Apéndice 2

Ingreso de Datos para Muros
de Prevención de Concreto

Ingreso de Datos para Muros de Prevención de Concreto

Dimensión del Muro de Concreto

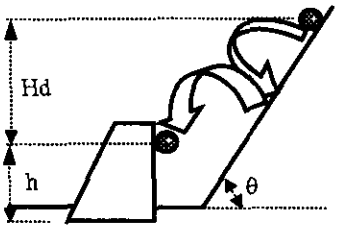
Item	Marca	Unidad	Ingreso datos	Observación
Altura del muro	H	m	-	
Ancho de la corona	b 1	m	-	
Ancho de la placa de asiento	b 2	m	-	
Grado de la superficie frontal	1:Nf	—	-	
Longitud de resistecia efectiva	L	m	10.000	
Peso unitario	γ c	kN/m^3	23.0	

Datos para Coeficiente de Reacción Subrasante

Item	Marca	Unidad	Ingreso datos	Observación
Coeficiente de deformación	E_0	kN/m^2	-	
Coeficiente de fuerza de reacción	α	-	-	
Valor N	N	-	30.0	

Datos de Caida de Rocas

Item	Marca	Unidad	Ingreso datos	Observación
Peso del canto rodado	W	kN	-	D=26KN/m3
Altura de caida	H d	m	-	
Coeficiente de fricción equivalente	μ	—	0.18	
Grado de inclinación	θ	grados	-	
Altura de choque	h'	m	-	0.9h



Datos para Análisis de Estabilidad

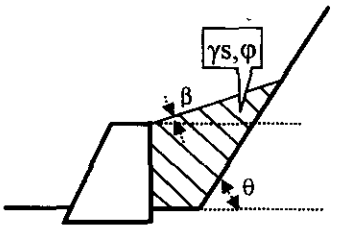
Item		Marca	Unidad	Ingreso datos	Observación
Módulos de fricción de asiento		μ s	—	0.60	
Resistencia del terreno deducible	Ordinario	q a	kN/m^2	700	
	Sedimentación	q as	kN/m^2	600	
	Terremoto	q ae	kN/m^2	450	

Valor máx. deducible de Angulo de Giro del Muro de Concreto

Item	Marca	Unidad	Ingreso datos	Observación
Valor máx. deducible de ángulo de giro	θ a	grados	2.0	2 ~ 3
Relación plástica deducible	μ	—	5.0	4 ~ 6

Datos para Nivel de Sedimentación

Item	Marca	Unidad	Ingreso datos	Observación
Unidad de peso de sedimentación de suel	γ s	kN/m^3	20.0	
Angulo de fricción interna	ϕ	grados	35.0	
Angulo de Sedimentación de Suelo	β	grados	30.0	$\beta < \phi$



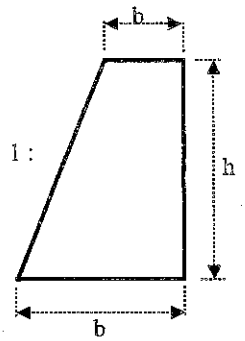
Data para Nivel de Terremoto

Item	Marca	Unidad	Ingreso datos	Observaciones
Coeficiente de diseño sísmico	k h	-	0.14	

Resultado de la revisión de la capacidad portante para muros de prevención de concreto

Peso de cantos rodados	ra de inclina	Grado de inclinación (grados)					
(kN)	(m)	30	40	50	60	70	80
1.7 (ϕ =0.5m)	10						
	20						
	30						
	40						
	50						
(kN)	(m)	30	40	50	60	70	80
13.6 (ϕ =1.0m)	10						
	20						
	30						
	40						
	50						
(kN)	(m)	30	40	50	60	70	80
45.9 (ϕ =1.5m)	10						
	20						
	30						
	40						
	50						
(kN)	(m)	30	40	50	60	70	80
108.9 (ϕ =2.0m)	10						
	20						
	30						
	40						
	50						

Tipo de Muro de Prevención de Concreto

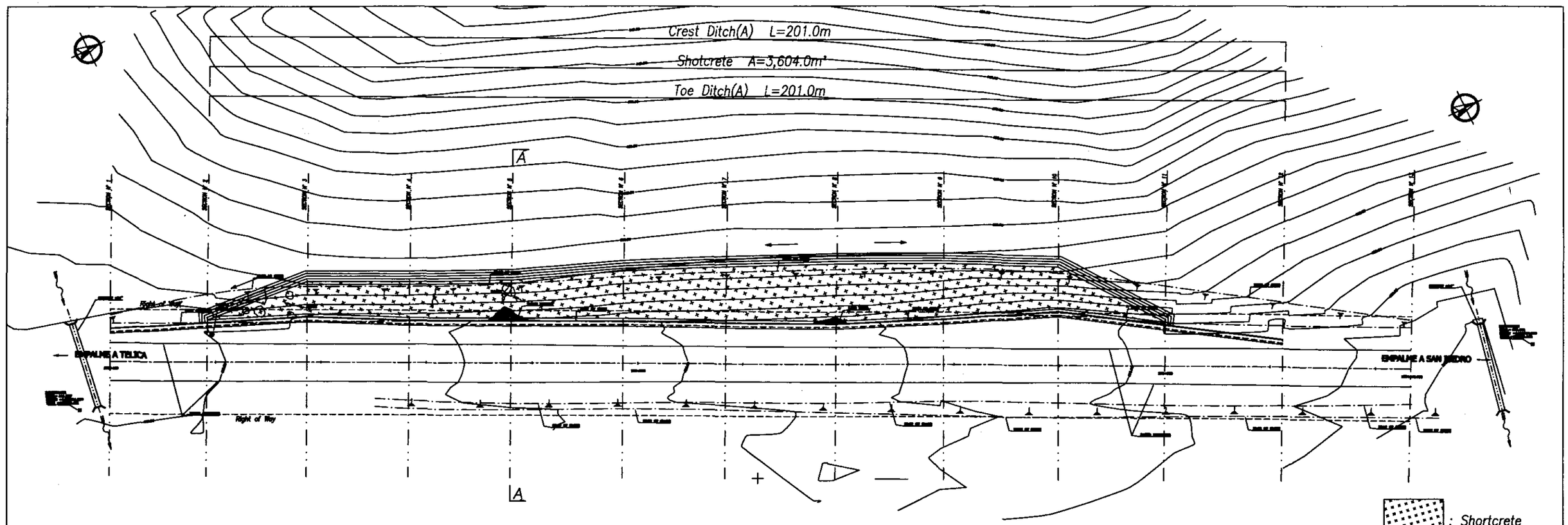
Tipo		Tamaño (m)				
		h	b1	b2	Nf	Em (KJ)
	A	2.00	0.50	1.50	0.50	8.94
	B	2.50	0.75	2.00	0.50	21.01
	C	3.00	1.00	2.50	0.50	40.90
	D	3.50	1.25	3.00	0.50	70.21
	E	4.00	1.50	3.50	0.50	110.41
	F	4.50	1.75	4.00	0.50	163.21
	G	5.00	2.00	4.50	0.50	229.76
	H	5.50	2.25	5.00	0.50	310.77
	I	6.00	2.50	5.50	0.50	406.73
	J	6.50	2.75	6.00	0.50	518.11

Em: Energía absorbible deducida

Apéndice 3

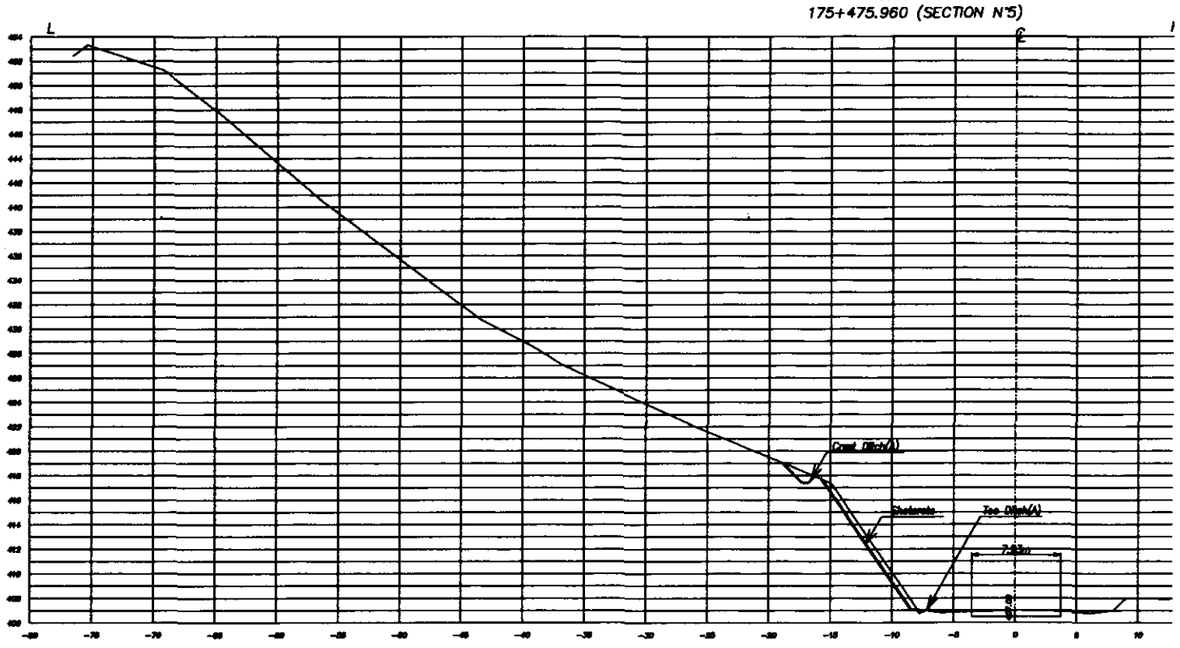
PLANOS ESTÁNDARDS

APÉNDICE -3 PLANOS ESTÁNDARDS	No
Contramedidas para Talud (por ej.N026A060)	1/16
Contramedidas para Talud (por ej.N001B170)	2/16
Contramedidas para Talud (por ej.N026B160)	3/16
Contramedidas para Talud (por ej.N026B140)	4/16
Contramedidas para Talud (por ej.N003E160)	5/16
Corte Típico de Talud	6/16
Diagrama General de Encofrado de Concreto	7/16
Diagrama General de Presa Simple	8/16
Diagrama General de Concreto Lanzado	9/16
Diagrama General de Red de Prevención	10/16
Diagrama General de Trabajos de Drenaje (1/2)	11/16
Diagrama General de Trabajos de Drenaje (2/2)	12/16
Contramedidas para Puentes Socavados (por ej. Puente Tapacali)	13/16
Diagrama General de Protección contra Socavaciones	14/16
Diagrama General de Protección contra Socavaciones alrededor de los pilares	15/16
Diagrama General de Protección contra Socavaciones por Gavión	16/16

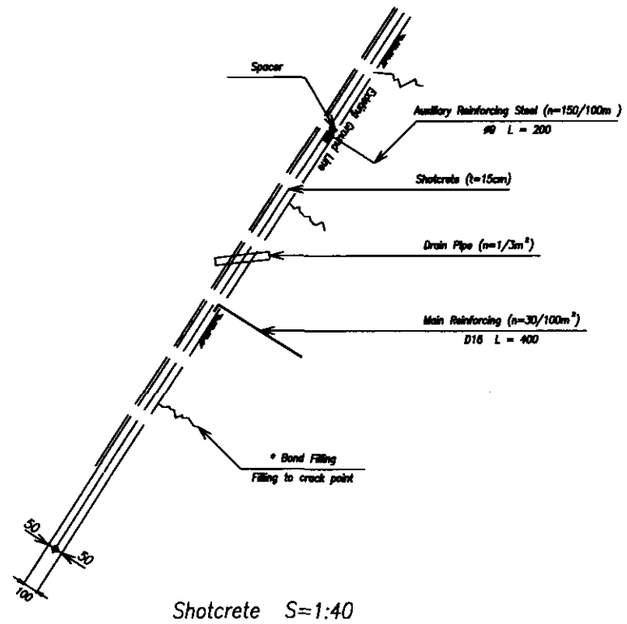


Plan S=1:750

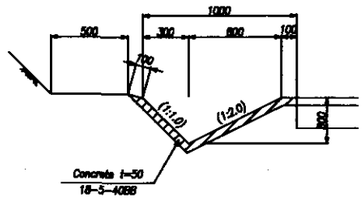
A – A
175+475.960 (SECTION N°5)



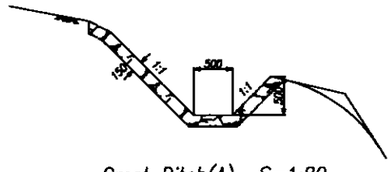
Cross Section S=1:500



Shotcrete S=1:40



Toe Ditch(A) S=1:40
*For Cut



Crest Ditch(A) S=1:80

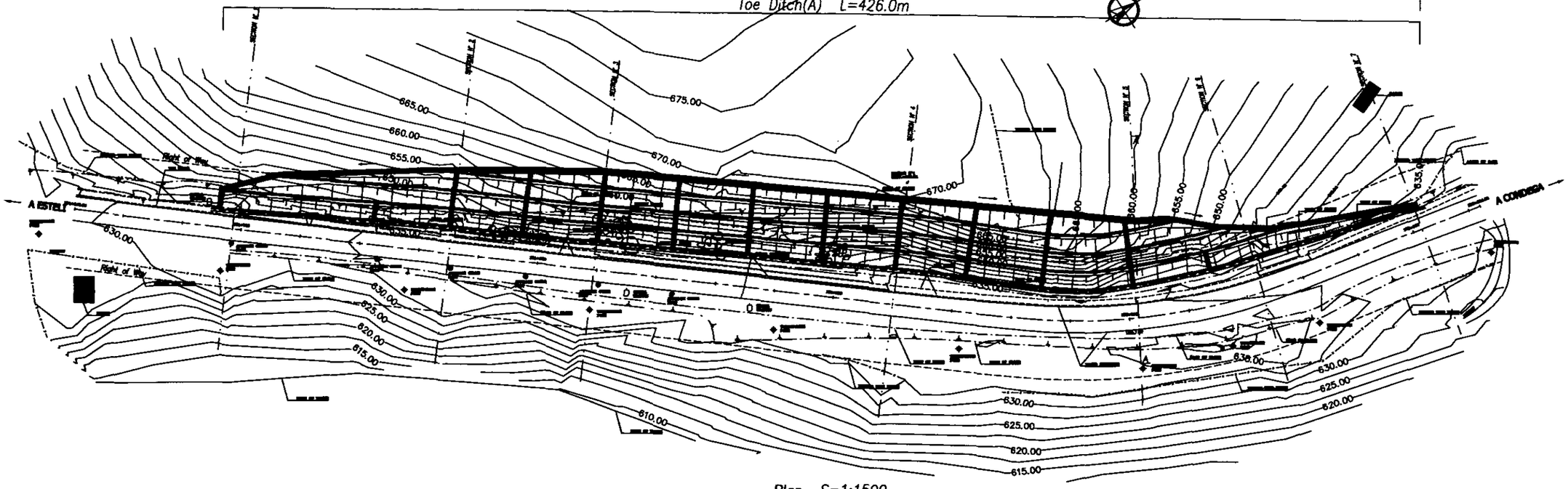
ORIENTAL CONSULTANTS CO., LTD. JAPAN ENGINEERING CONSULTANTS CO., LTD.	CONTENIDO: LEVANTAMIENTO TOPOGRAFICO SECCIONES TRANSVERSALES UBICACION: KM 175+450 CARRETERA TELICA - SAN ISIDRO SITIO: N026A006	PROYECTO: STUDY OF VULNERABILITY REDUCTION FOR MAJOR ROADS IN THE REPUBLIC OF NICARAGUA	CALCULO: LEVANTO : RESPONSABLE TECNICO :	DIBUJO: FECHA: November 2002 ESCALA: Illustration	HOJA N° 1 / 16

Crest Ditch(A) L=426.0m

Berm Ditch(A) L=1065.0m

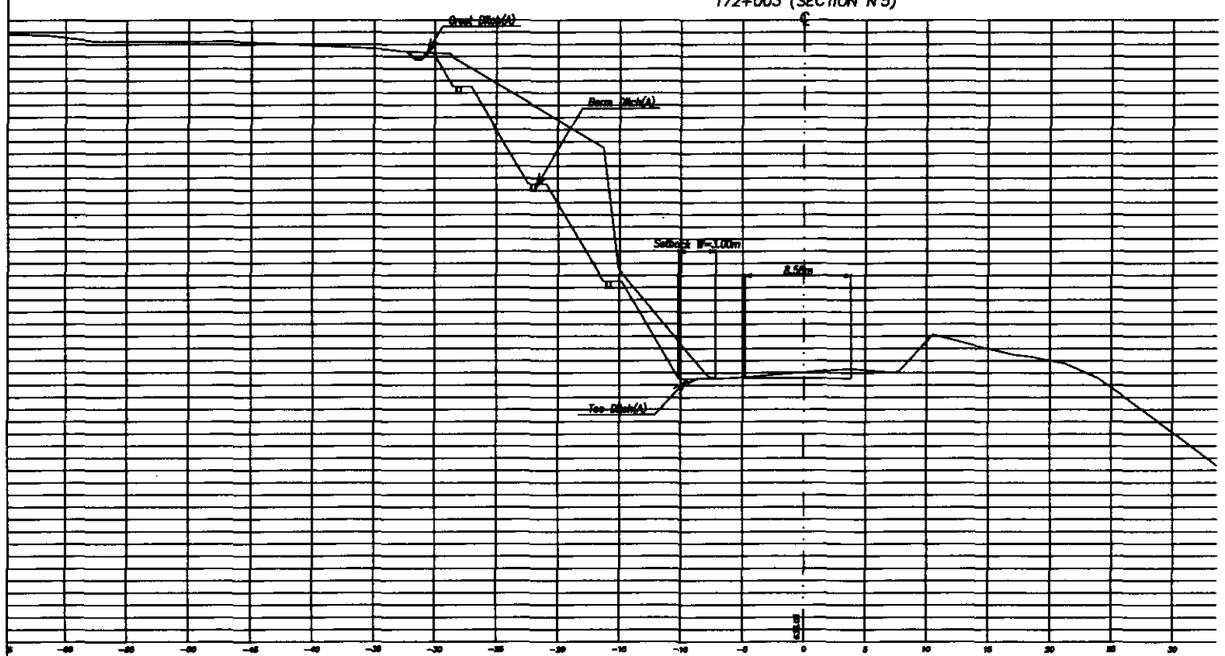
Vertical Ditch L=364.0m

Toe Ditch(A) L=426.0m

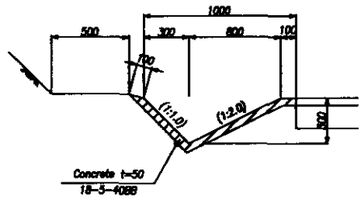


Plan S=1:1500

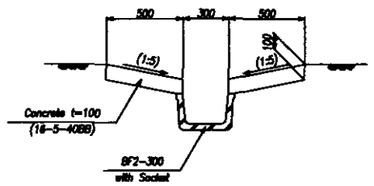
A – A
172+003 (SECTION N°5)



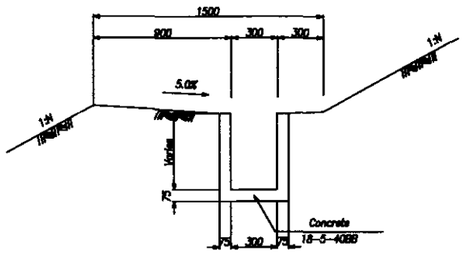
Cross Section S=1:500



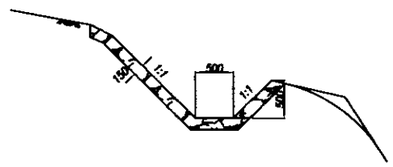
Toe Ditch(A) S=1:40
*For Cut



Vertical Ditch S=1:40

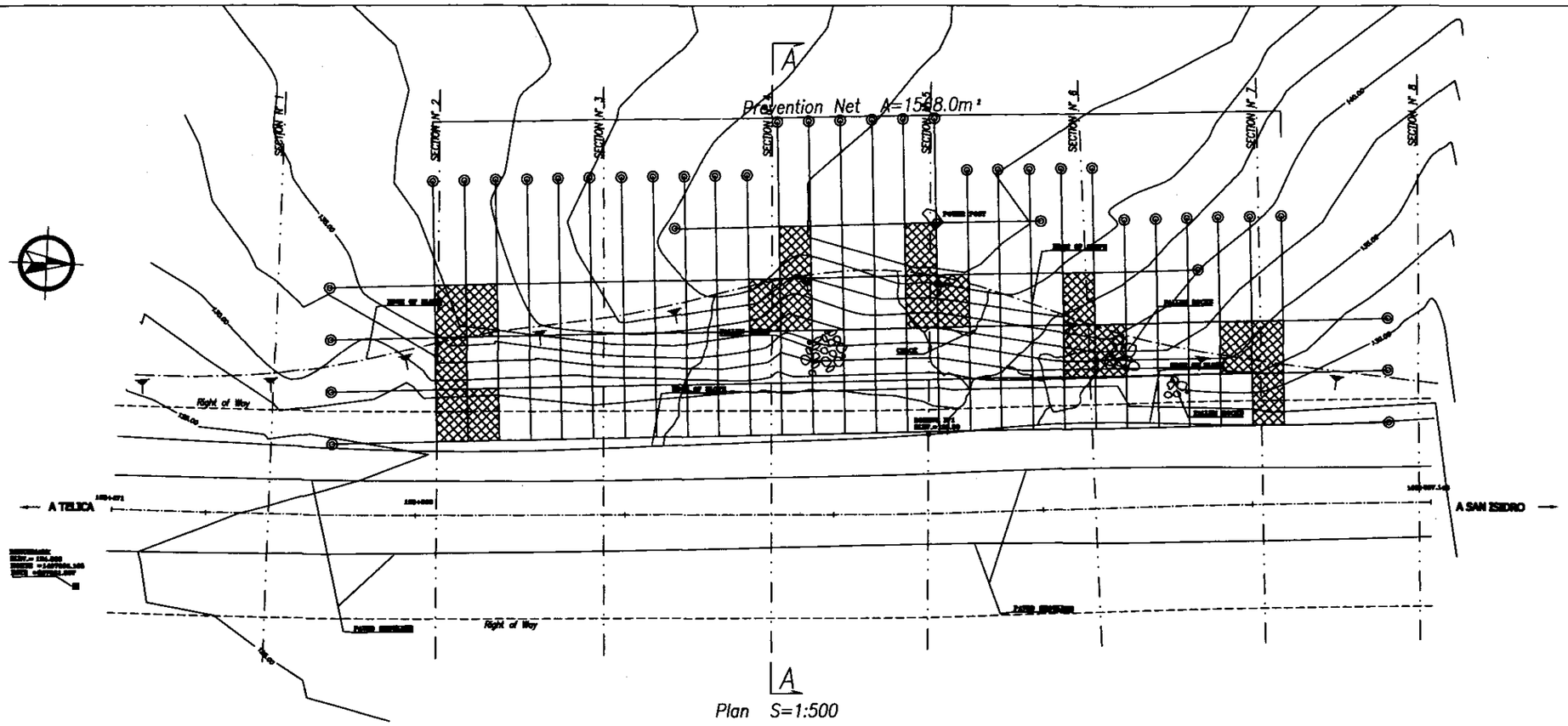


Berm Ditch(A) S=1:40
*For Cut of Soft Rock

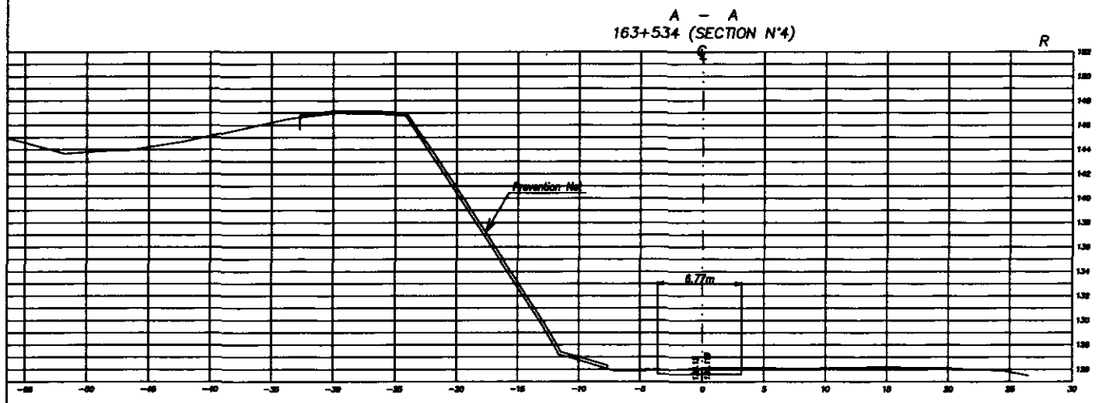


Crest Ditch(A) S=1:80

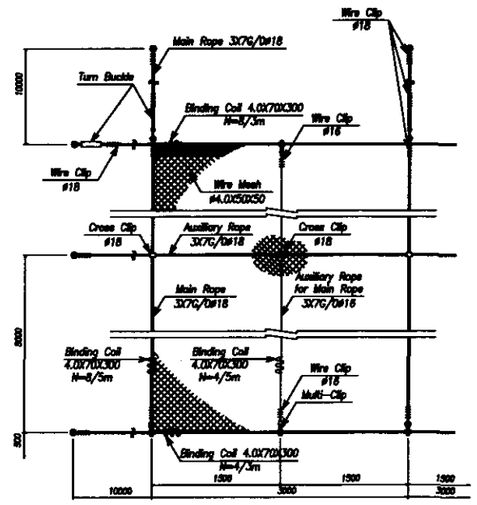
ORIENTAL CONSULTANTS CO., LTD. JAPAN ENGINEERING CONSULTANTS CO., LTD.	CONTENIDO: LEVANTAMIENTO TOPOGRAFICO SECCIONES TRANSVERSALES UBICACION: KM 171+643.95 CARRETERA MANAGUA - EL ESPINO SITIO: N0018170	PROYECTO: STUDY OF VULNERABILITY REDUCTION FOR MAJOR ROADS IN THE REPUBLIC OF NICARAGUA	CALCULO: LEVANTO : RESPONSABLE TECNICO :	DIBUJO: FECHA: November 2002 ESCALA Illustration	HOJA N° 2 / 16



Plan S=1:500

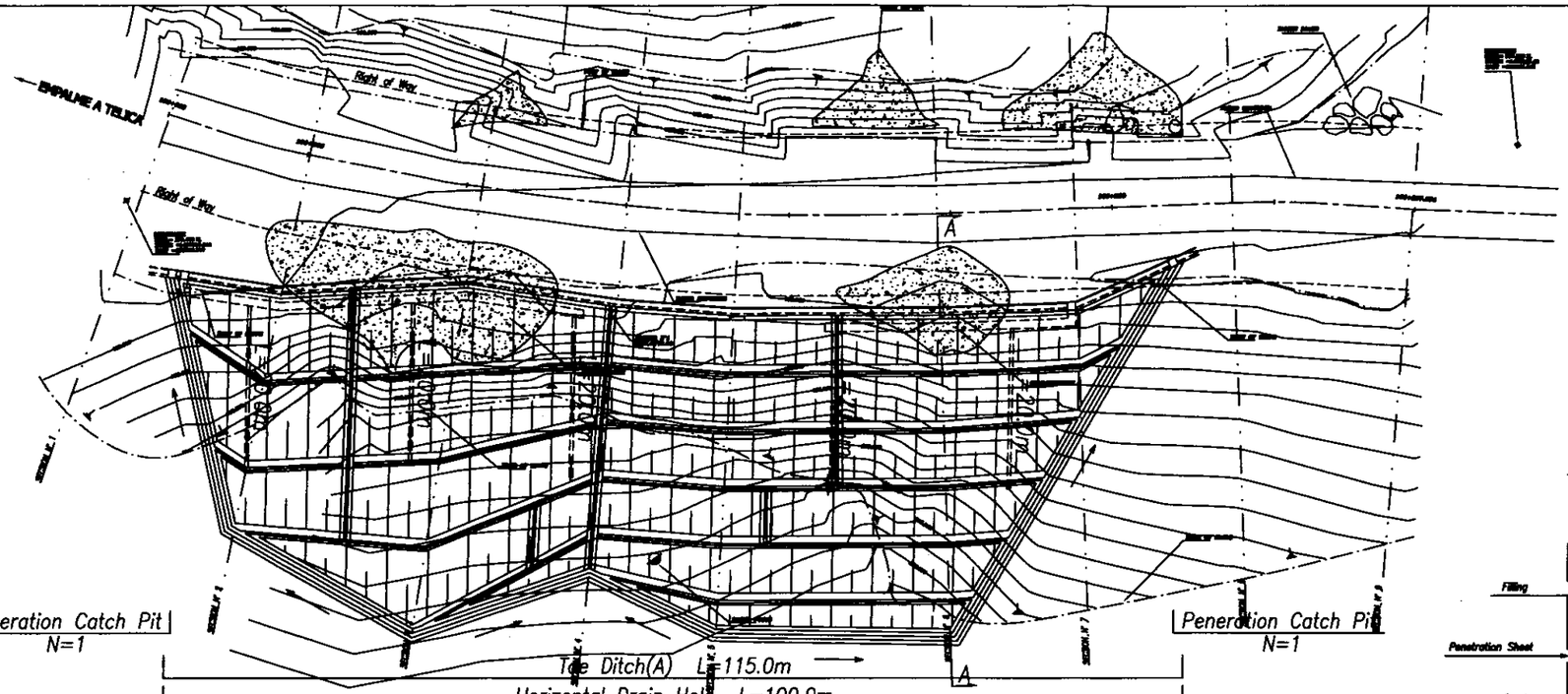


Cross Section S=1:500



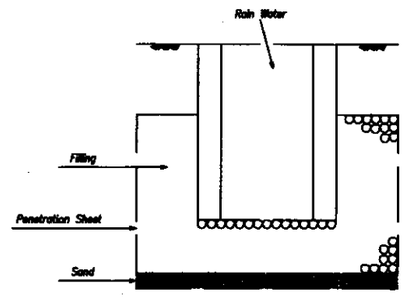
General Layout of Prevention Net S=Non Scale

ORIENTAL CONSULTANTS CO., LTD. JAPAN ENGINEERING CONSULTANTS CO., LTD.	CONTENIDO: LEVANTAMIENTO TOPOGRAFICO SECCIONES TRANSVERSALES UBICACION: KM 163+471 CARRETERA TELICA - SAN ISIDRO SITIO: N0268160	PROYECTO: STUDY OF VULNERABILITY REDUCTION FOR MAJOR ROADS IN THE REPUBLIC OF NICARAGUA	CALCULO: LEVANTO : RESPONSABLE TECNICO :	DIBUJO: FECHA: November 2002 ESCALA Illustration	HOJA N° 3 / 16

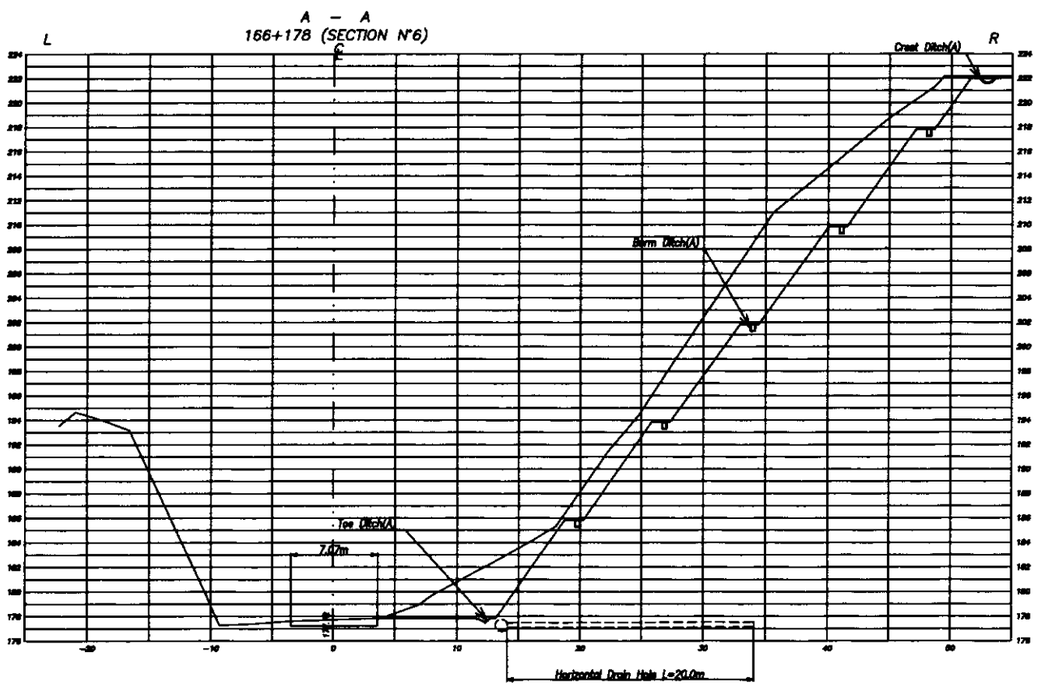


Toe Ditch(A) L=115.0m
Horizontal Drain Hole L=100.0m
Vertical Ditch L=105.0m
Berm Ditch(A) L=287.0m
Crest Ditch(A) L=115.0m

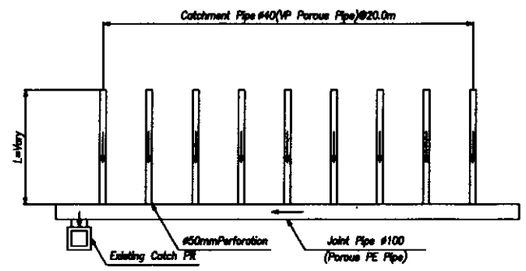
Plan S=1:750



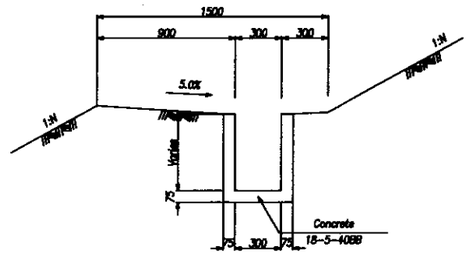
Penetration Catch Pit S=1:400



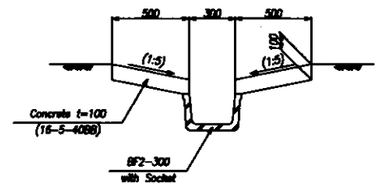
Cross Section S=1:500



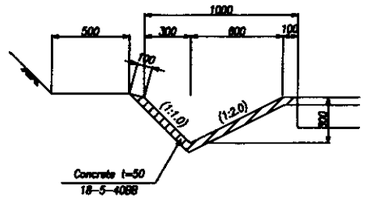
Horizontal Drain Hole S= –



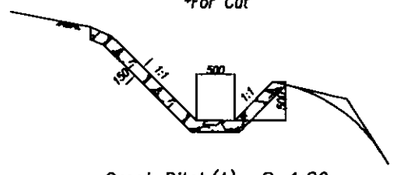
Berm Ditch(A) S=1:40
*For Cut of Soft Rock



Vertical Ditch S=1:40

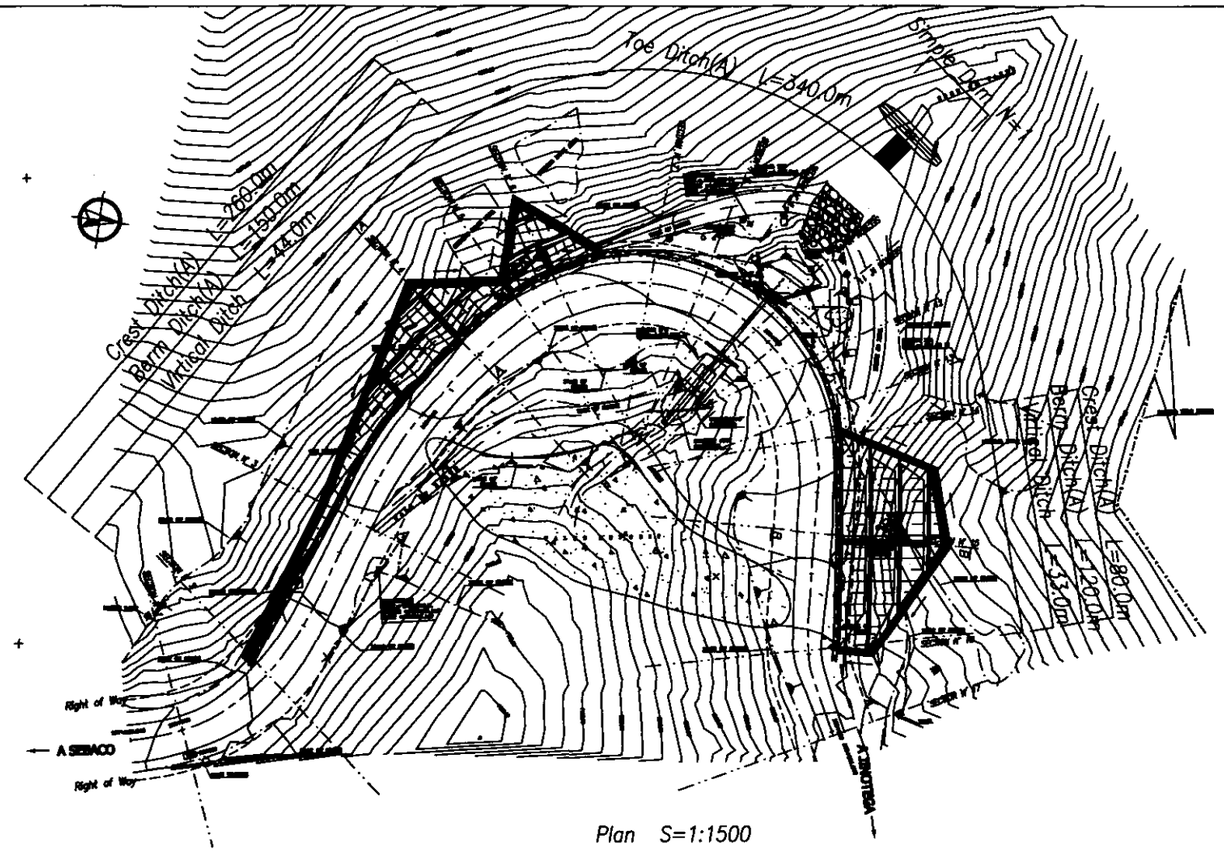


Toe Ditch(A) S=1:40
*For Cut

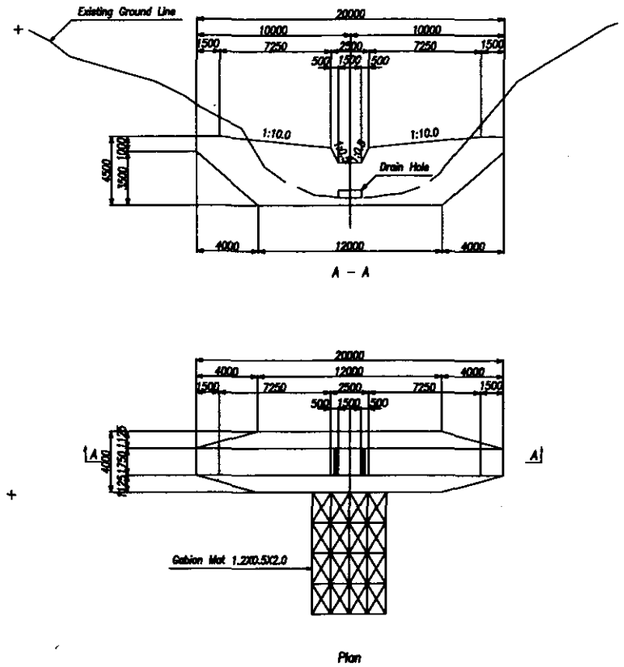


Crest Ditch(A) S=1:80

ORIENTAL CONSULTANTS CO., LTD. JAPAN ENGINEERING CONSULTANTS CO., LTD.	CONTENIDO: LEVANTAMIENTO TOPOGRAFICO SECCIONES TRANSVERSALES UBICACION: KM 166+300 CARRETERA TELICA - SAN ISIDRO SITIO: N026B140	PROYECTO: STUDY OF VULNERABILITY REDUCTION FOR MAJOR ROADS IN THE REPUBLIC OF NICARAGUA	CALCULO: LEVANTO : RESPONSABLE TECNICO :	DIBUJO: FECHA: November 2002 ESCALA Illustration	HOJA N° 4 / 16

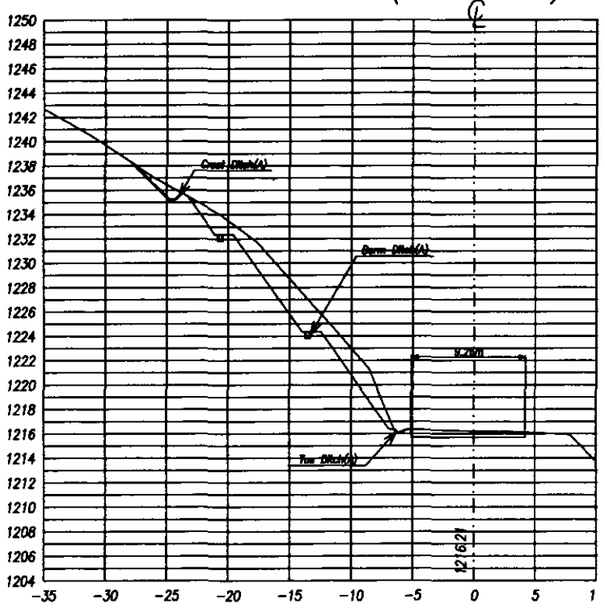


Plan S=1:1500

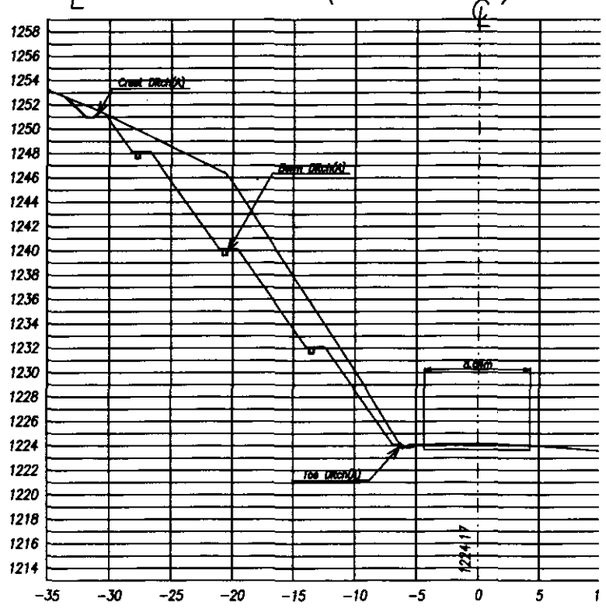


Simple Dam S=1:400

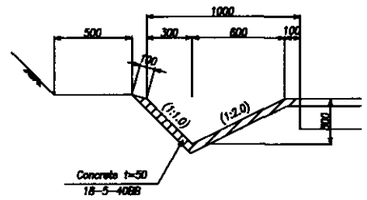
A – A
138+119 (SECTION N°4)



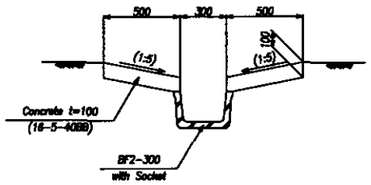
B – B
138+250 (SECTION N°15)



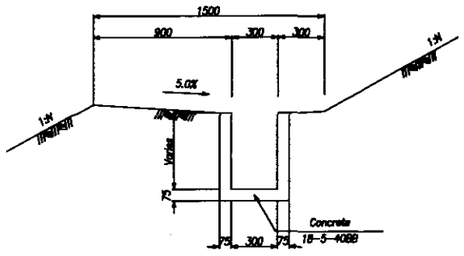
Cross Section S=1:500



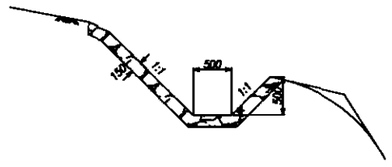
Toe Ditch(A) S=1:40
*For Cut



Vertical Ditch S=1:40



Berm Ditch(A) S=1:40
*For Cut of Soft Rock



Crest Ditch(A) S=1:80

ORIENTAL CONSULTANTS CO., LTD. JAPAN ENGINEERING CONSULTANTS CO., LTD.	CONTENIDO: LEVANTAMIENTO TOPOGRAFICO SECCIONES TRANSVERSALES UBICACION: KM 138+000 CARRETERA SEBACO - JINOTEGA SITIO: N003E170	PROYECTO: STUDY OF VULNERABILITY REDUCTION FOR MAJOR ROADS IN THE REPUBLIC OF NICARAGUA	CALCULO: LEVANTO : RESPONSABLE TECNICO :	DIBUJO: FECHA: November 2002 ESCALA Illustration	HOJA N° 5 / 16

Typical Cross Section

For Cut

Cut Slope Standard in Nicaragua

Functional Classification		Minor Collector	Major Collector	Minor Arterial	Principal Arterial	Special Arterial
Number of Lane		2	2	2	2	4
Future Average Daily Traffic (vpd)		~400	400 ~ 1,800	1,800 ~ 3,000	~3,000	Over 3,000
Side-slope	On Sound Rock	0 ~ 1/2 : 1	0 ~ 1/2 : 1	0 ~ 1/2 : 1	0 ~ 1/2 : 1	0 ~ 1/2 : 1
	Unknown Soil	1 : 1	1 1/2 : 1	1 1/2 : 1	2 : 1	2 : 1
	Well Compacted Soil	1 : 1	1 1/2 : 1	1 1/2 : 1	2 : 1	2 : 1
	Not Well Compacted Soil	1 1/2 : 1	1 1/2 : 1	2 : 1	2 : 1	2 : 1

Recommendable Cut Slope Standard in Nicaragua

Classification		Height of cut (m)	Degree of Cut θ(°)	1/tan θ	n	:	1
hard rock	IB	10 ≧ H	80	0.1763	0.2	:	1
		10 < H ≦ 20	80	0.1763	0.2	:	1
		20 < H ≦ 30	60	0.5774	0.6	:	1
		H > 30	60	0.5774	0.6	:	1
soft rock	IIB	10 ≧ H	65	0.4663	0.5	:	1
		10 < H ≦ 20	65	0.4663	0.5	:	1
		20 < H ≦ 30	55	0.7002	0.8	:	1
		H > 30	55	0.7002	0.8	:	1
	IA	10 ≧ H	60	0.5774	0.6	:	1
		10 < H ≦ 20	60	0.5774	0.6	:	1
		20 < H ≦ 30	50	0.8391	1.0	:	1
		H > 30	50	0.8391	1.0	:	1
	IIA	10 ≧ H	55	0.7002	0.8	:	1
		10 < H ≦ 20	55	0.7002	0.8	:	1
		20 < H ≦ 30	45	1.0000	1.0	:	1
		H > 30	45	1.0000	1.0	:	1
soil/sand	III	10 ≧ H	45	1.0000	1.0	:	1
		10 < H ≦ 20	40	1.1918	1.2	:	1
		20 < H ≦ 30	35	1.4281	1.5	:	1
		H > 30	30	1.7321	1.8	:	1

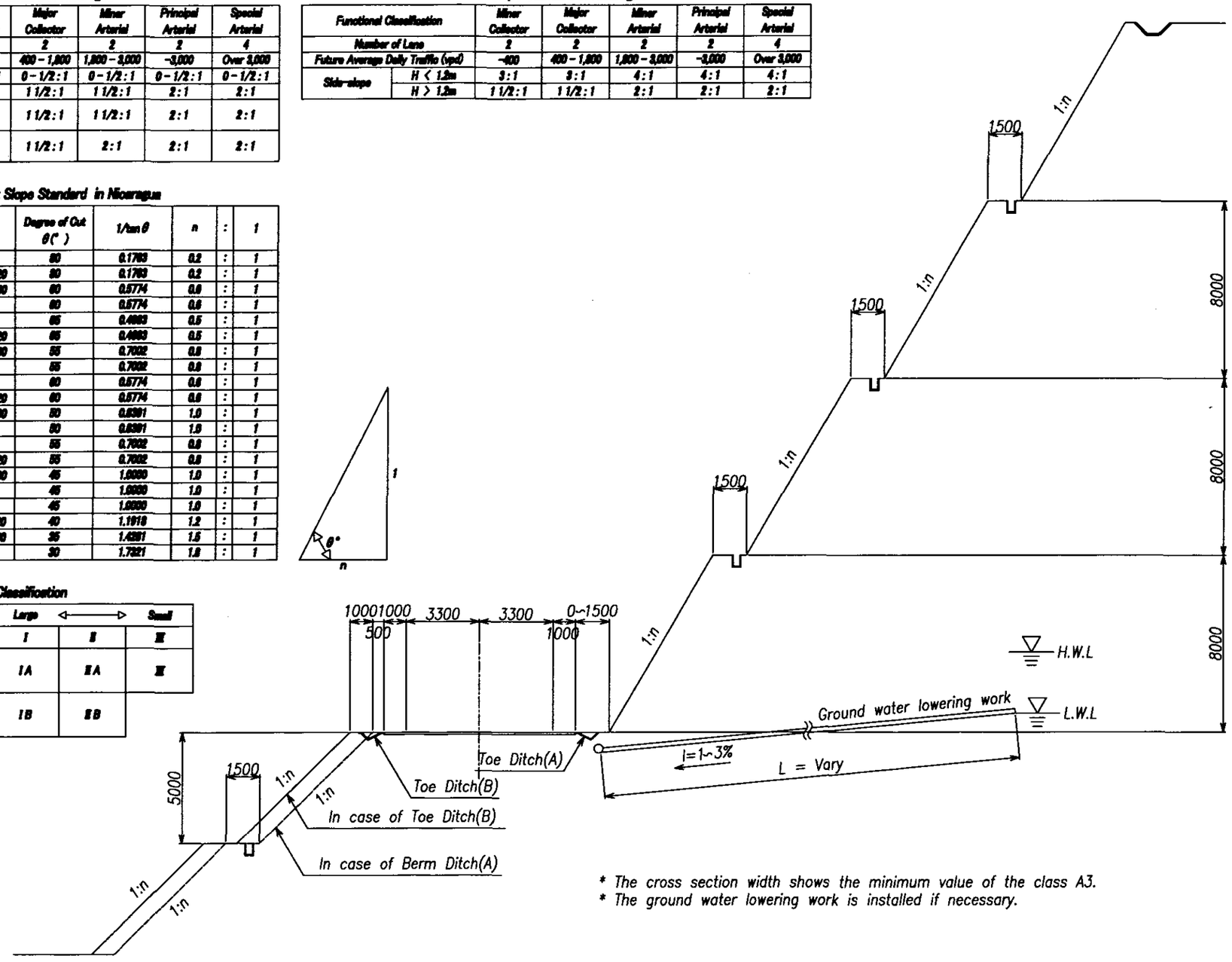
Concept for Rock Classification

Rock Quality Classification according to Hardness		Large ⟷ Small		
		I	II	III
Rock Quality Classification according to Decrease in Strength (Large ↕ Small)	A	IA	IIA	III
	B	IB	IIB	

For Embankment

Cut Slope Standard in Nicaragua

Functional Classification		Minor Collector	Major Collector	Minor Arterial	Principal Arterial	Special Arterial
Number of Lane		2	2	2	2	4
Future Average Daily Traffic (vpd)		~400	400 ~ 1,800	1,800 ~ 3,000	~3,000	Over 3,000
Side-slope	H < 1.2m	3 : 1	3 : 1	4 : 1	4 : 1	4 : 1
	H > 1.2m	1 1/2 : 1	1 1/2 : 1	2 : 1	2 : 1	2 : 1



* The cross section width shows the minimum value of the class A3.
* The ground water lowering work is installed if necessary.

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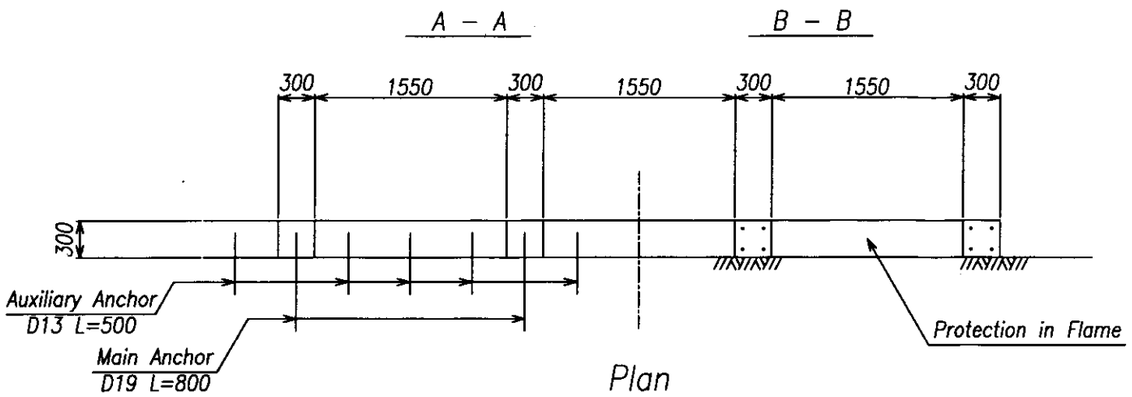
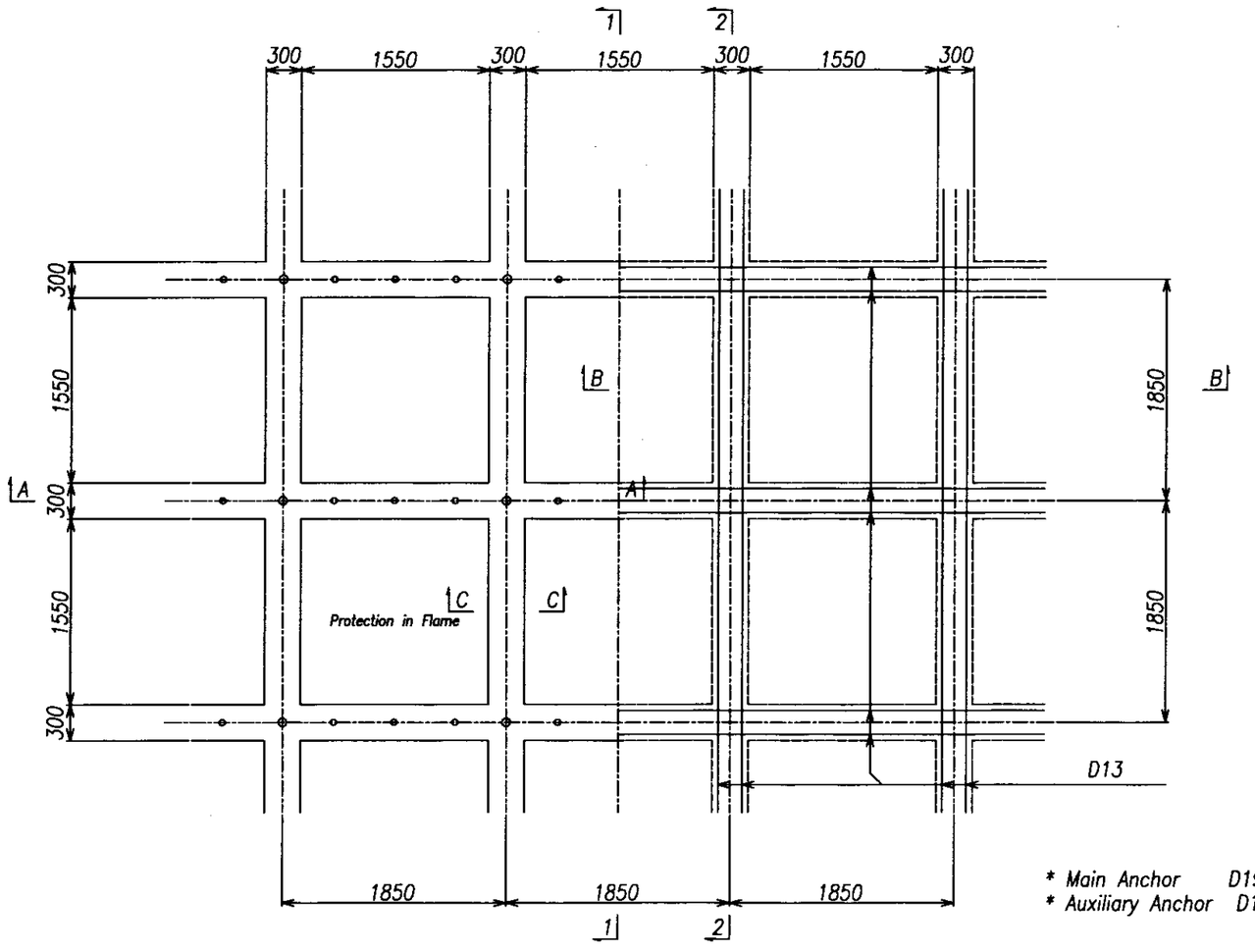
General Layout of Concrete Cribwork

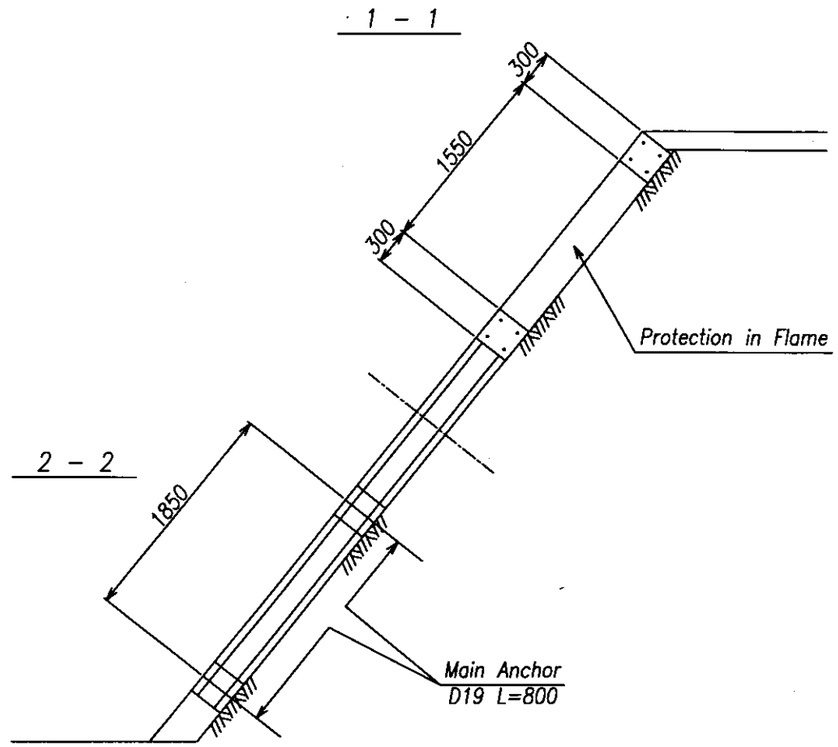
Cross



Plan



Typical Cross Section



* Main Anchor D19 L=800
* Auxiliary Anchor D13 L=500

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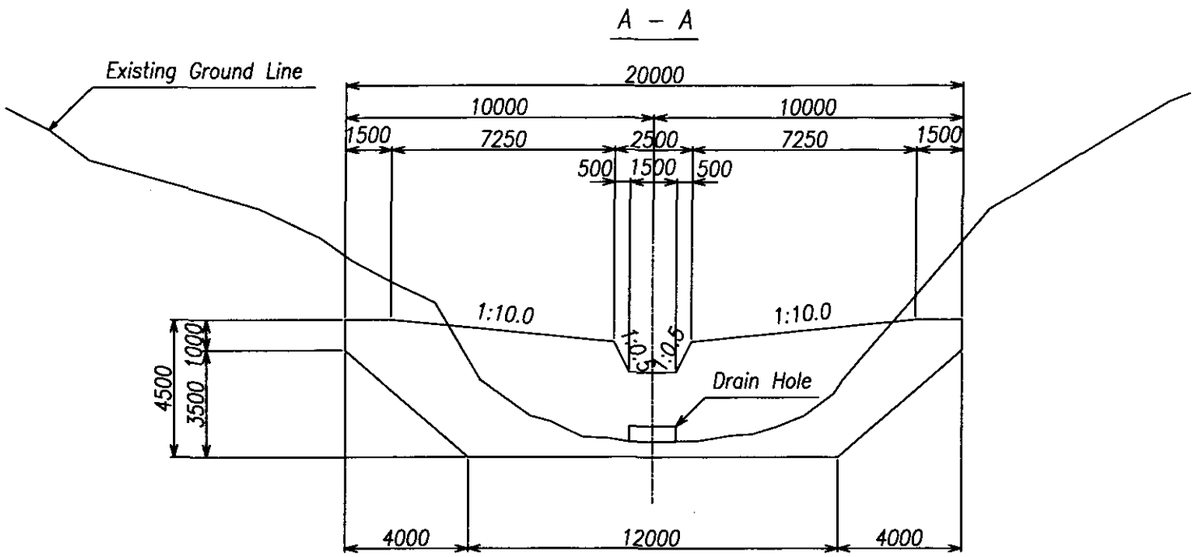
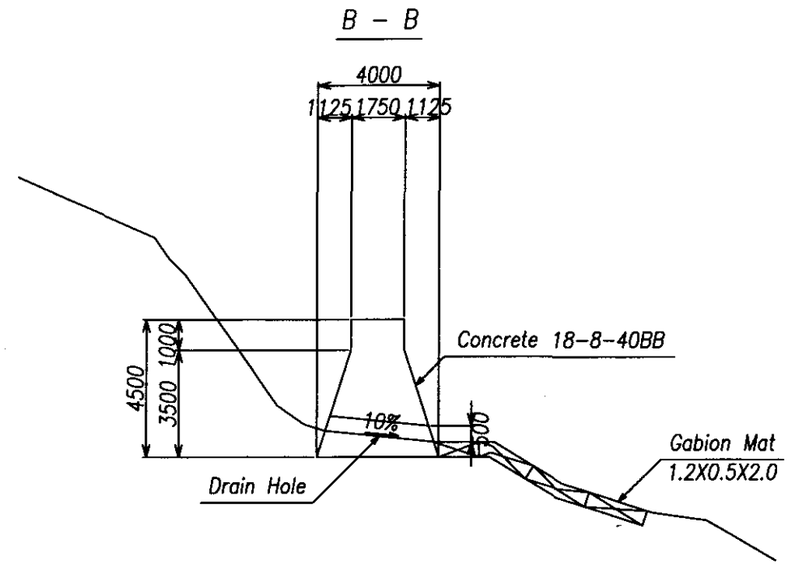
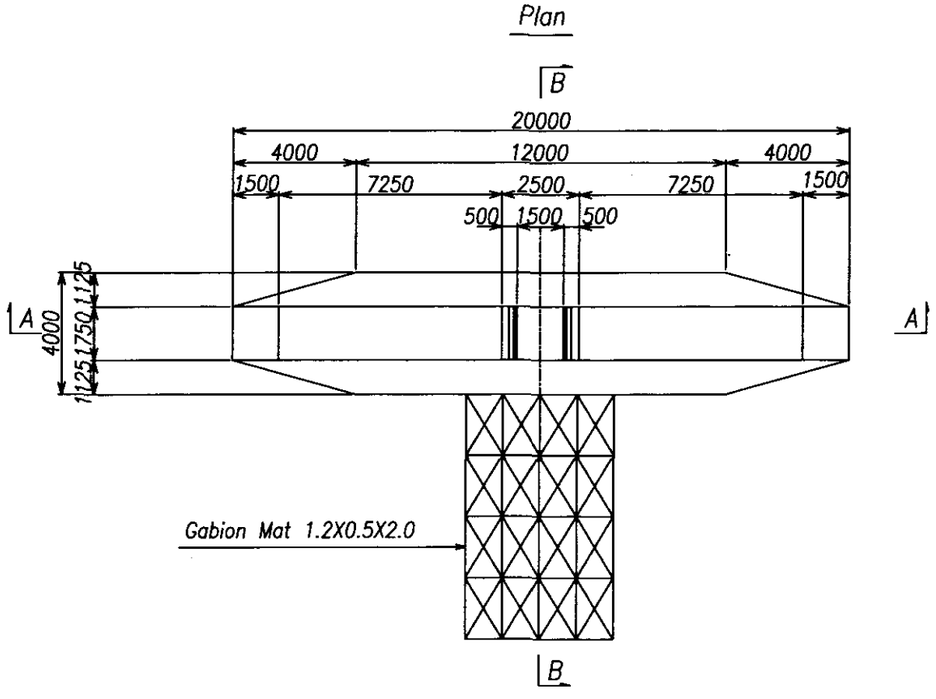
General Layout of Simple Dam







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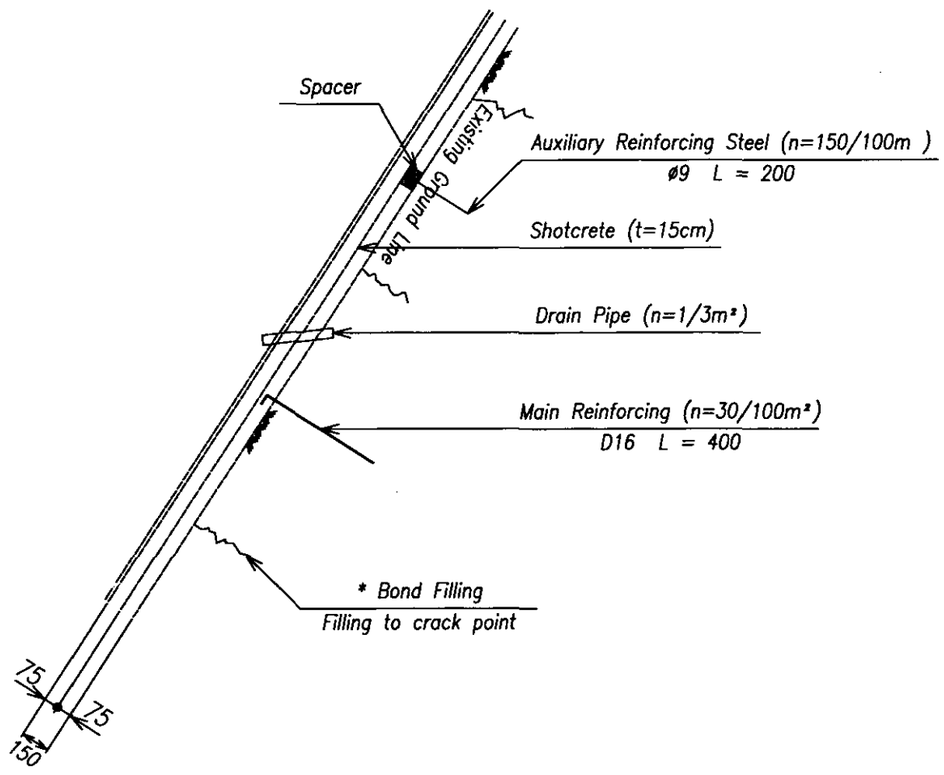
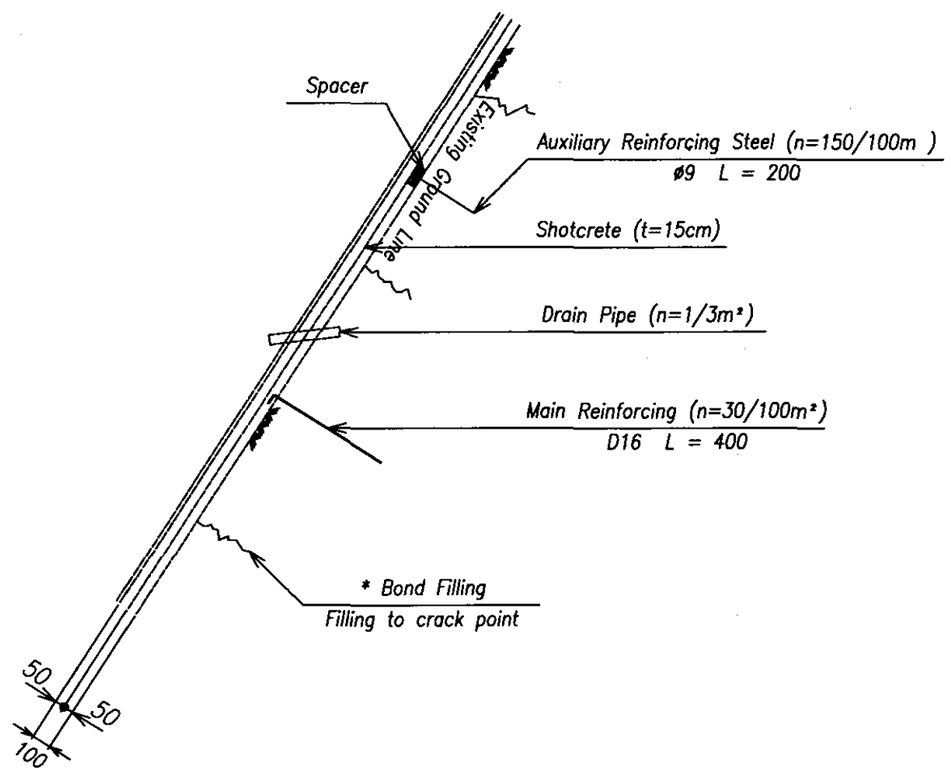
General Layout of Shotcrete

Shotcrete(Unevenness Point)



Shotcrete(Flatness Point)



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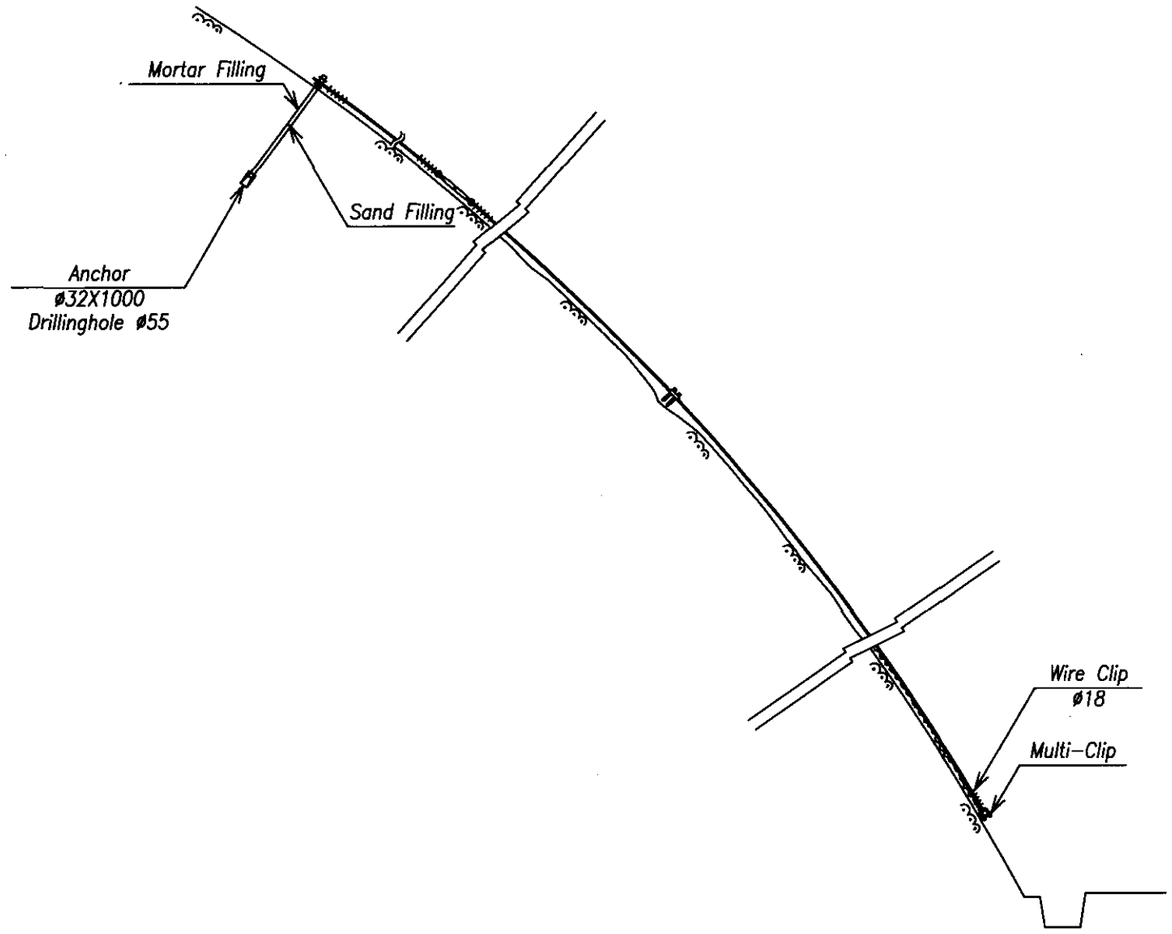
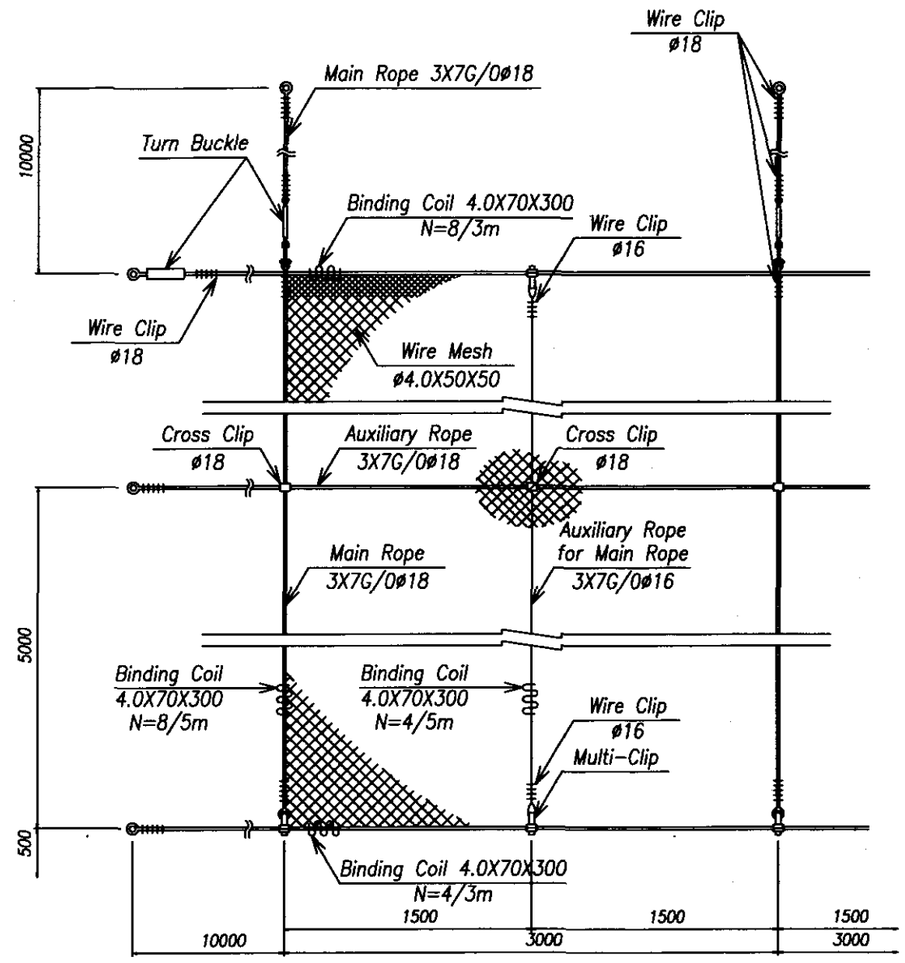
General Layout of Prevention Net





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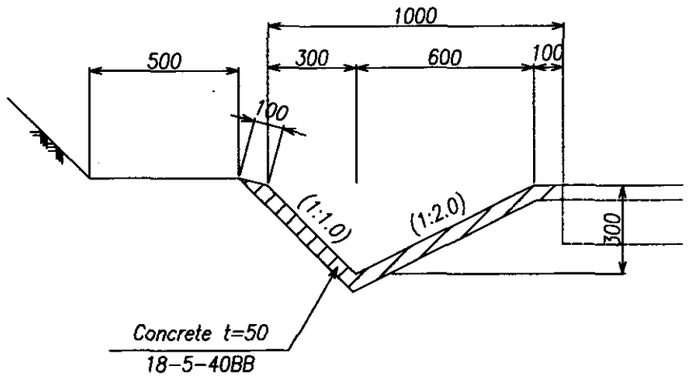
General Layout of Drainage Work (1/2)

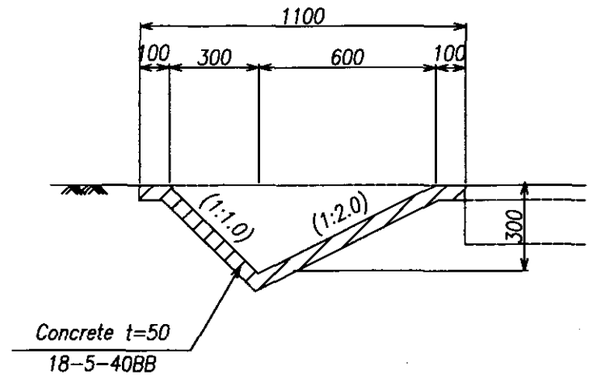
Toe Ditch(A)

S=1:20
*For Cut



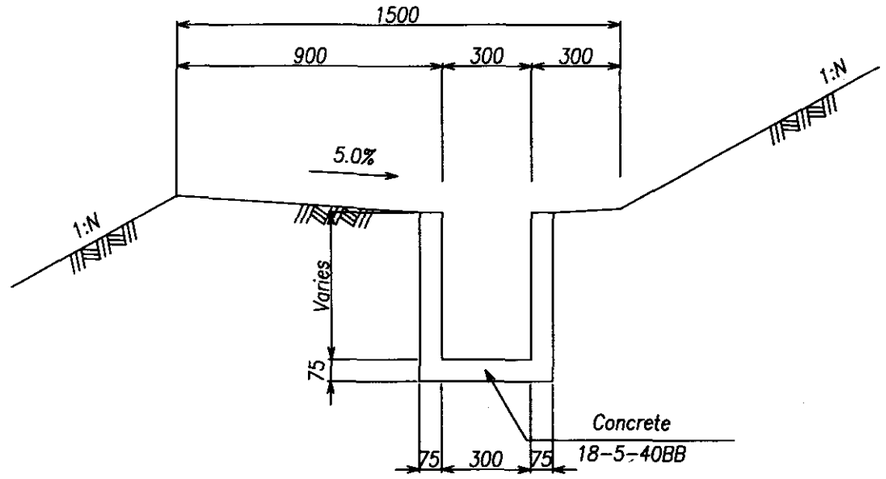
Toe Ditch(B)

S=1:20
*For Embankment



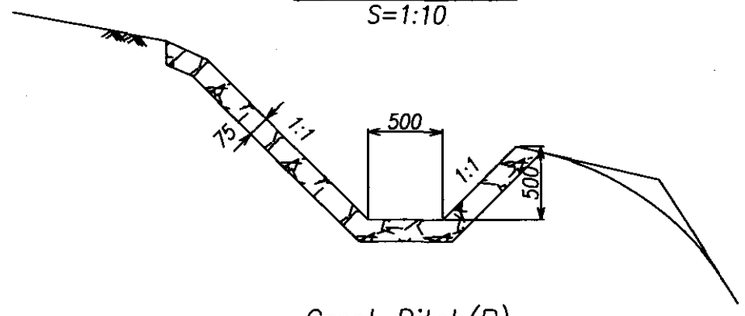
Drainage Dicth on Berm(A)

S=1:20
*For Cut of Soft Rock



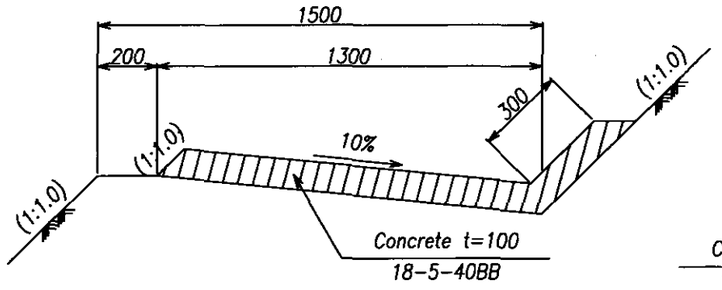
Crest Ditch(A)

S=1:10



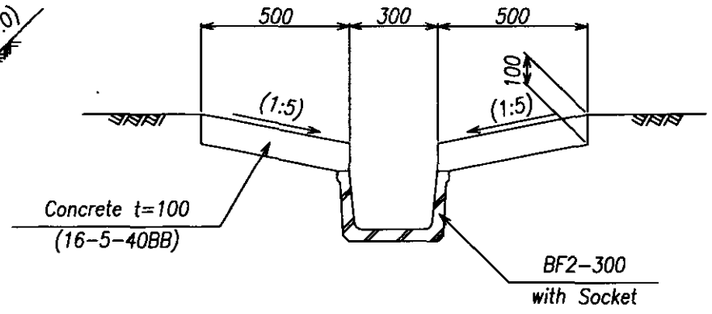
Drainage Ditch on Berm(B)

S=1:20
*For Cut for Hard Rock



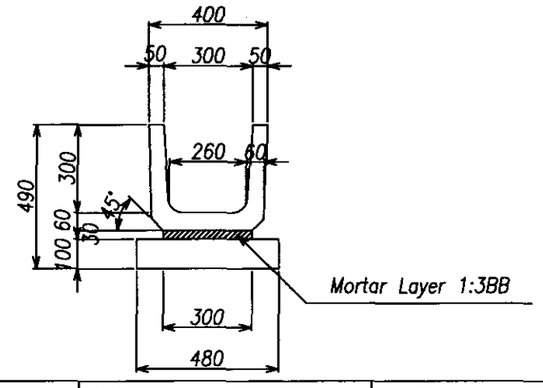
Vertical Ditch

S=1:20



Crest Ditch(B)

S=1:20



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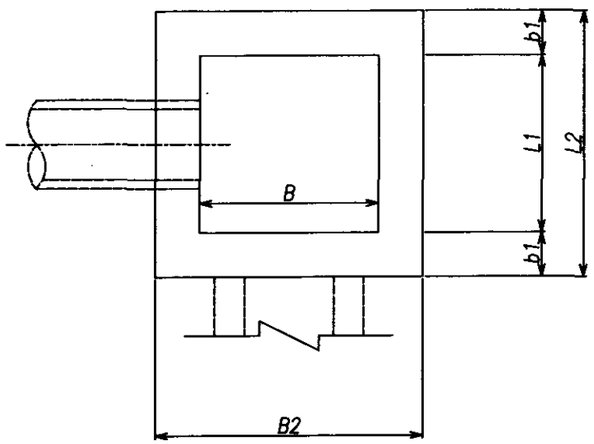
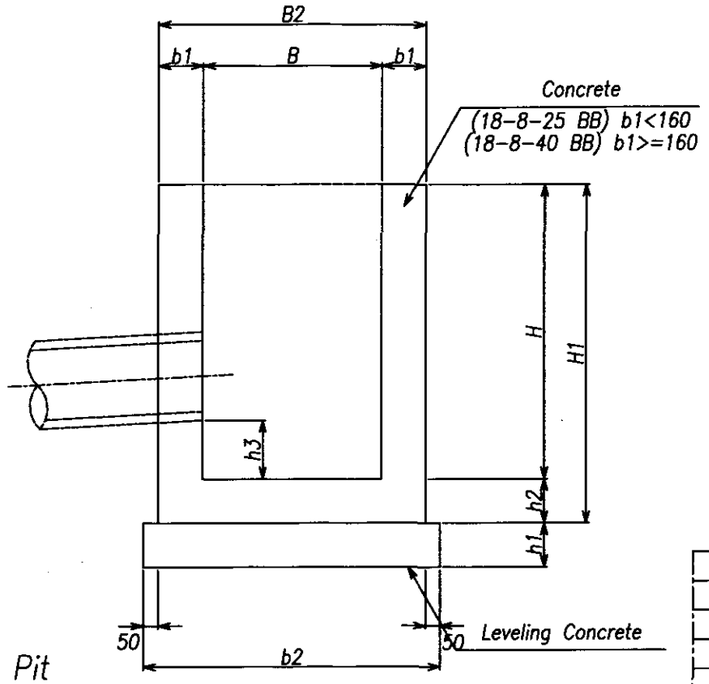
General Layout of Drainage Work (2/2)

Catch Pit

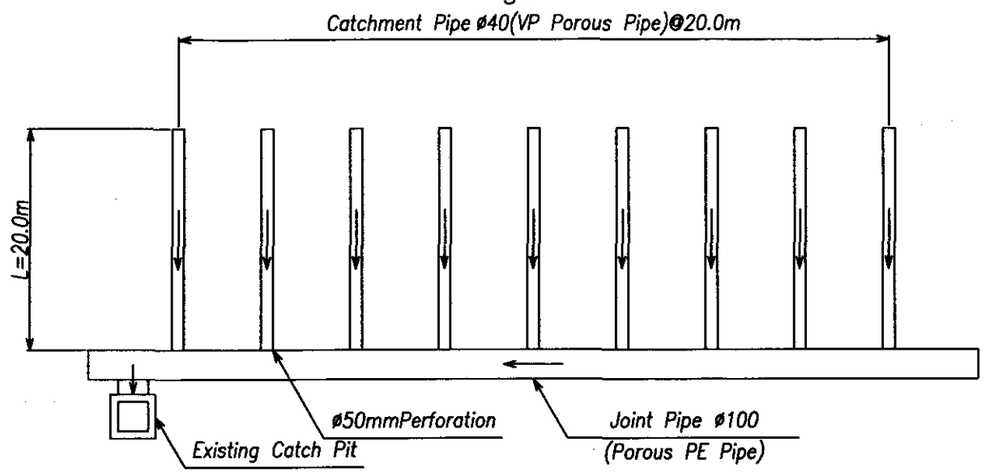
S=1:20





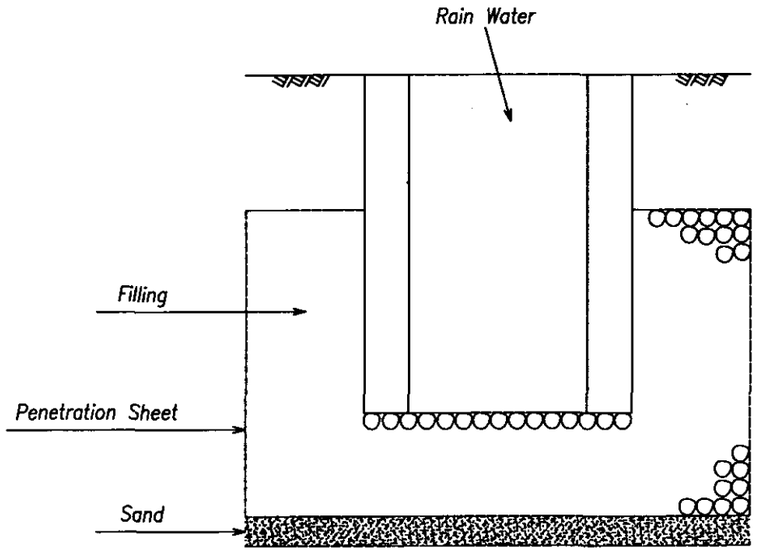
Horizontal Drain Hole

S= –

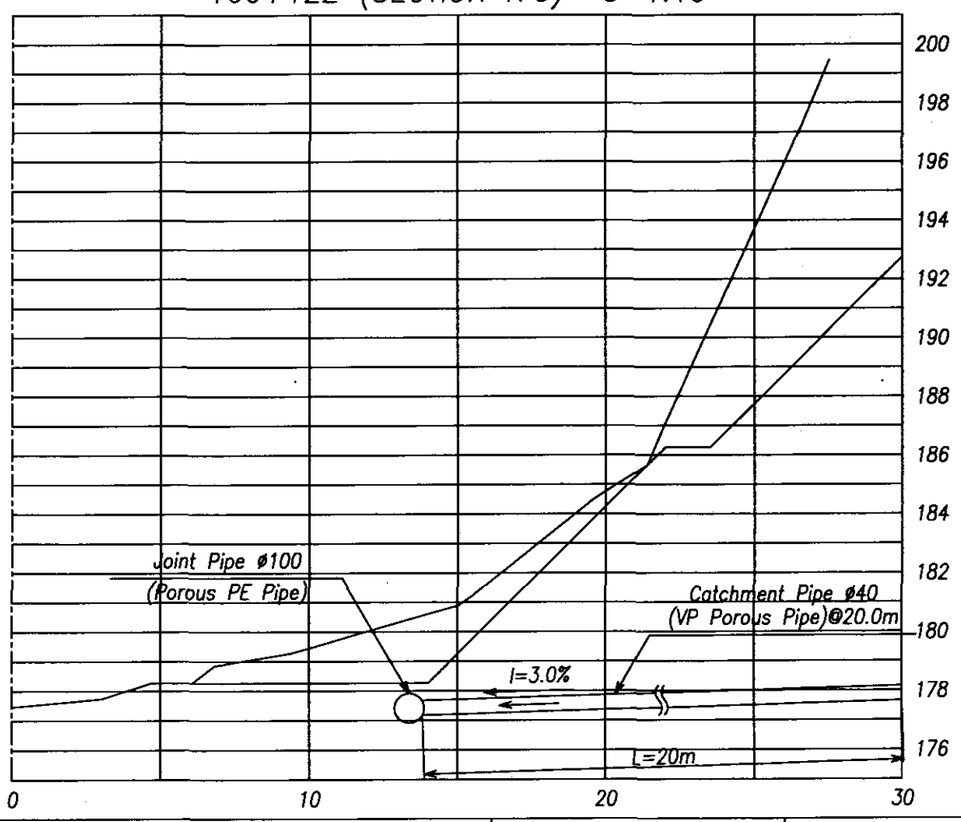


Penetration Catch Pit

S=1:20



166+122 (SECTION N°3) S=1:10



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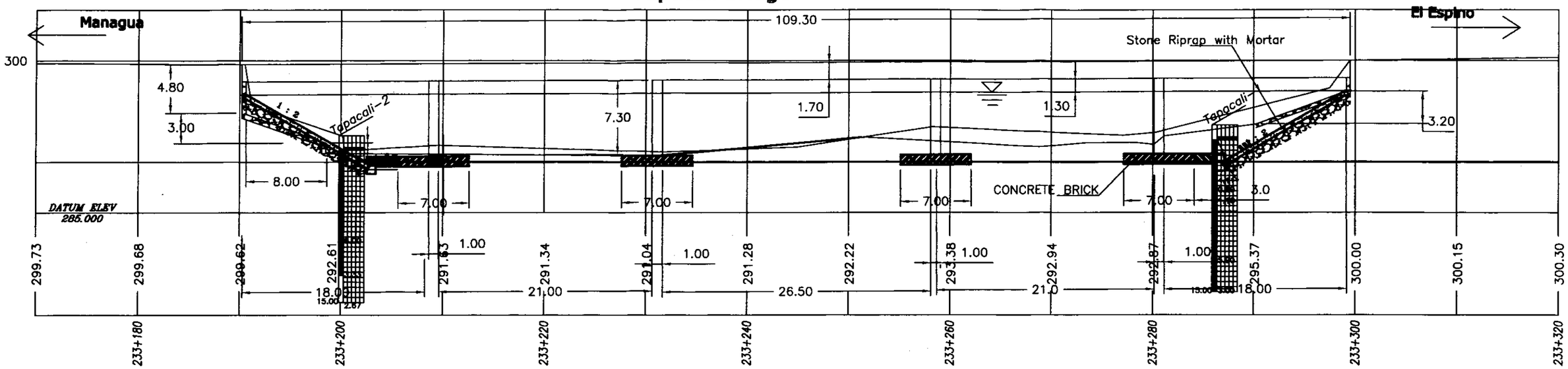
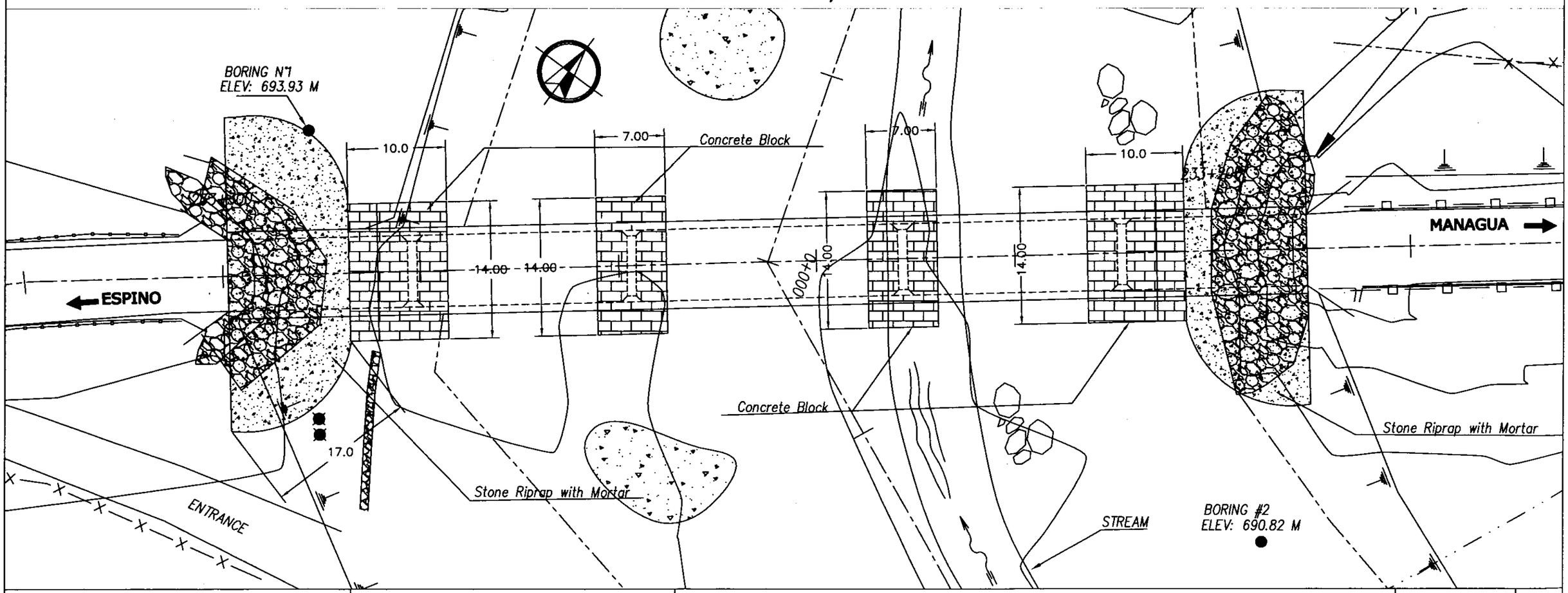
Tapacali bridge



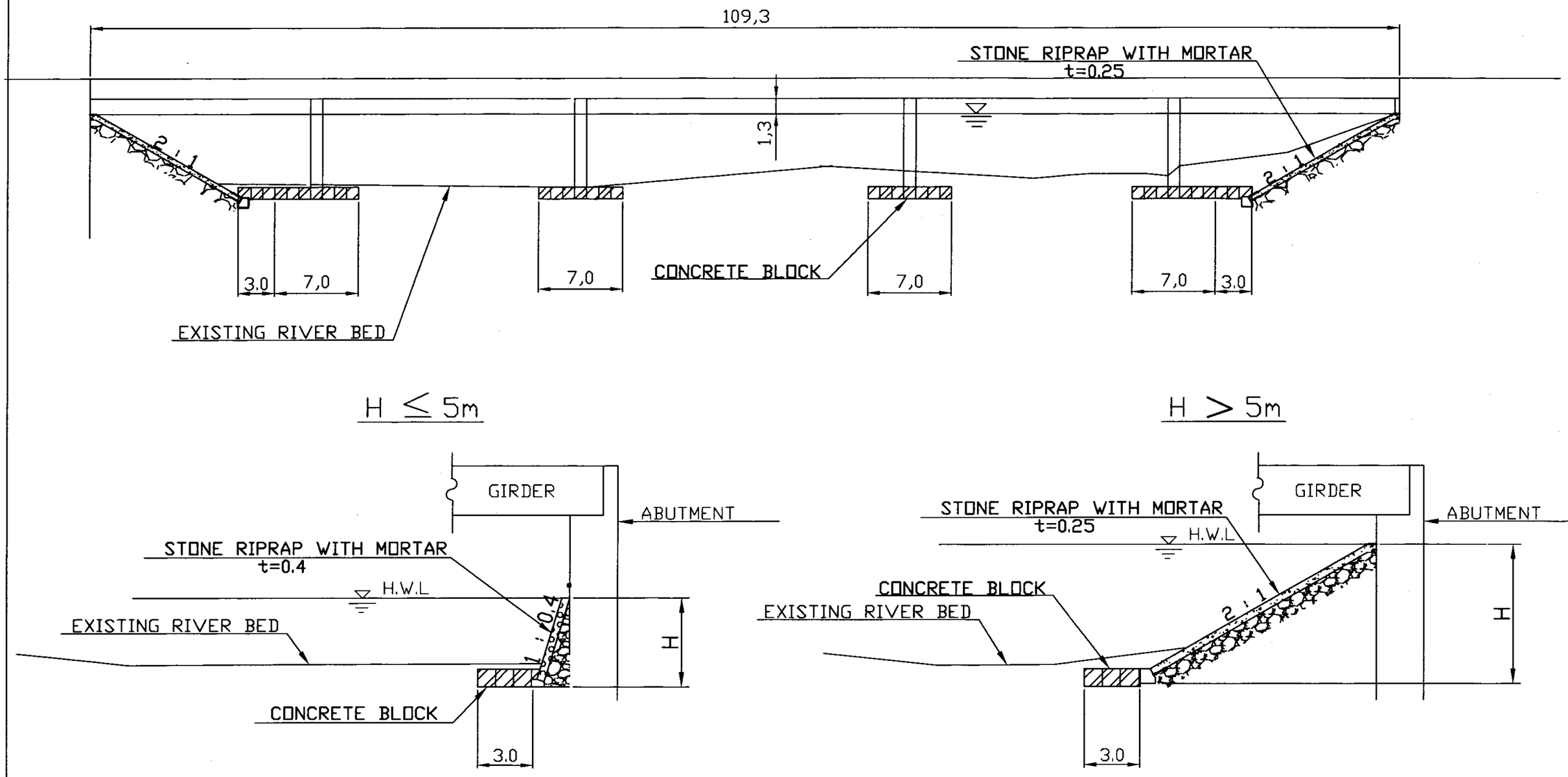
CROSS SECTION ALONG CENTER LINE OF HIGHWAY

SCALE HOR: 1:400 ; VER: 1:400



ORIENTAL CONSULTANTS CO., LTD. JAPAN ENGINEERING CONSULTANTS CO., LTD.	CONTENIDO: LEVANTAMIENTO TOPOGRAFICO UBICACION: KM 233+245 CARRETERA MANAGUA - EL ESPINO SITIO: PUENTE TAPACALI (NIC 1)	PROYECTO: STUDY OF VULNERABILITY REDUCTION FOR MAJOR ROADS IN THE REPUBLIC OF NICARAGUA	CALCULO : Ch. Rivera. C. LEVANTO : Mauricio Méndez RESPONSABLE TECNICO :	DIBUJO: Ch. Rivera. C. FECHA: ESCALA 1 : 200	HOJA N° 13 / 16

General Layout of Protection for Scouring



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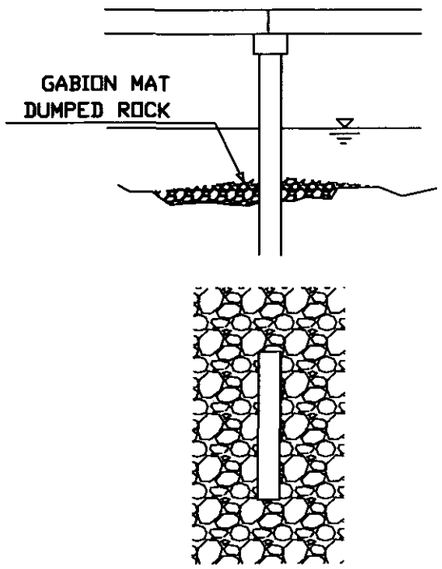
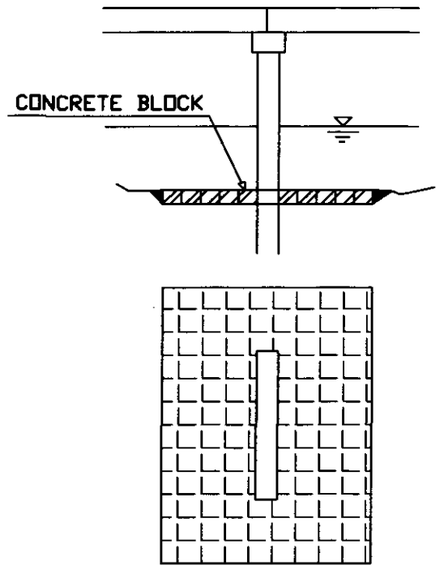
General Layout of Protection for Scouring Around Pier

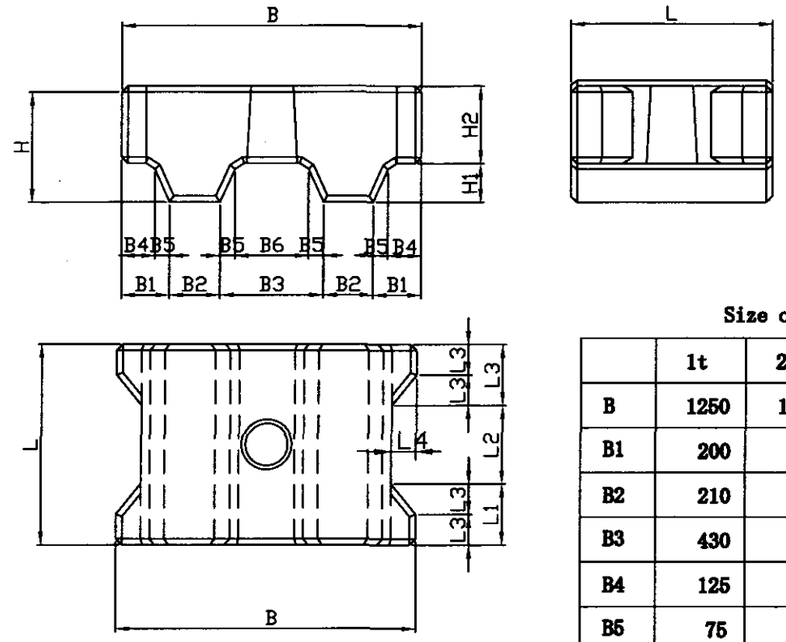
Flow Velocity ≤ 2 m/sec



Flow Velocity ≤ 2 m/sec



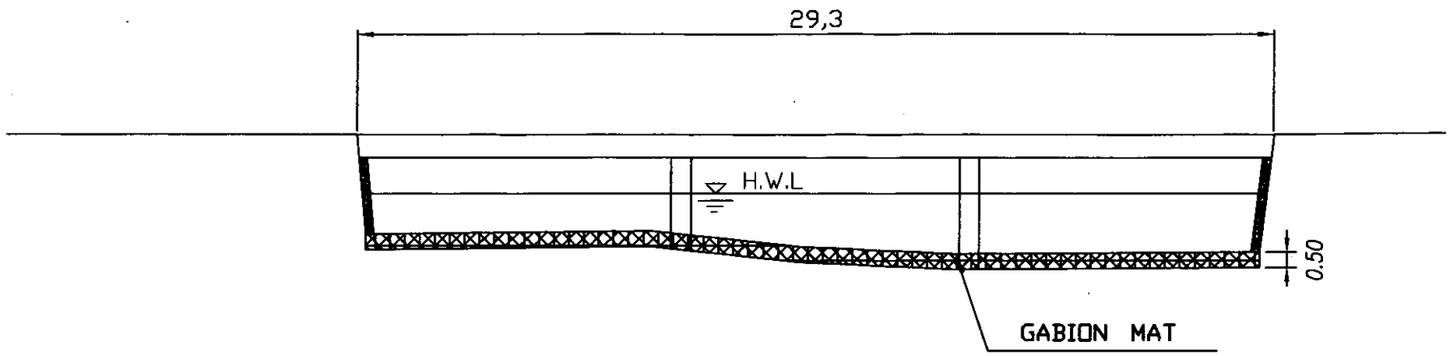
Detail of Concrete Block

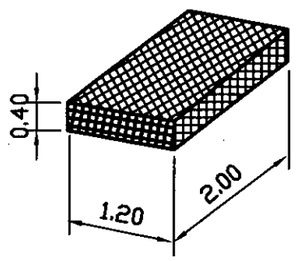


Size of Conncurete Block

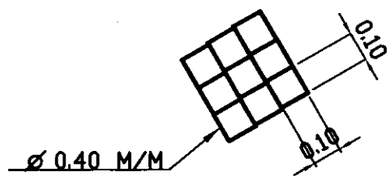
	1t	2 t	3 t	4 t	6 t
B	1250	1550	1800	1950	2250
B1	200	250	290	315	360
B2	210	260	300	325	380
B3	430	530	620	670	770
B4	125	160	180	200	235
B5	75	90	110	115	125
B6	280	350	400	440	520
L	850	1050	1210	1330	1500
L1	260	320	370	410	460
L2	330	410	470	510	580
L3	130	160	185	205	230
L4	100	130	145	160	190
H	520	650	750	820	940
H1	160	200	240	260	300
H2	360	450	510	560	640

General Layout of Protection for Scouring by Gabion Mat





GABION MAT



DETAIL OF WIRE MESH

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JICA