m ³	2 250.16 kg
5 CELL	1 500	200	17.583 m ³	891.54 kg
	3 000	275	37.444 m ³	2 448.83 kg
6 CELL	1 500	200	20.239 m ³	997.91 kg
	3 000	275	41.571 m ³	2 647.50 kg

NOTE : Table is shown quantities only for one end & total quantities for inlet and outlet are twice.



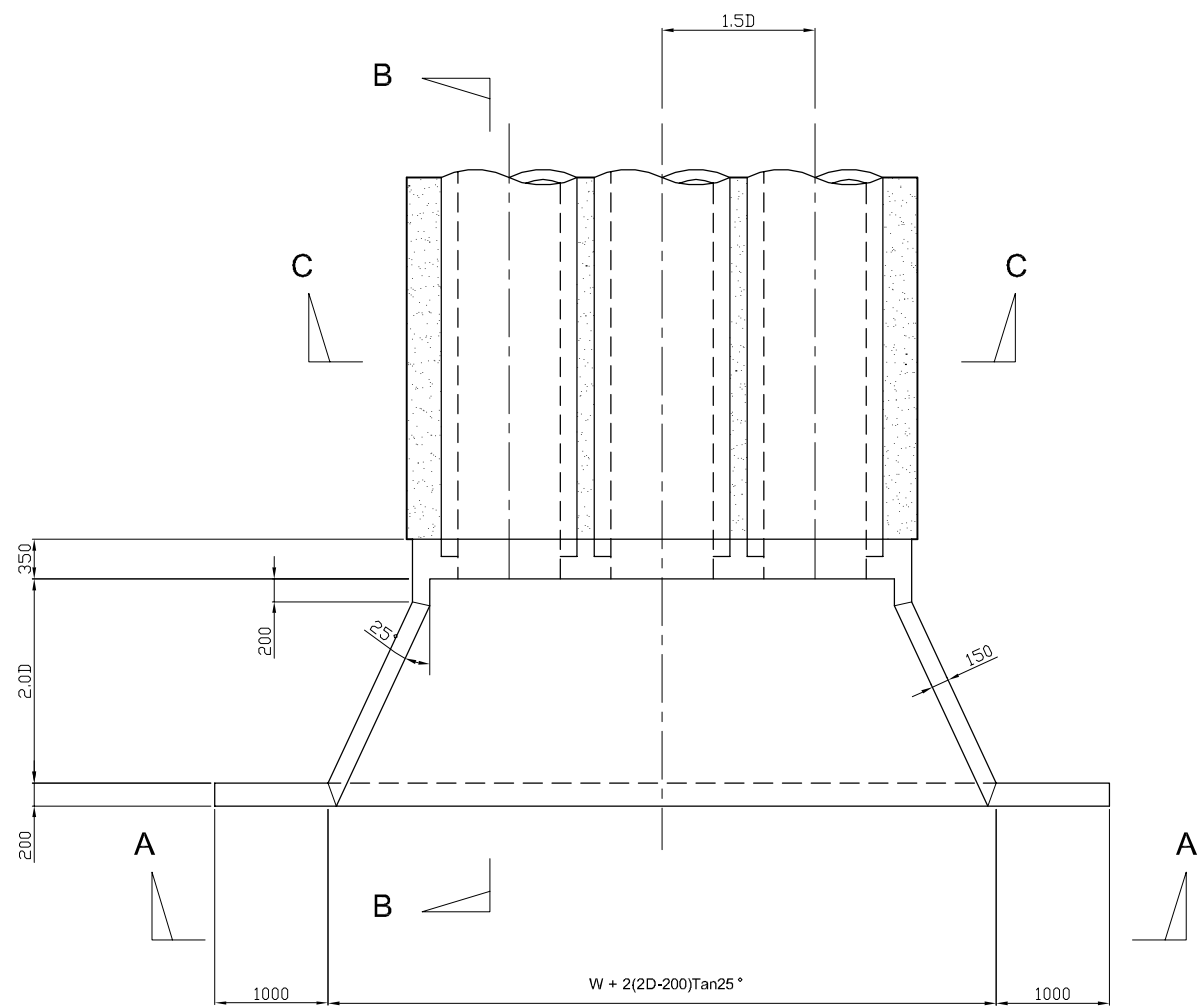
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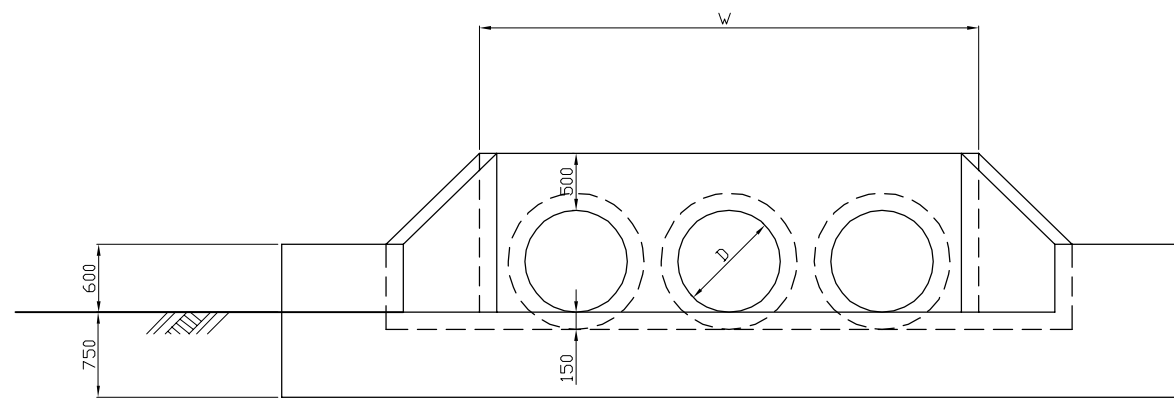
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Standard Box Culverts
Headwall & Wingwall

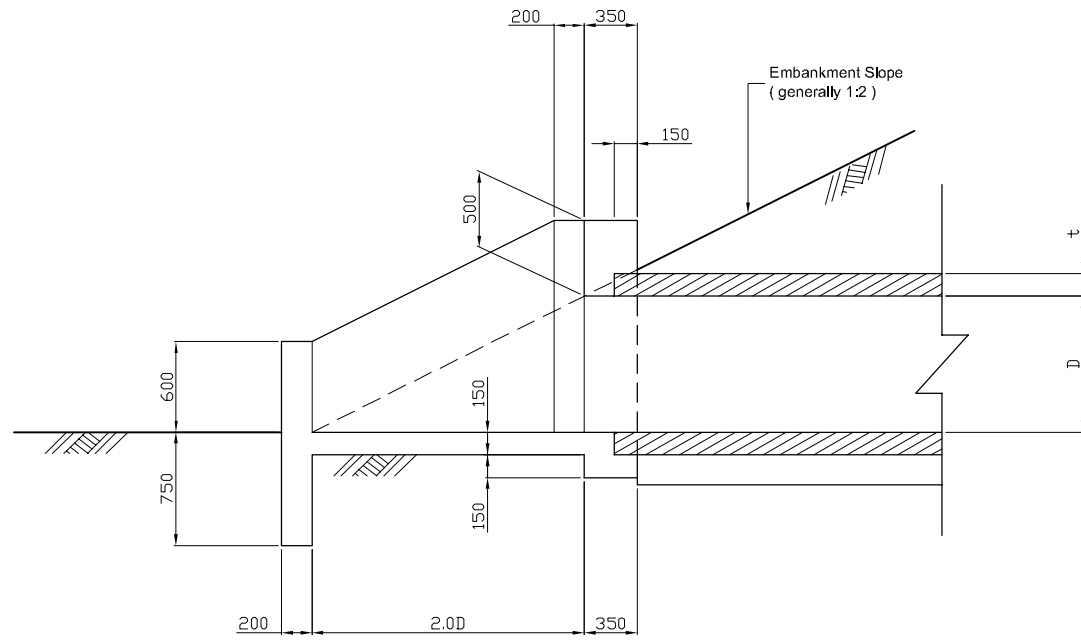
Dwg No.	S-6
Scale	as shown
Date	Nov. 2004



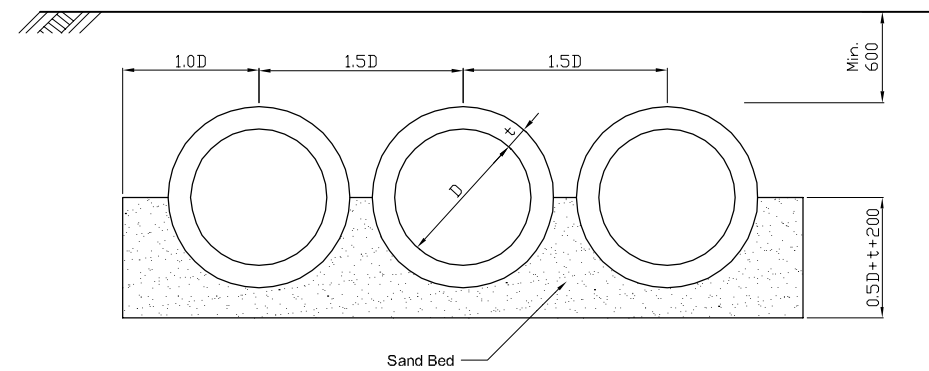
PLAN no scale



SECTION A - A no scale



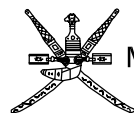
SECTION B - B no scale



SECTION C - C no scale

DIMENSIONS OF PIPE CULVERT									
D (mm)	T (mm)	No. of PIPE	W (mm)	Head & Wing Wall	D (mm)	T (mm)	No. of PIPE	W (mm)	Head & Wing Wall
600	100	1	1 400	2.163 m ³	900	150	3	4 400	5.191 m ³
600	100	2	2 300	2.882 m ³	1 500	250	1	2 300	5.290 m ³
600	100	3	3 200	3.375 m ³	1 500	250	2	4 550	7.626 m ³
900	150	1	1 700	3.045 m ³	1 500	250	3	6 800	9.963 m ³
900	150	2	3 050	4.118 m ³					

NOTE : Table is shown quantities of head & wing wall only for one end & total quantities for inlet and outlet are twice.



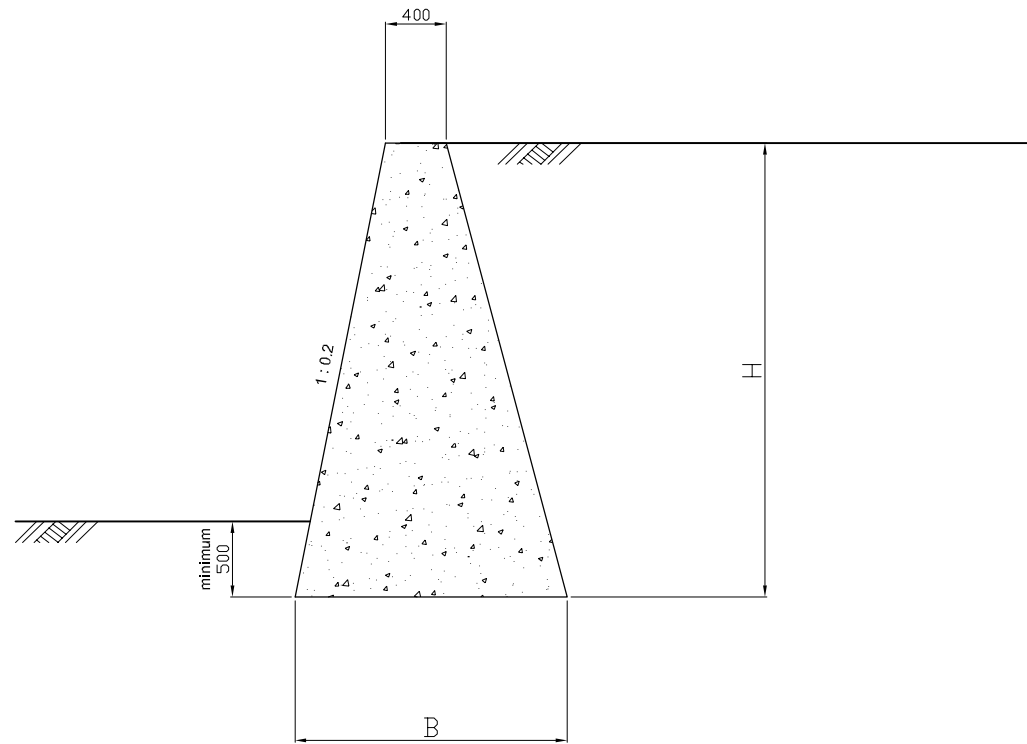
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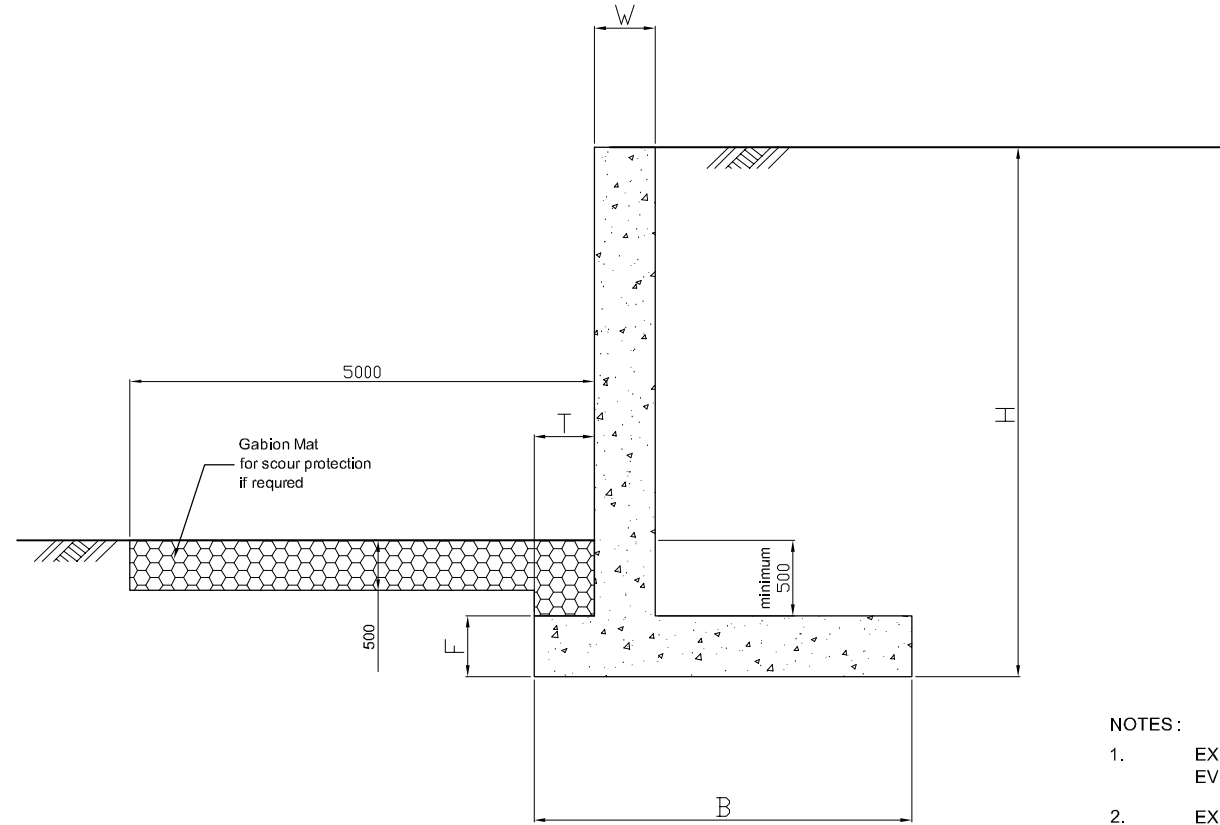
Standard Pipe Culverts
Headwall and Wing Wall

Dwg No.	S-7
Scale	as shown
Date	Nov. 2004



GRAVITY RETAINING WALL no scale

DIMENSIONS OF GRAVITY RETAINING WALL			
H (mm)	B (mm)	CONCRETE VOLUME	FORM AREA
1 000	700	0.550 m ³ / m	2.025 m ² / m
2 000	1 200	1.600 m ³ / m	4.079 m ² / m
3 000	1 800	3.300 m ³ / m	6.164 m ² / m
4 000	2 250	5.300 m ³ / m	8.215 m ² / m
5 000	2 750	7.875 m ³ / m	10.278 m ² / m



REVERSE T SHAPE RETAINING WALL no scale

DIMENSIONS OF REVERSE T SHAPE RETAINING WALL							
H (mm)	B (mm)	W (mm)	F (mm)	T (mm)	CONCRETE VOLUME	FORM AREA	REINFORCING BAR
3 000	2 000	400	400	400	1.840 m ³ / m	6.000 m ² / m (1.840 m ² for end)	92.957 kg
3 500	2 500	400	400	400	2.240 m ³ / m	7.000 m ² / m (2.240 m ² for end)	143.581 kg
4 000	2 500	400	400	600	2.440 m ³ / m	8.000 m ² / m (2.440 m ² for end)	166.761 kg
4 500	3 000	400	400	600	2.840 m ³ / m	9.000 m ² / m (2.840 m ² for end)	229.909 kg
5 000	3 000	400	400	600	3.040 m ³ / m	10.000 m ² / m (3.040 m ² for end)	343.543 kg
5 500	3 500	400	400	600	3.750 m ³ / m	11.000 m ² / m (3.750 m ² for end)	432.471 kg
6 000	3 500	500	500	600	4.500 m ³ / m	12.000 m ² / m (4.500 m ² for end)	485.331 kg
6 500	4 000	500	600	800	5.350 m ³ / m	13.000 m ² / m (5.350 m ² for end)	499.445 kg
7 000	4 000	600	600	800	6.240 m ³ / m	14.000 m ² / m (6.240 m ² for end)	567.827 kg
7 500	4 500	600	600	1 000	6.840 m ³ / m	15.000 m ² / m (6.840 m ² for end)	782.452 kg
8 000	5 000	700	700	1 200	8.610 m ³ / m	16.000 m ² / m (8.610 m ² for end)	842.915 kg

NOTES:

- EXPANSION JOINTS SHALL BE PROVIDED IN RETAINING WALL AT LEAST EVERY 10 METER.
- EXPANSION JOINTS IN RETAINING WALL SHALL BE FORMED WITH 20mm THICK JOINT FILLER. THE TOP SURFACE SHALL BE SEALED WITH 20 x 20 HOT Poured JOINT SEALANT.



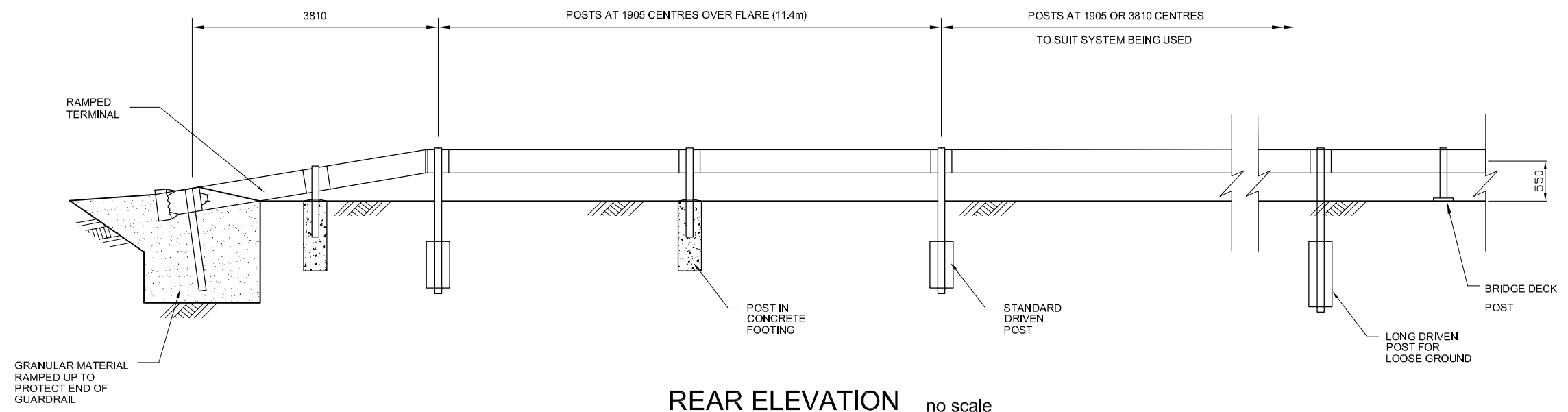
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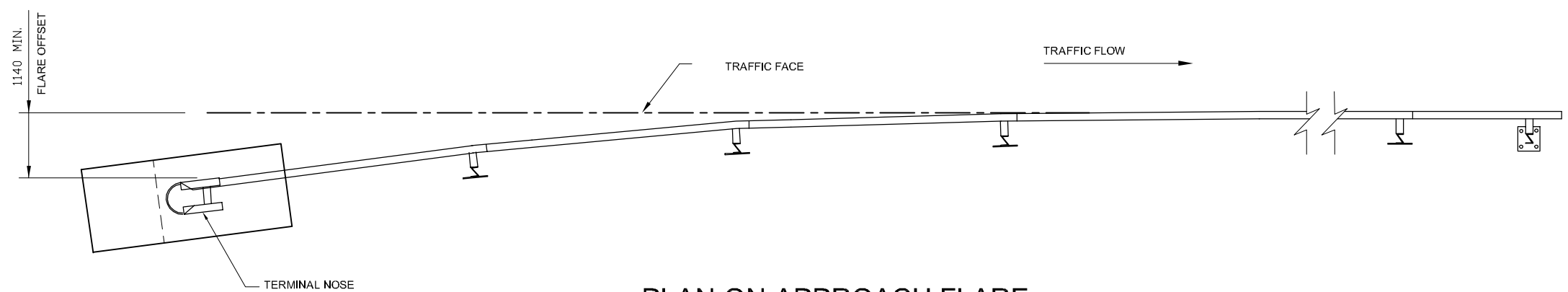
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Standard Retaining Walls

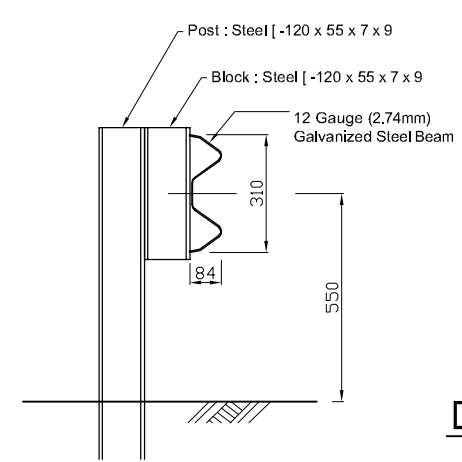
Dwg No.	S-8
Scale	as shown
Date	Nov. 2004



REAR ELEVATION no scale



PLAN ON APPROACH FLARE no scale
DEPARTURE END SIMILAR WHERE POSSIBLE



DETAILS OF W-BEAM s=1/20

NOTES

1. WHERE THE GUARDRAIL ABUTS A BRIDGE PARAPET OR CONCRETE BARRIER, THE GUARDRAIL MUST JOIN THE PARAPET OR BARRIER WITH A CONNECTION CAPABLE OF DEVELOPING THE FULL STRENGTH OF THE BARRIER. POSTS CENTRES SHALL BE 1905mm FOR 11.4m IN ADVANCE OF THE CONNECTION WHATEVER SYSTEM IS BEING USED.
2. GUARDRAIL SHALL BE PROVIDED FOR 30m IN ADVANCE OF A HAZARD AND CONTINUE 15m BEYOND IT.
3. GUARDRAIL SHALL OVERLAP IN THE DIRECTION OF THE TRAFFIC FLOW.
4. FLARE OFFSET SHALL BE 1140mm MINIMUM. THE FLARE LENGTH SHALL BE AT LEAST 10x OFFSET.
5. WHERE THE GUARDRAIL HAS TO FOLLOW A CURVE OF LESS THAN 45m RADIUS, THE BEAMS SHALL BE CURVED TO SUIT BY THE BEAM MANUFACTURER.
6. THE HOLES FOR END POSTS SHALL BE BACKFILLED WITH WELL COMPACTED GRANULAR MATERIAL. THE SPACE INSIDE THE TERMINAL NOSE SHALL BE FILLED WITH CONCRETE.



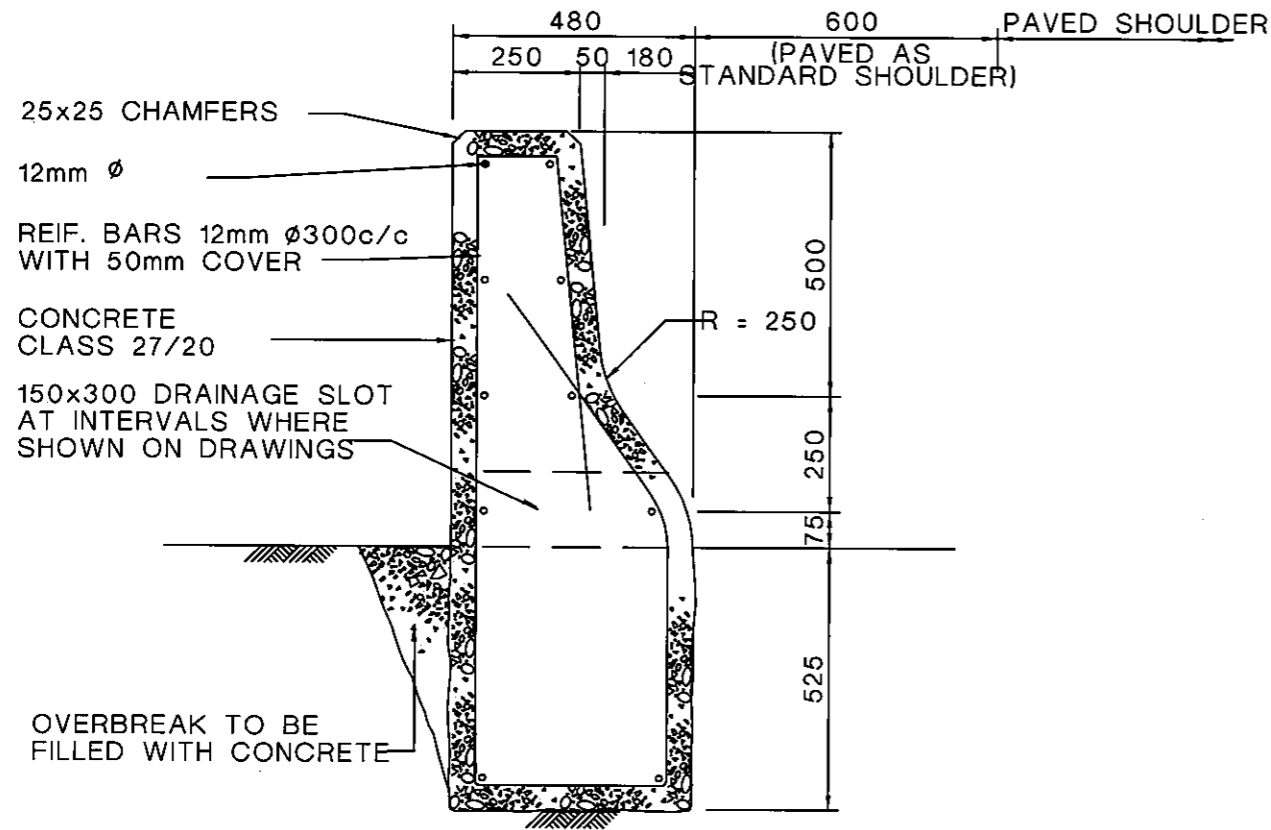
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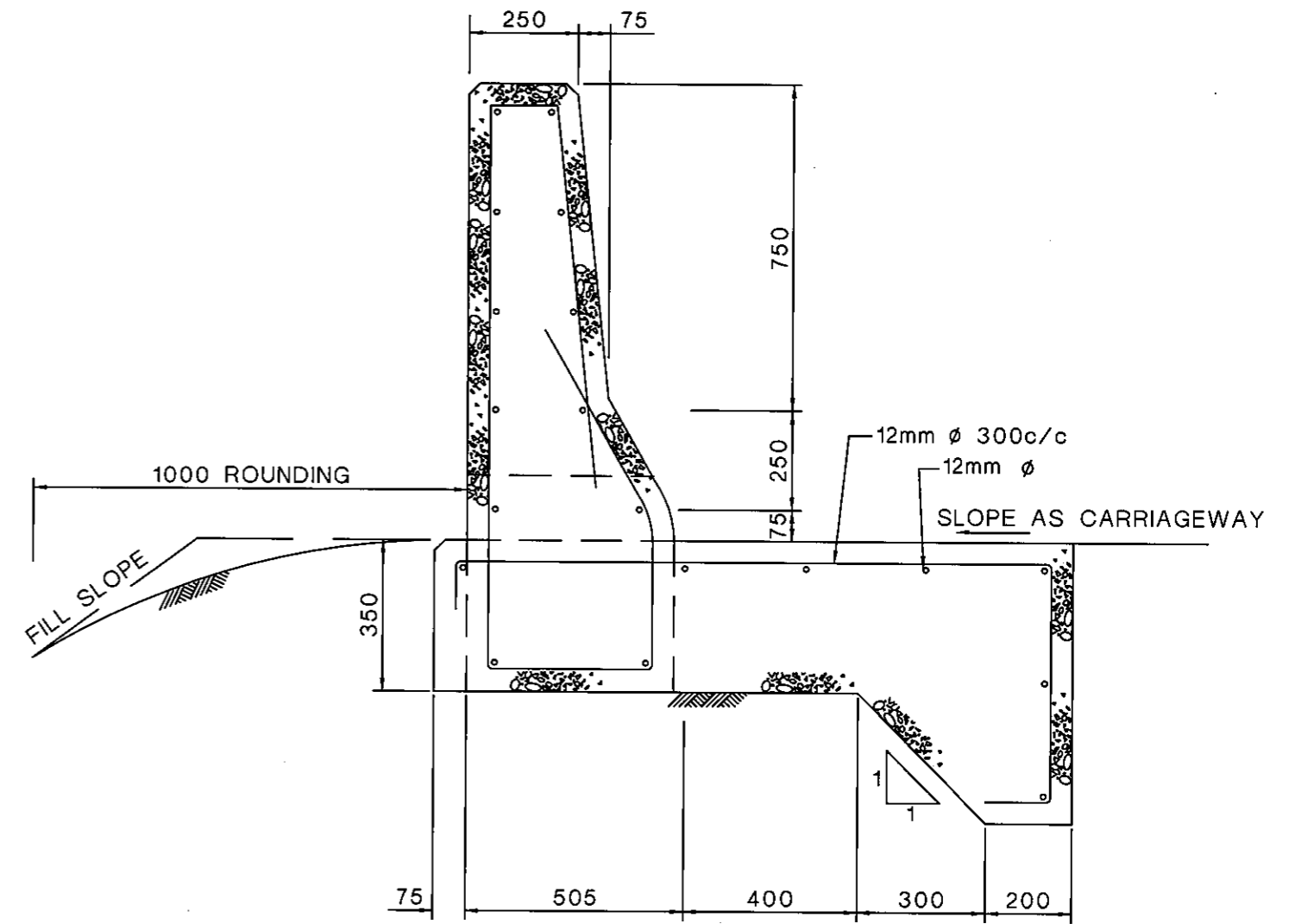
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Details of Guardrail

Dwg No.	S-9
Scale	as shown
Date	Nov. 2004

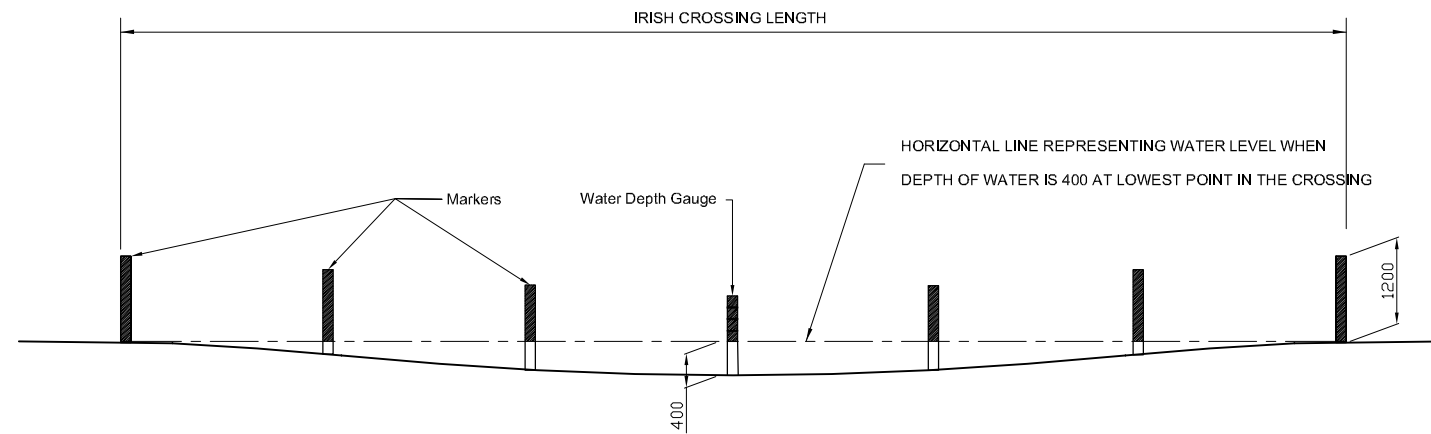


STANDARD SECTION



HEAVY DUTY SECTION
(OTHER DETAILS AS STANDARD SECTION)

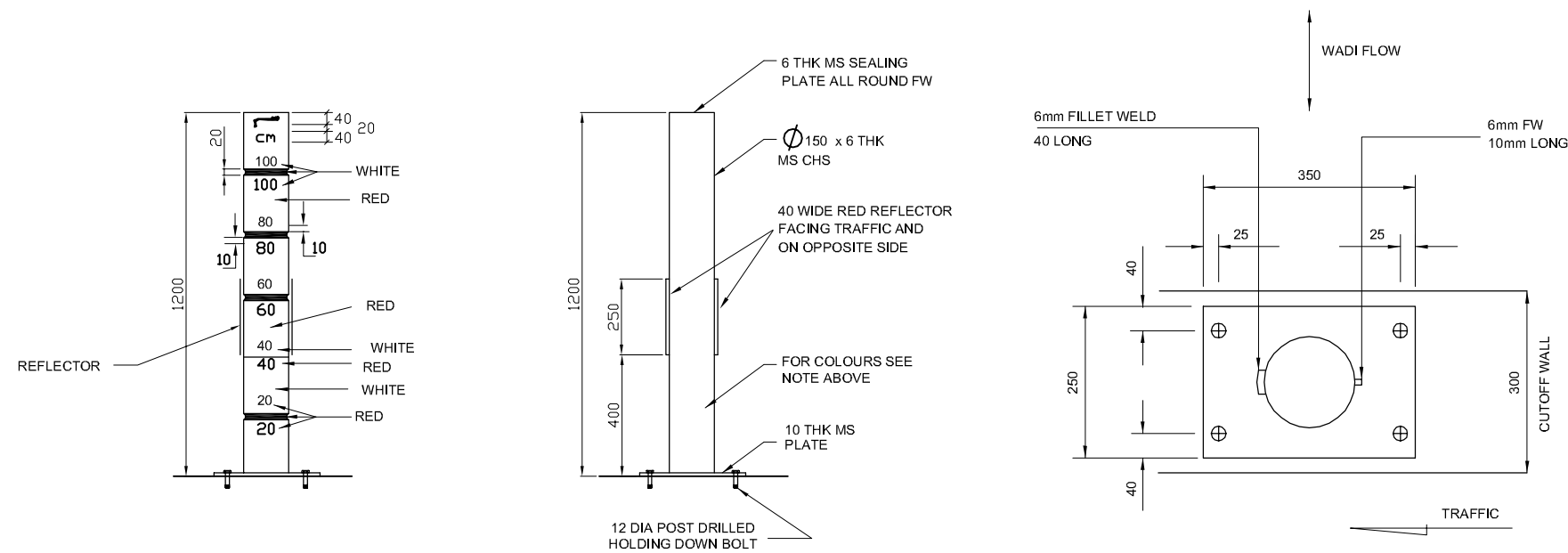
 <p>SULTANATE OF OMAN MINISTRY OF TRANSPORTATION AND COMMUNICATIONS DIRECTORATE GENERAL OF ROADS</p>	<p>JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL</p>	<p>THE STUDY ON THE ROAD NETWORK DEVELOPMENT IN THE SULTANATE OF OMAN</p>	<p>Standard Concrete Barrier</p>	Dwg No.	S-10
				Scale	no scale
				Date	Nov. 2004



SECTION OF IRISH CROSSING

SPACING OF MARKERS

RADIUS OF CURVE (m)	MAX. SPACING OF MARKERS.
> 500	100
400 - 500	50
300 - 400	40
200 - 300	30
100 - 200	20
< 100	15



WATER DEPTH GAUGE

(OTHER DETAILS AS FOR MARKER)

MARKER

PLAN ON BASE

MINIMUM NUMBER OF MARKERS

(INCLUDING THE WATER DEPTH GAUGE)

LENGTH OF IRISH CROSSING OR BRIDGE	MIN. NUMBER OF POSTS
< 60m	3
60 - 400m	5
> 400m	1 AT EVERY 100m



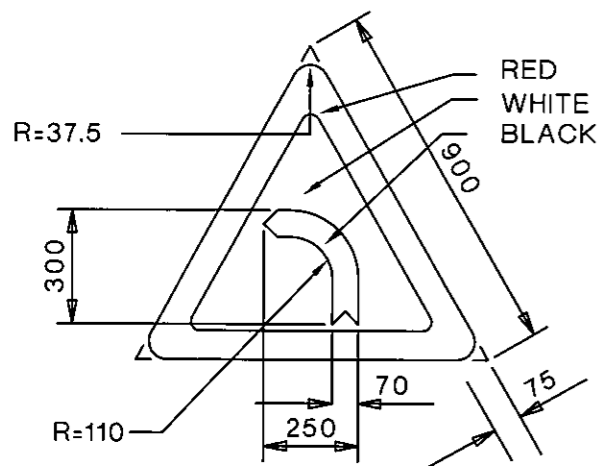
SULTANATE OF OMAN
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
DIRECTORATE GENERAL OF ROADS

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

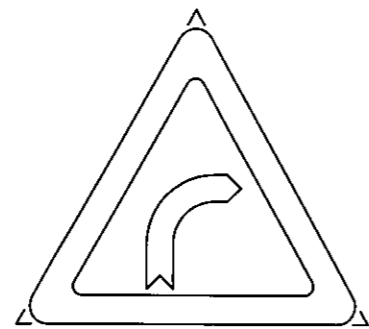
THE STUDY ON
THE ROAD NETWORK DEVELOPMENT
IN THE SULTANATE OF OMAN

Water Depth Gauge & Marker
for Irish Crossing

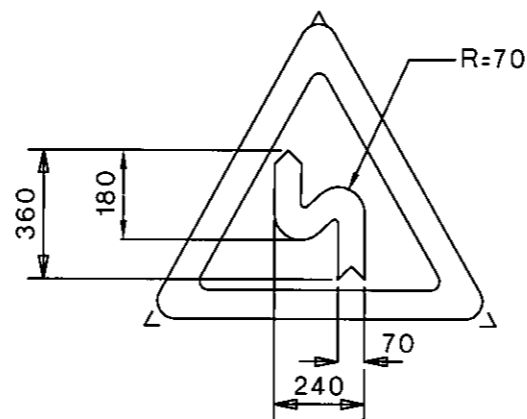
Dwg No.	S-11
Scale	no scale
Date	Nov. 2004



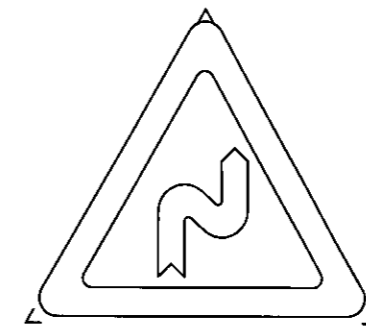
101 LEFT BEND



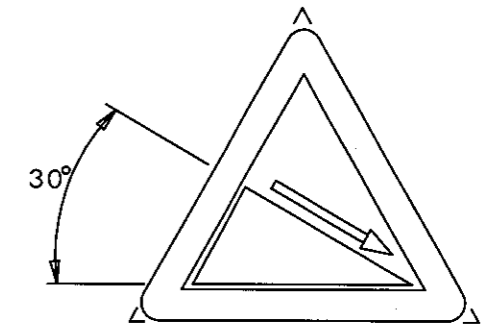
102 RIGHT BEND



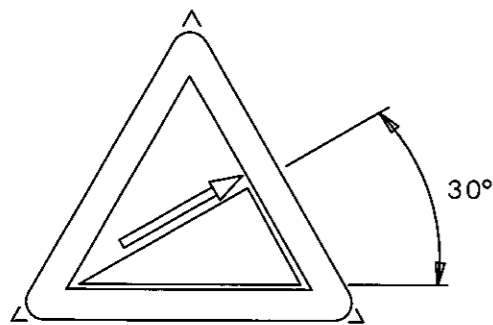
103 SERIES OF BENDS
FIRST TO LEFT



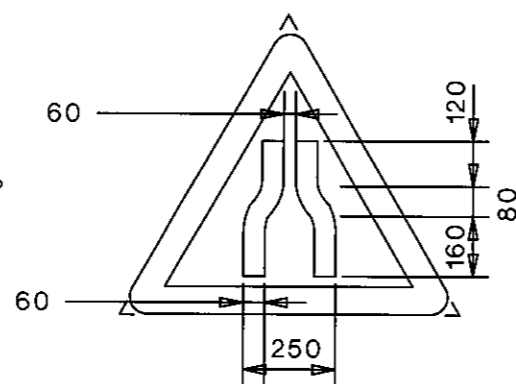
104 SERIES OF BENDS
FIRST TO RIGHT



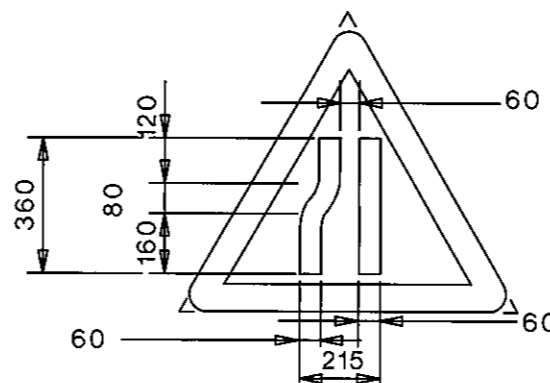
105 STEEP DESCENT



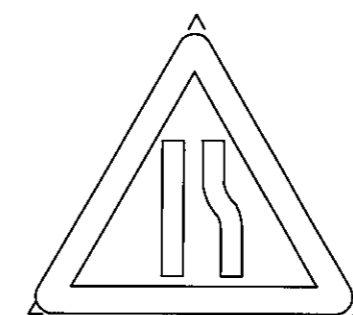
106 STEEP ASCENT



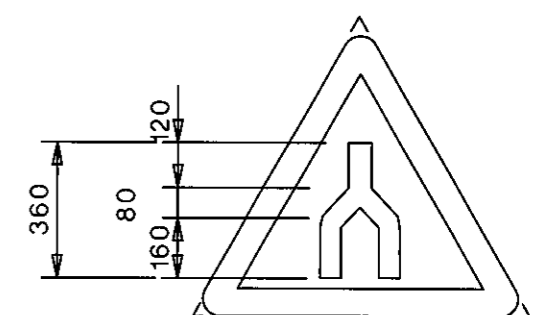
107 CARRIAGEWAY NARROWS
(BOTH SIDES)



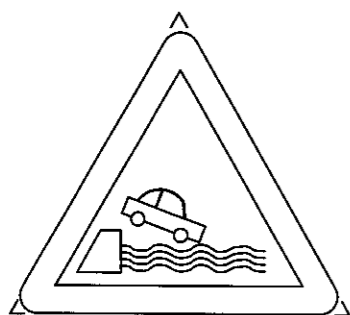
108 CARRIAGEWAY NARROWS-FROM LEFT



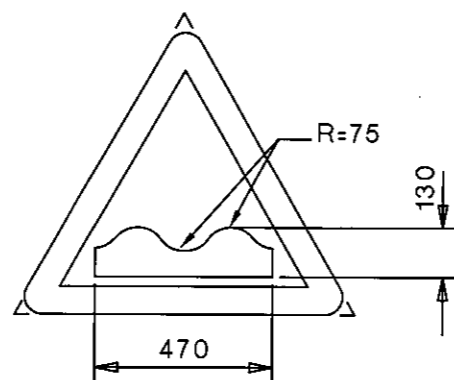
109 CARRIAGEWAY NARROWS
FROM RIGHT



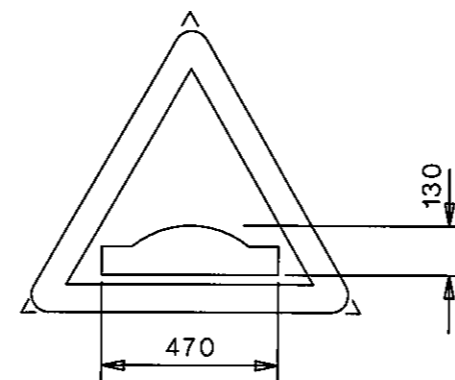
110 DUAL CARRIAGEWAY ENDS



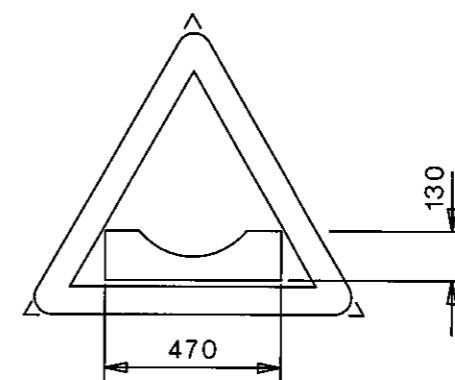
111 QUAYSIDE AHEAD



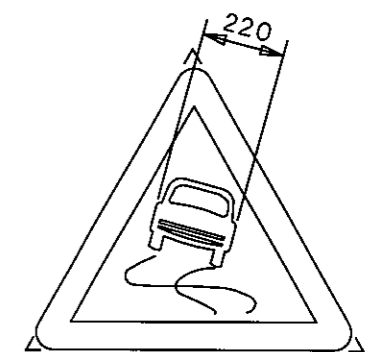
112 UNEVEN ROAD



113 SPEED HUMP



114 DIP



115 SLIPPERY ROAD



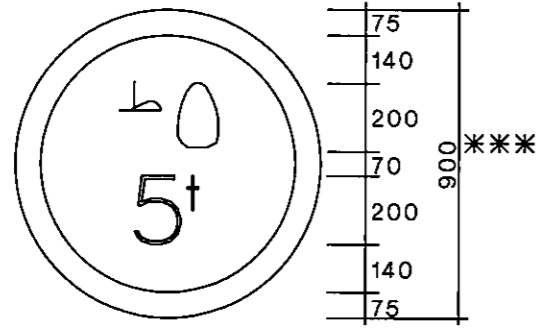
SULTANATE OF OMAN
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
DIRECTORATE GENERAL OF ROADS

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

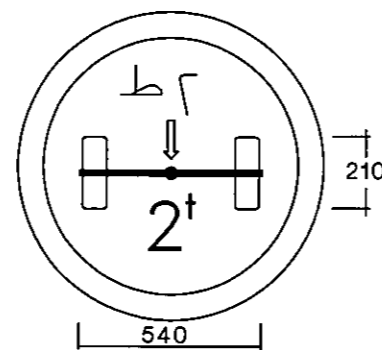
THE STUDY ON
THE ROAD NETWORK DEVELOPMENT
IN THE SULTANATE OF OMAN

Typical Road Signs
Warning Signs

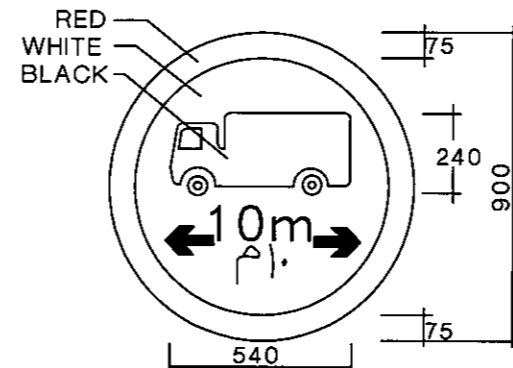
Dwg No.	S-12
Scale	no scale
Date	Nov. 2004



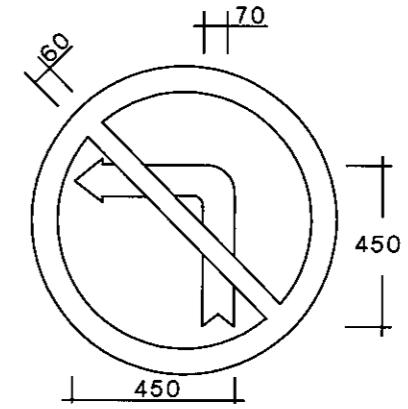
217 NO ENTRY FOR VEHICLES WITH GROSS WEIGHT EXCEEDING LIMIT SHOWN



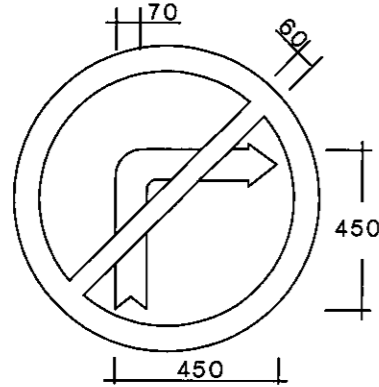
218 NO ENTRY FOR VEHICLES WITH AN AXLE LOAD EXCEEDING LIMIT SHOWN



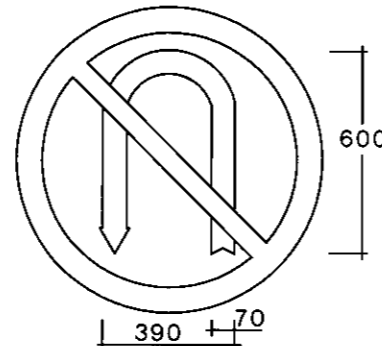
219 NO ENTRY FOR VEHICLES WITH OVERALL LENGTH GREATER THAN LIMIT SHOWN



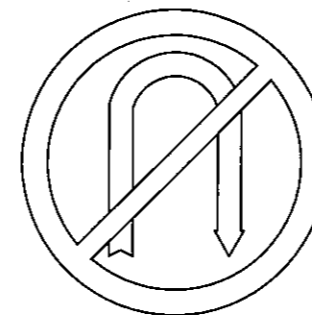
220 NO LEFT TURN



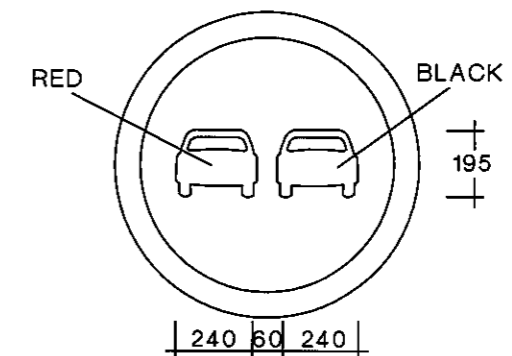
221 NO RIGHT TURN



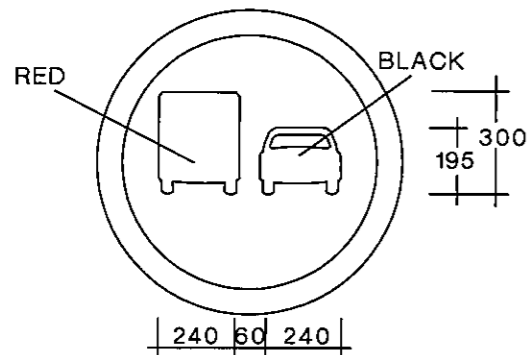
222 NO U TURN



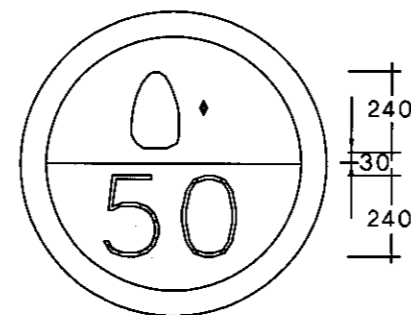
223 NO U TURN



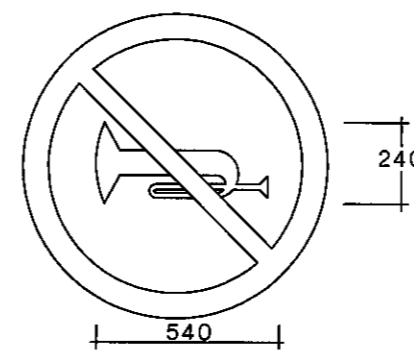
224 NO OVERTAKING BY ALL VEHICLES



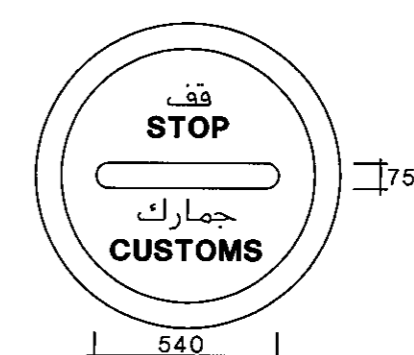
225 NO OVERTAKING BY GOODS VEHICLES



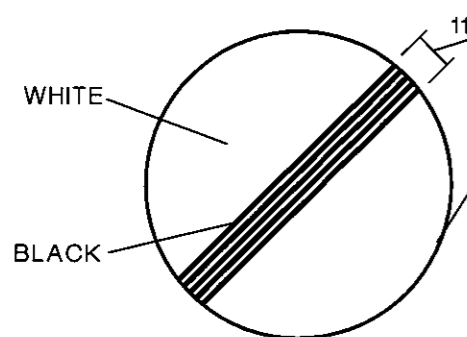
226(50) MAXIMUM SPEED AS LIMIT SHOWN



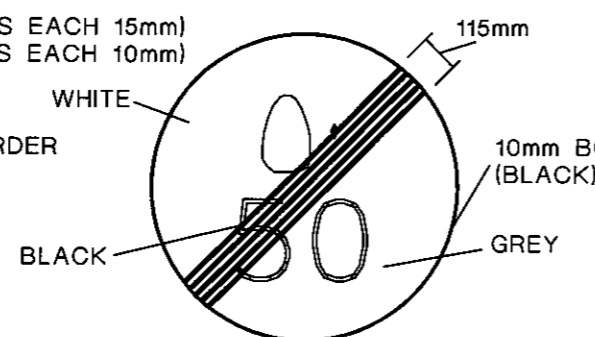
227 NO SOUNDING OF HORN



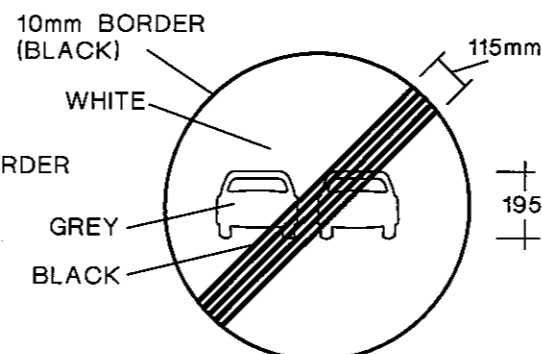
228 STOP FOR MESSAGE SHOWN



229 END OF RESTRICTION

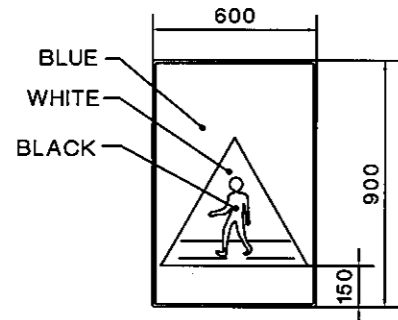


230(50) END OF MAXIMUM SPEED LIMIT SHOWN

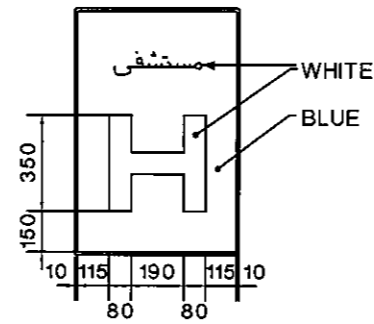


231 END OF OVERTAKING RESTRICTION

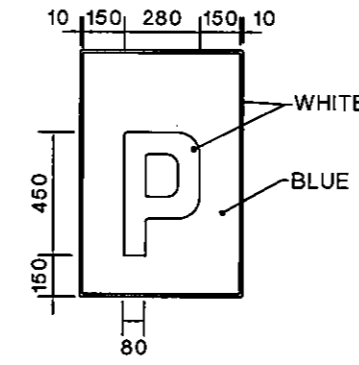




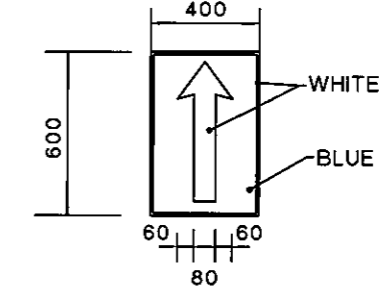
301 PEDESTRIAN CROSSING



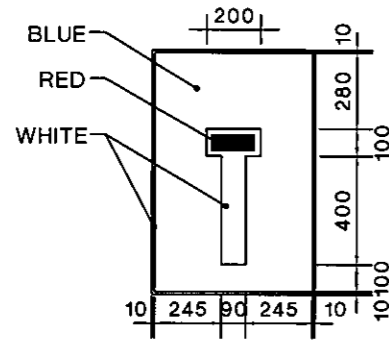
302 HOSPITAL



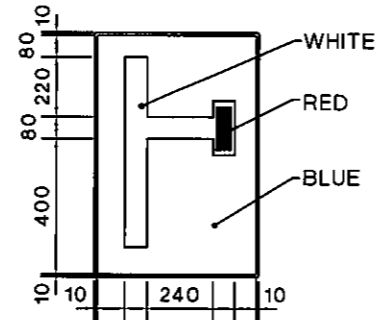
303 PARKING



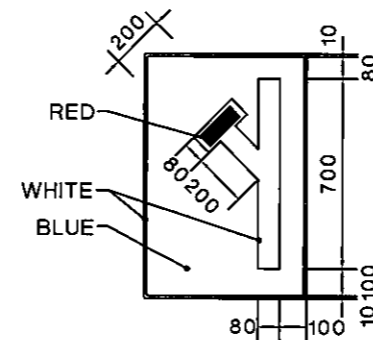
304 ONE WAY STREET



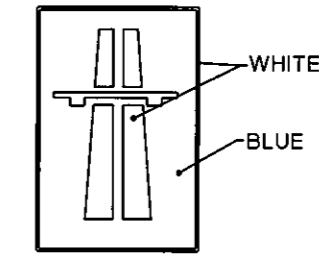
305 NO THROUGH ROAD STRAIGHT AHEAD



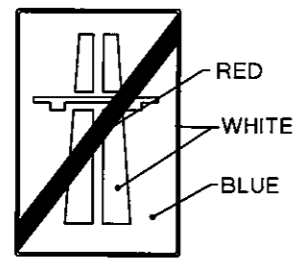
306 NO THROUGH ROAD TO RIGHT (307 REVERSED)



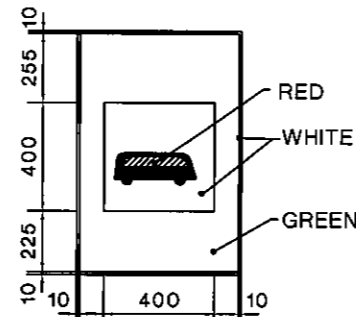
308 NO THROUGH ROAD TO LEFT (309 REVERSED)



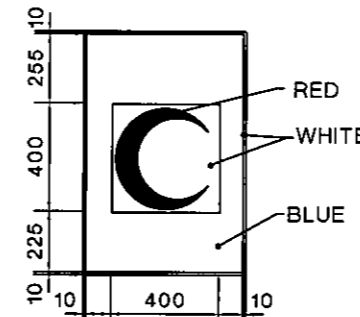
310 FREEWAY/MOTORWAY



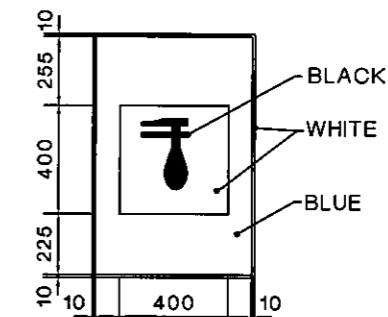
311 END OF FREEWAY/MOTORWAY



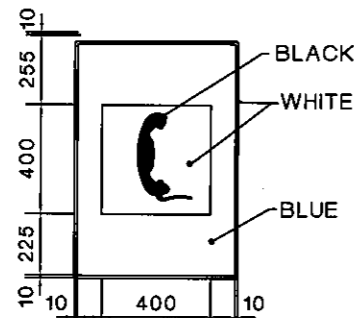
312 BUS STOP



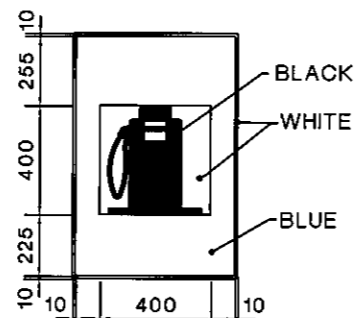
313 FIRST AID STATION



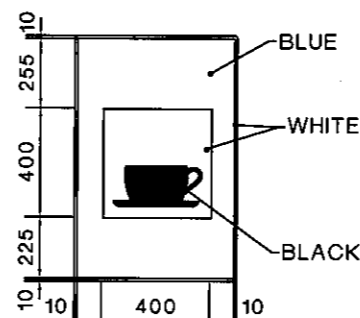
314 BREAKDOWN SERVICE



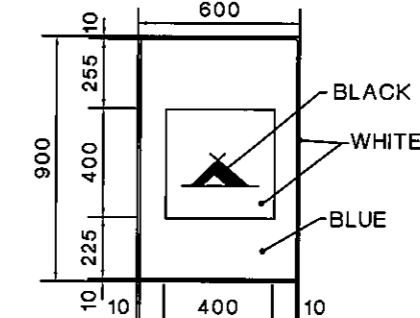
315 TELEPHONE



316 FILLING STATION



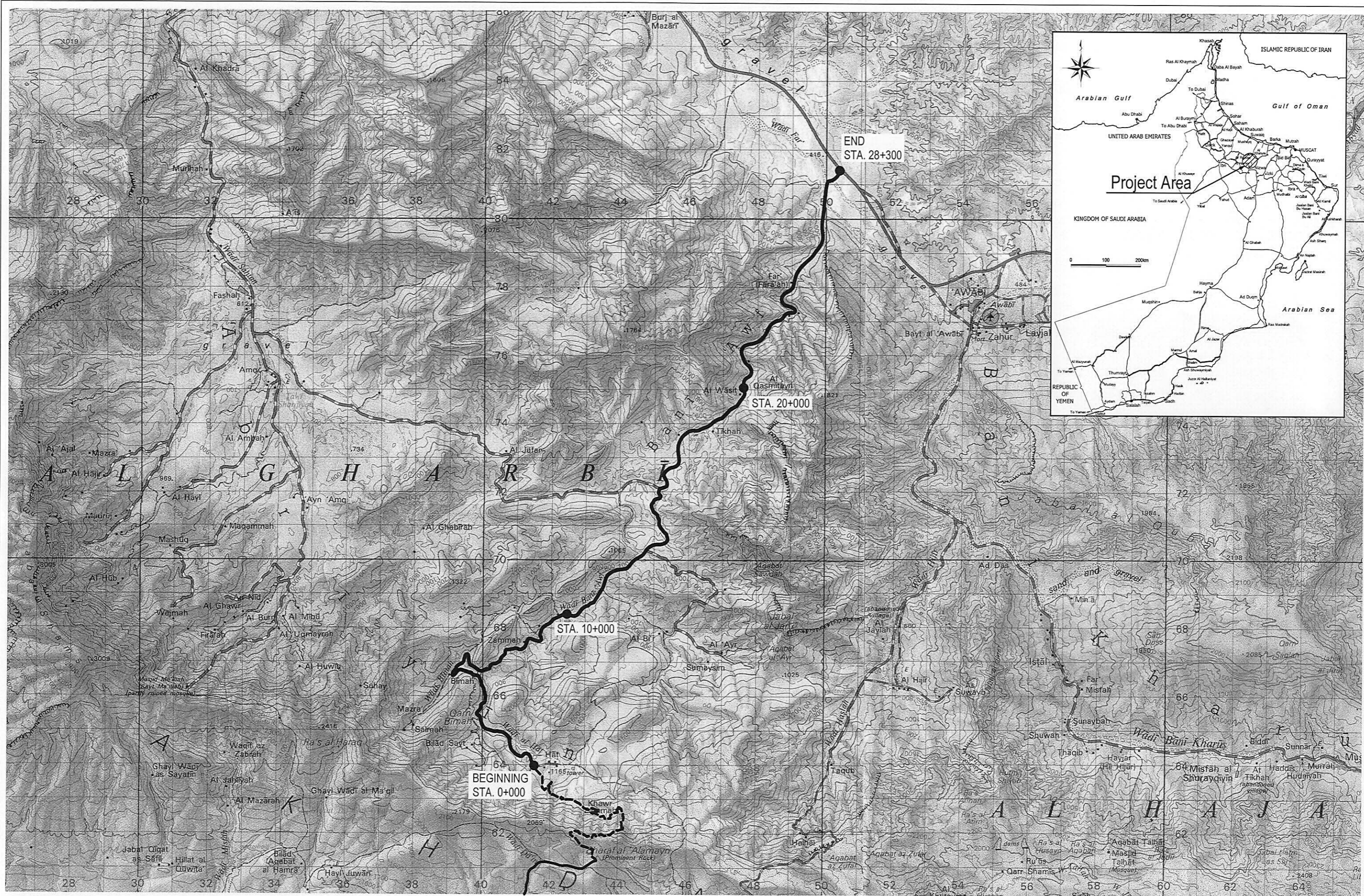
317 REFRESHMENT/CAFETERIA



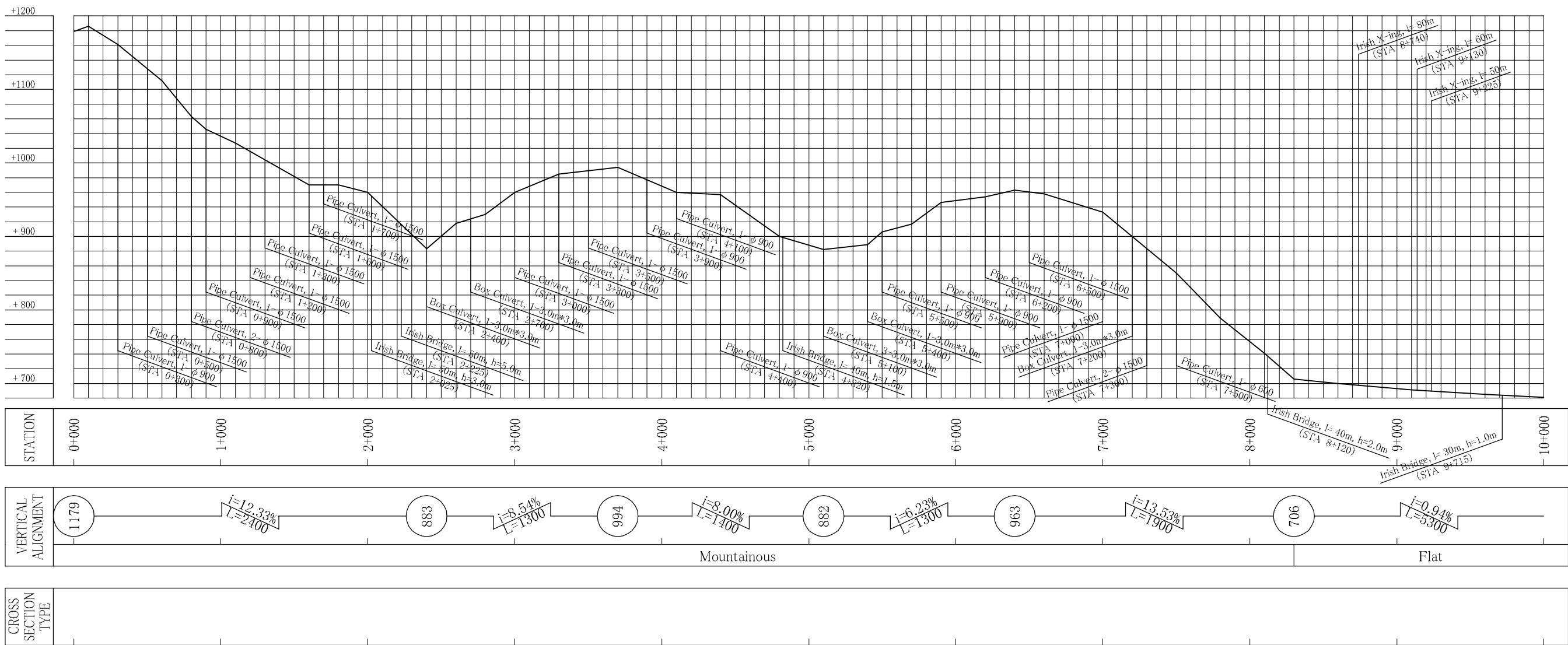
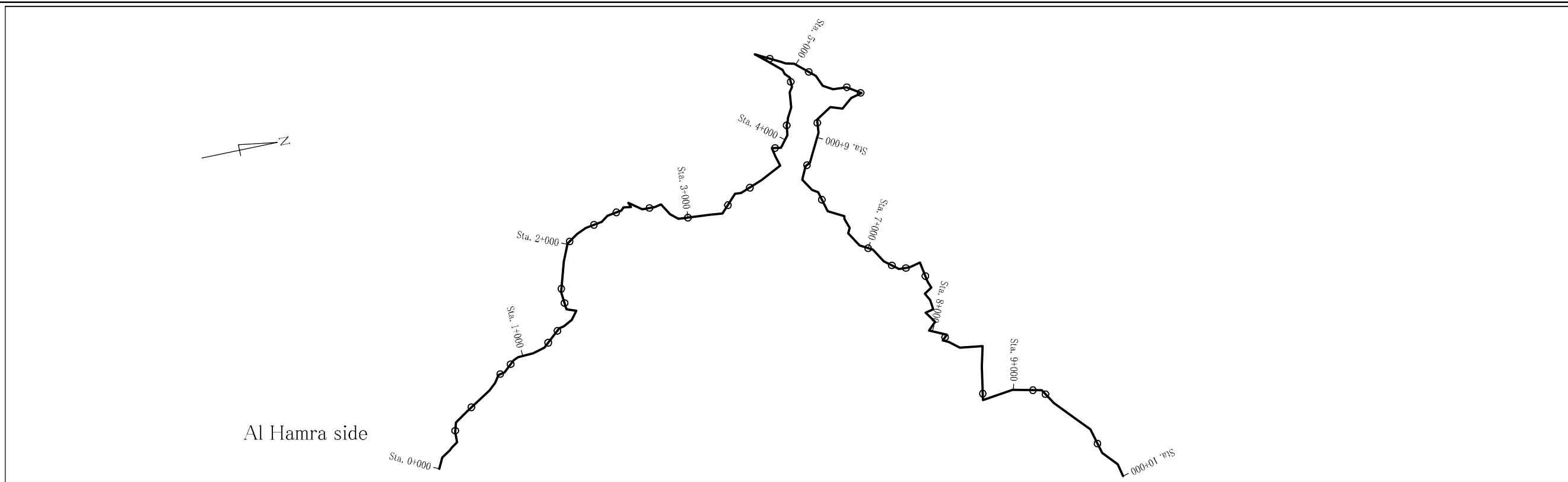
318 CAMPING SITE



II. AL HAMRA - RUSTAQ ROAD (PHASE 4)



 <p>SULTANATE OF OMAN MINISTRY OF TRANSPORTATION AND COMMUNICATIONS DIRECTORATE GENERAL OF ROADS</p>	<p>JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL</p>	<p>THE STUDY ON THE ROAD NETWORK DEVELOPMENT IN THE SULTANATE OF OMAN</p>	<p>N27 Al Hamra - Rustaq LOCATION MAP</p>	Dwg No.	N27-1
				Scale	1 : 100000
				Date	Nov. 2004



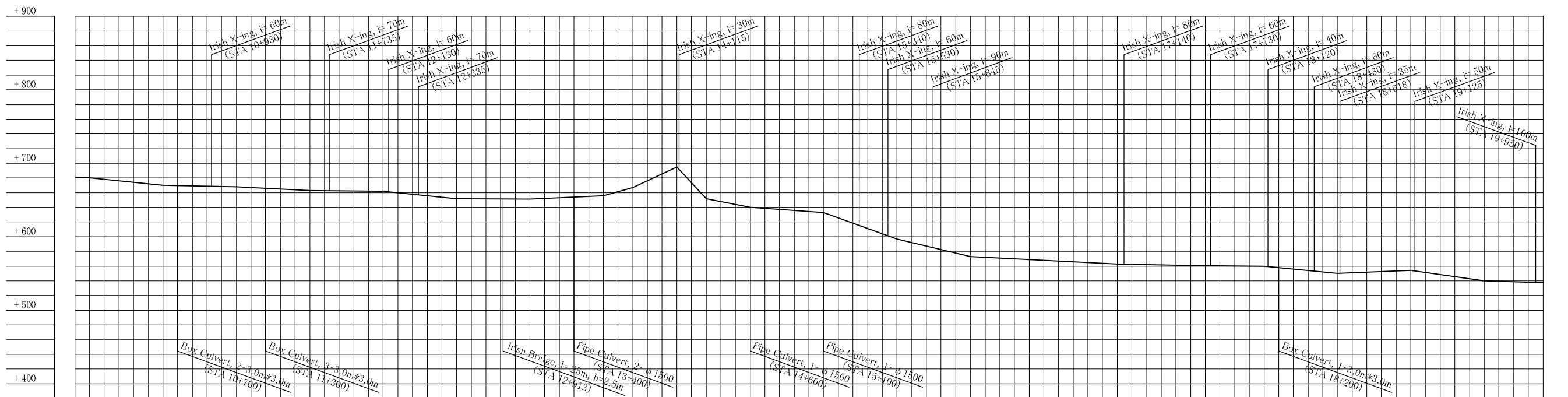
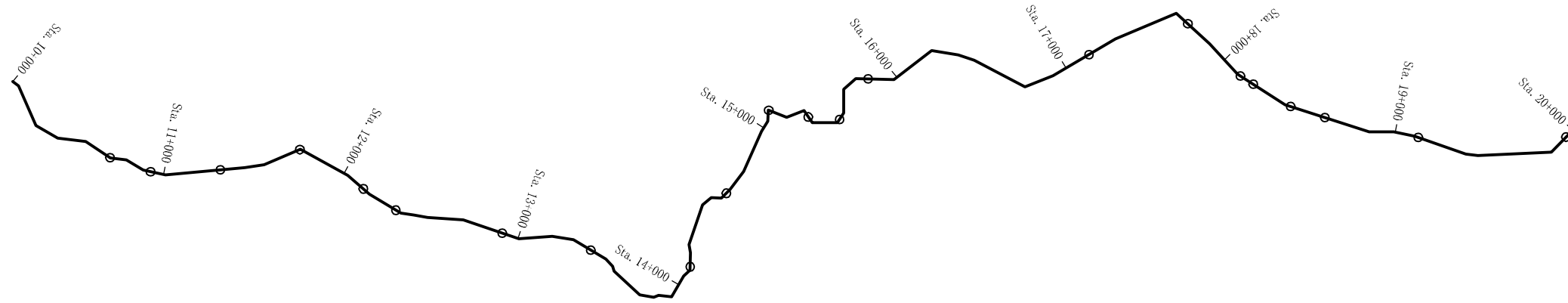
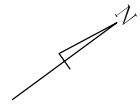
SULTANATE OF OMAN
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
DIRECTORATE GENERAL OF ROADS

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

THE STUDY ON
THE ROAD NETWORK DEVELOPMENT
IN THE SULTANATE OF OMAN

N27 Al Hamra - Rustaq
PLAN AND PROFILE
STA. 0km+000 - 10km+000

Dwg No.	N27-2
Scale	H = 1 : 30000 V = 1 : 6000
Date	Nov. 2004



STATION	10+000	11+000	12+000	13+000	14+000	15+000	16+000	17+000	18+000	19+000	20+000
VERTICAL ALIGNMENT	i=0.94% L=3300		656 i=1.21% L=2000			Flat		573 i=4.39% L=1800		i=1.35% L=9300	
CROSS SECTION TYPE											



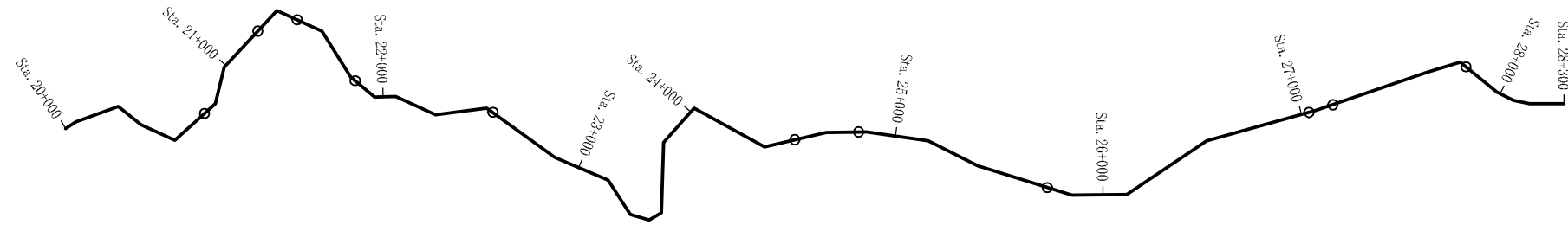
SULTANATE OF OMAN
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
DIRECTORATE GENERAL OF ROADS

JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL

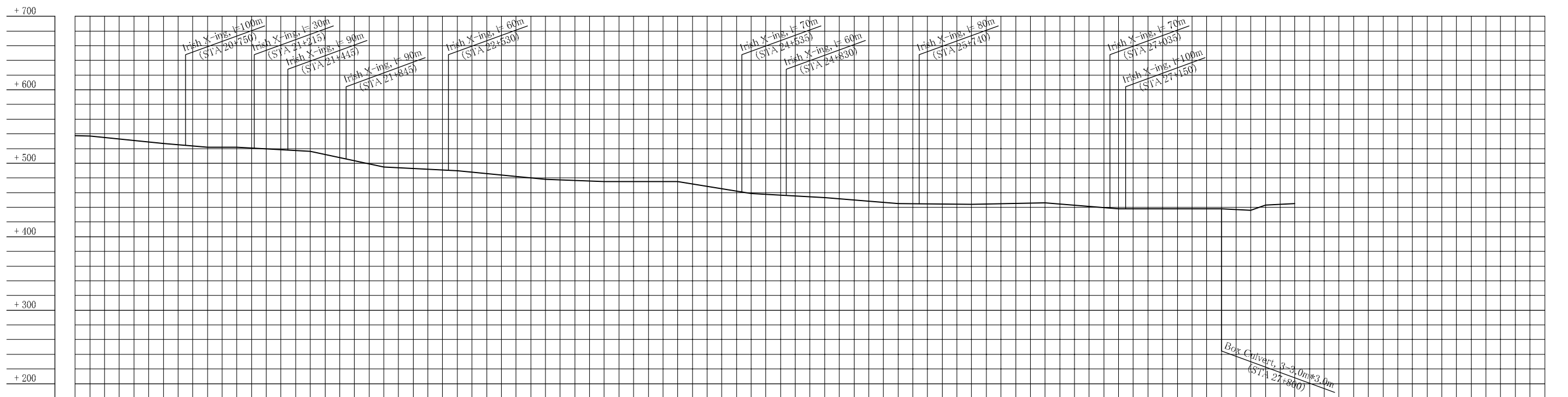
THE STUDY ON
THE ROAD NETWORK DEVELOPMENT
IN THE SULTANATE OF OMAN

N27 Al Hamra - Rustaq
PLAN AND PROFILE
STA. 10km+000 - 20km+000

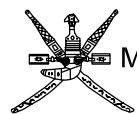
Dwg No.	N27-3
Scale	H = 1 : 30000 V = 1 : 6000
Date	Nov. 2004



Rustaq side



STATION	-20+000	-21+000	-22+000	-23+000	-24+000	-25+000	-26+000	-27+000	-28+000	-28+300
VERTICAL ALIGNMENT			$i=1.35\%$ $L=9500$		Flat		445	$i=0.38\%$ $L=2400$		436 448
CROSS SECTION TYPE										



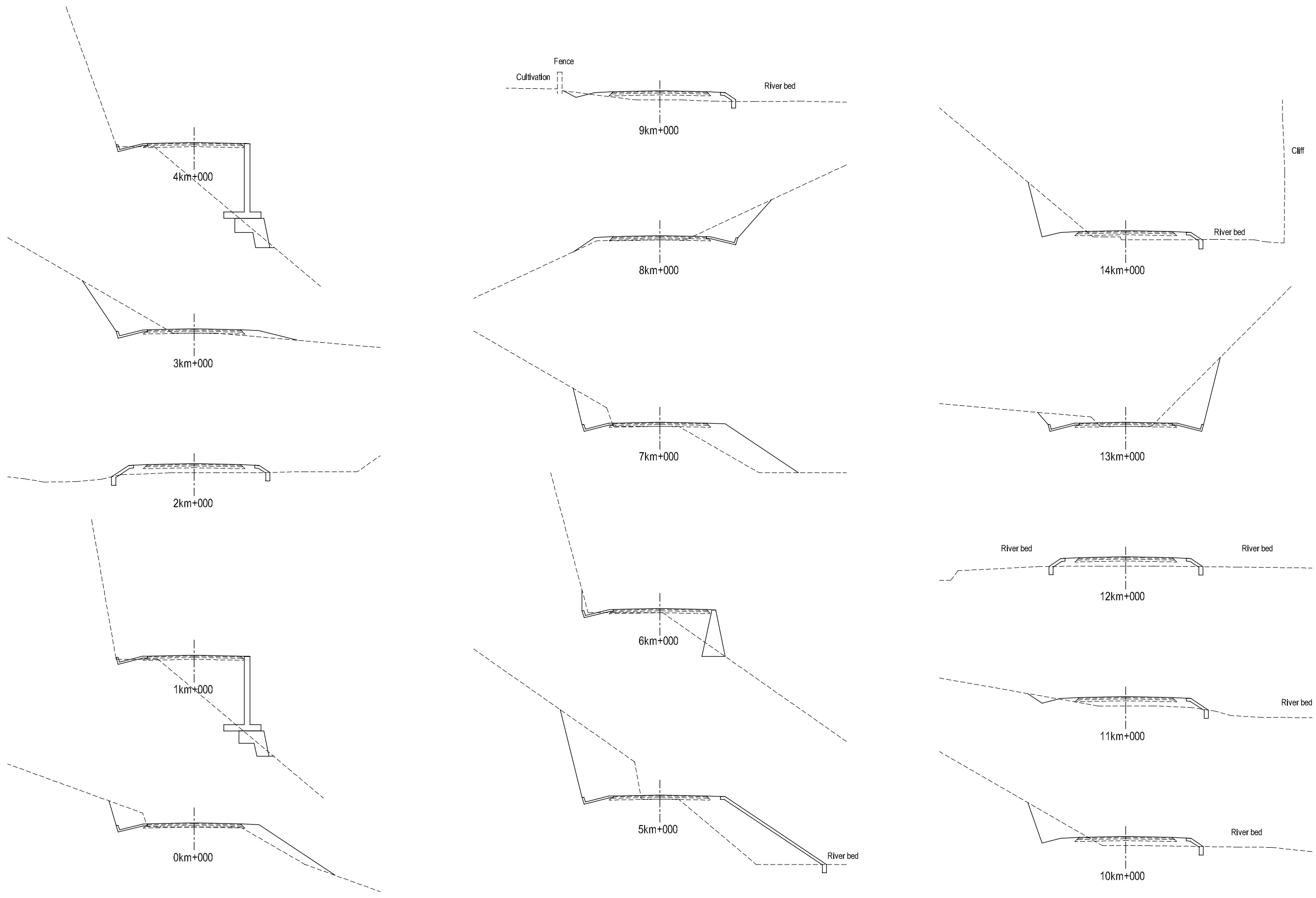
SULTANATE OF OMAN
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
 DIRECTORATE GENERAL OF ROADS

JAPAN INTERNATIONAL COOPERATION AGENCY
 KATAHIRA & ENGINEERS INTERNATIONAL

THE STUDY ON
 THE ROAD NETWORK DEVELOPMENT
 IN THE SULTANATE OF OMAN

N27 Al Hamra - Rustaq
 PLAN AND PROFILE
 STA. 20km+000 - 28km+300

Dwg No.	N27-4
Scale	H = 1 : 30000 V = 1 : 6000
Date	Nov. 2004



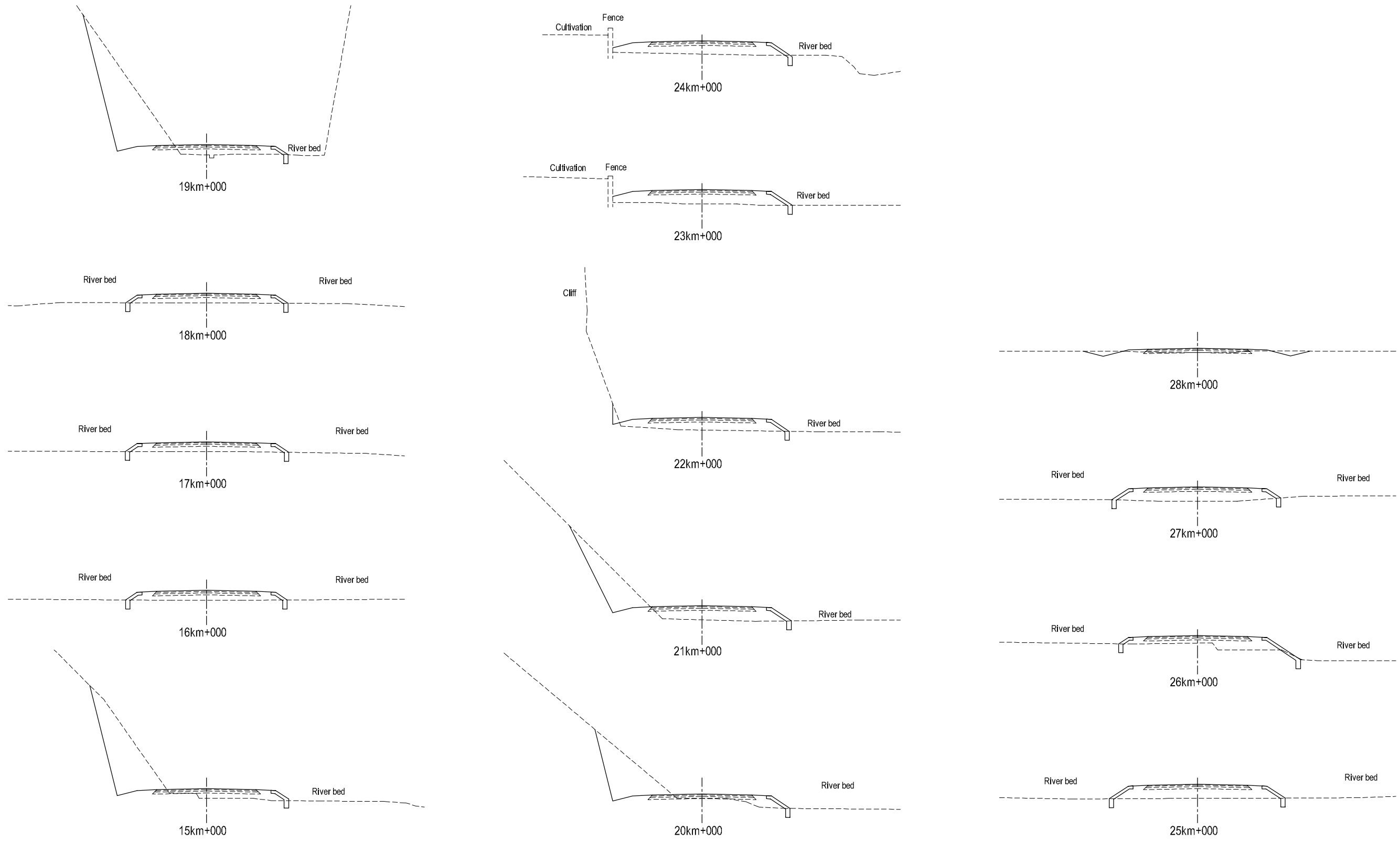
SULTANATE OF OMAN
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
 DIRECTORATE GENERAL OF ROADS

JAPAN INTERNATIONAL COOPERATION AGENCY
 KATAHIRA & ENGINEERS INTERNATIONAL

THE STUDY ON
 THE ROAD NETWORK DEVELOPMENT
 IN THE SULTANATE OF OMAN

N27 Al Hamra - Rustaq
 Cross Section
 0km+000 - 14km+000

Dwg No.	N27-5
Scale	1:400
Date	Nov. 2004



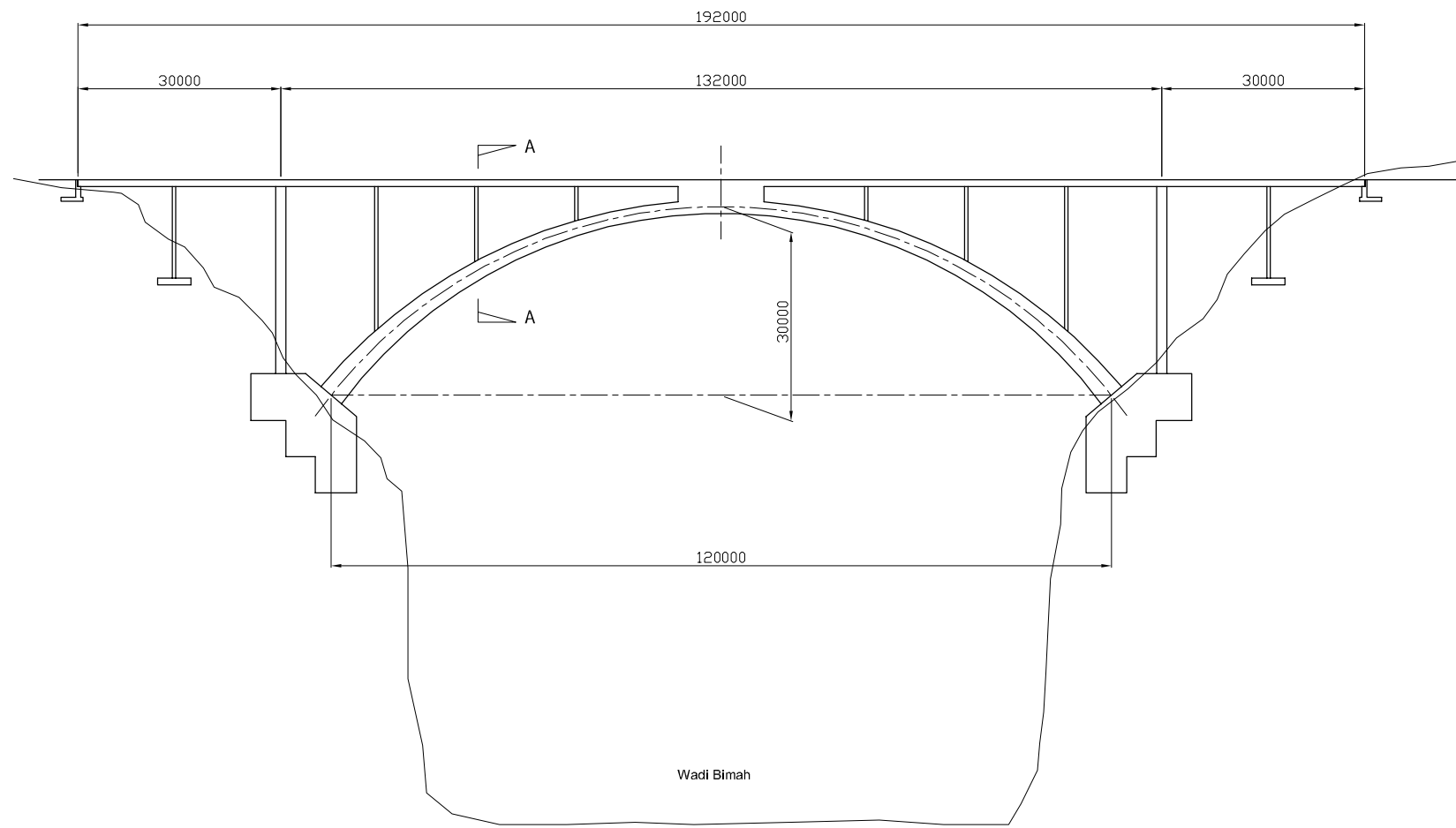
SULTANATE OF OMAN
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
 DIRECTORATE GENERAL OF ROADS

JAPAN INTERNATIONAL COOPERATION AGENCY
 KATAHIRA & ENGINEERS INTERNATIONAL

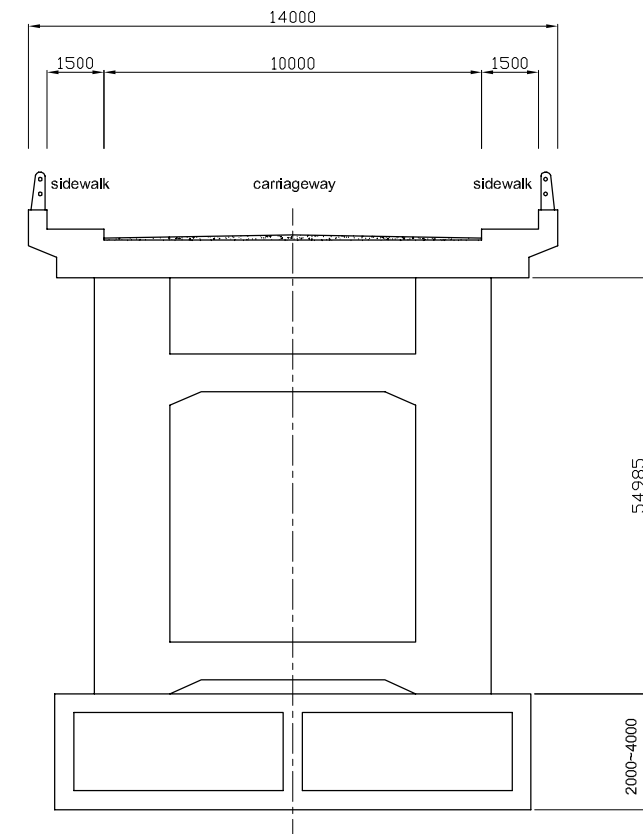
THE STUDY ON
 THE ROAD NETWORK DEVELOPMENT
 IN THE SULTANATE OF OMAN

N27 Al Hamra - Rustaq
 Cross Section
 15km+000 - 28km+000

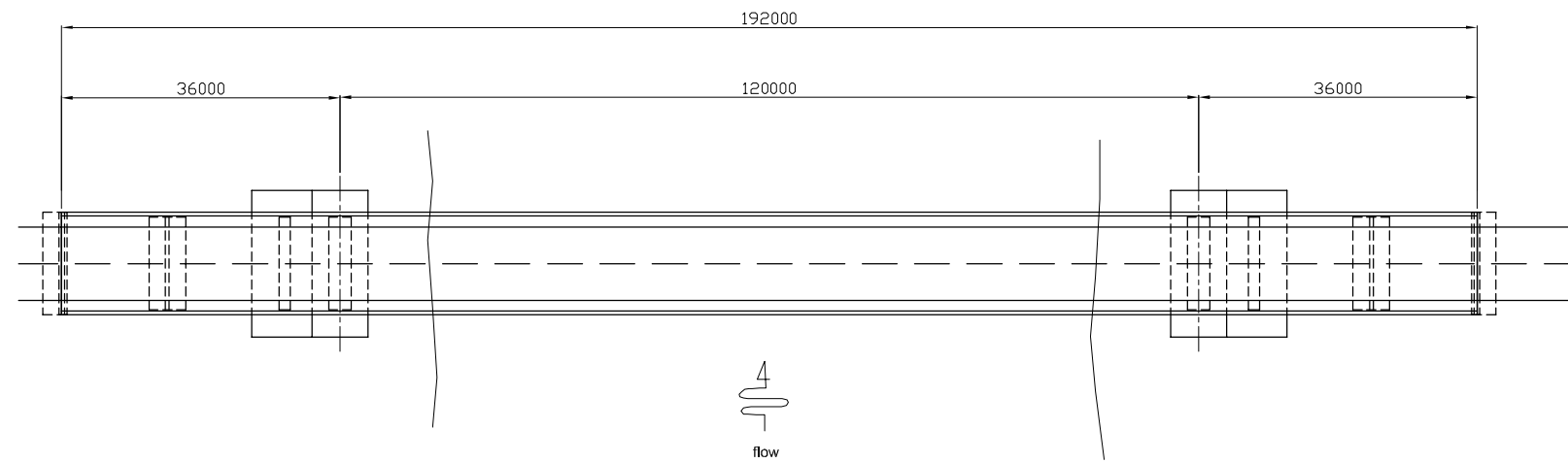
Dwg No.	N27-6
Scale	1:400
Date	Nov. 2004



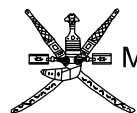
PROFILE



A-A SECTION



PLAN



SULTANATE OF OMAN
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
 DIRECTORATE GENERAL OF ROADS

JAPAN INTERNATIONAL COOPERATION AGENCY
 KATAHIRA & ENGINEERS INTERNATIONAL

THE STUDY ON
 THE ROAD NETWORK DEVELOPMENT
 IN THE SULTANATE OF OMAN

N27 Al Hamra - Rustaq
 General View of Arch Bridge

Dwg No.	N27-7
Scale	no scale
Date	Nov. 2004