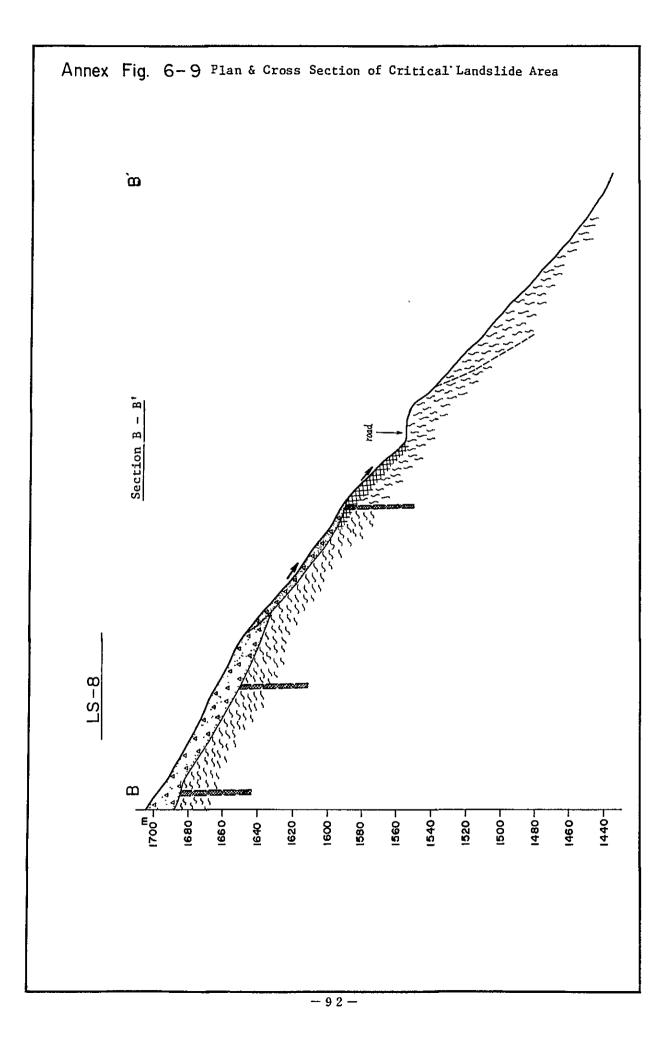
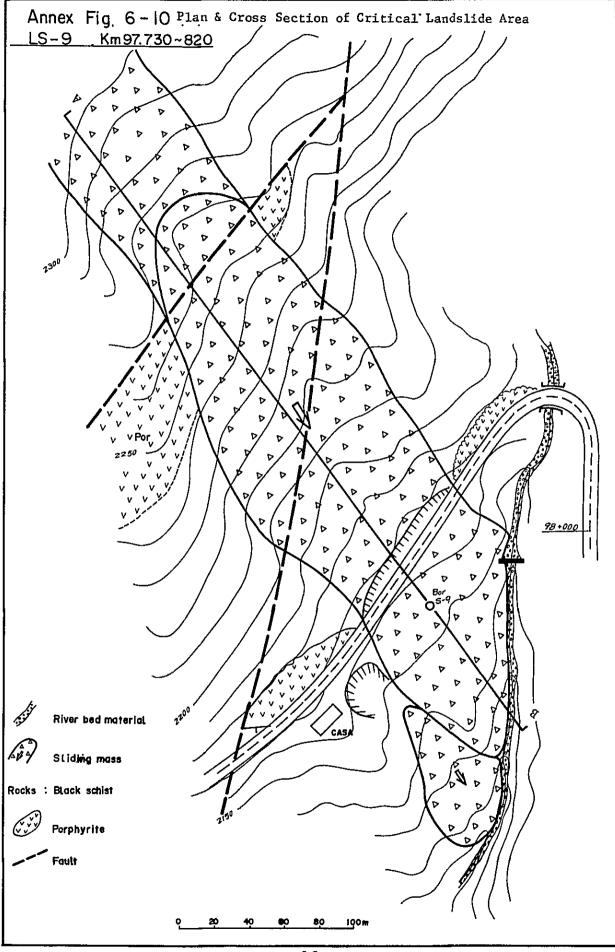
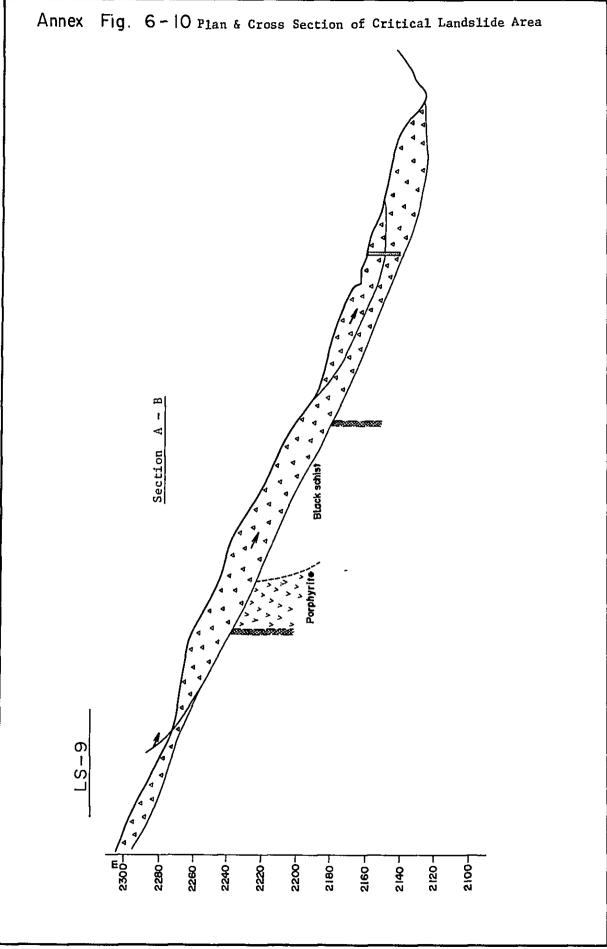


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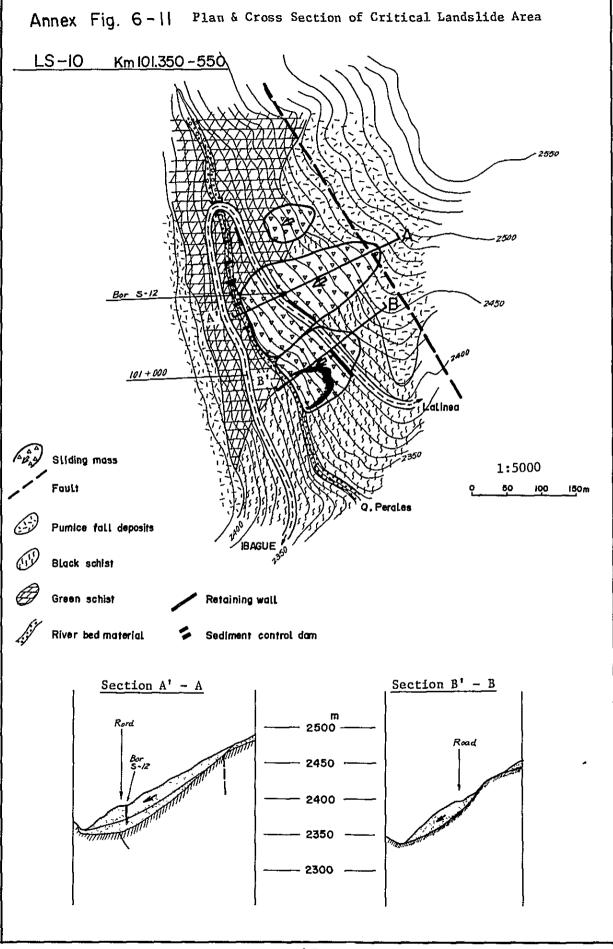




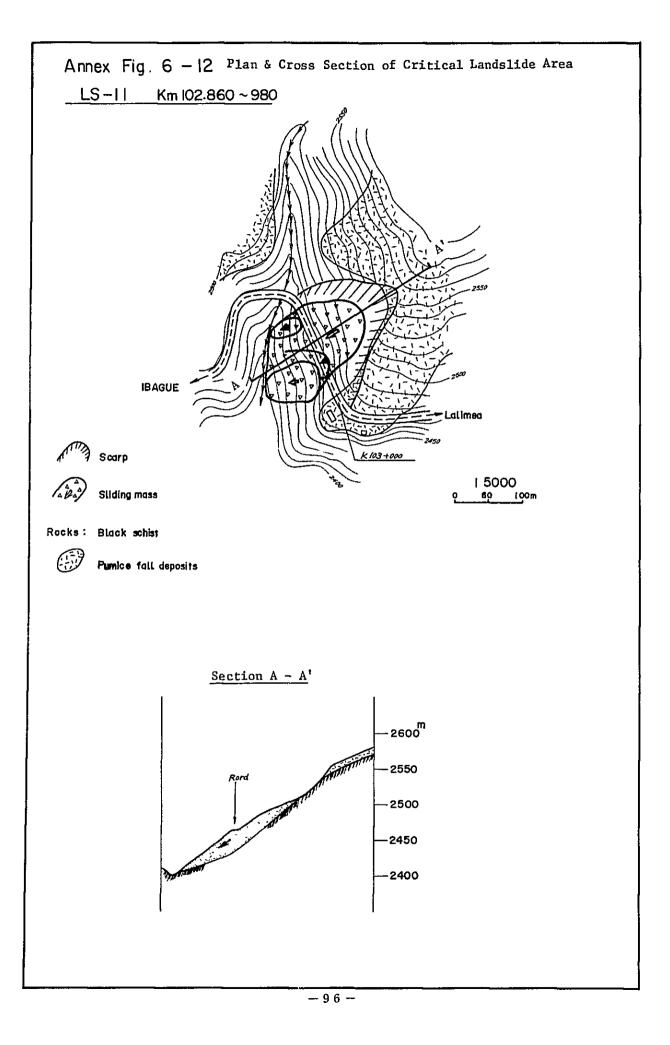
-93-

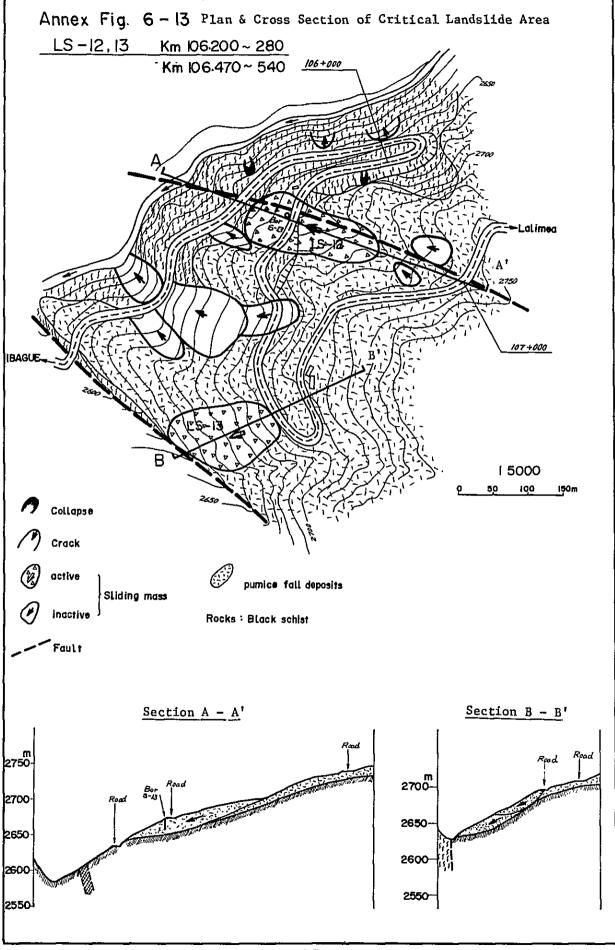


-94-

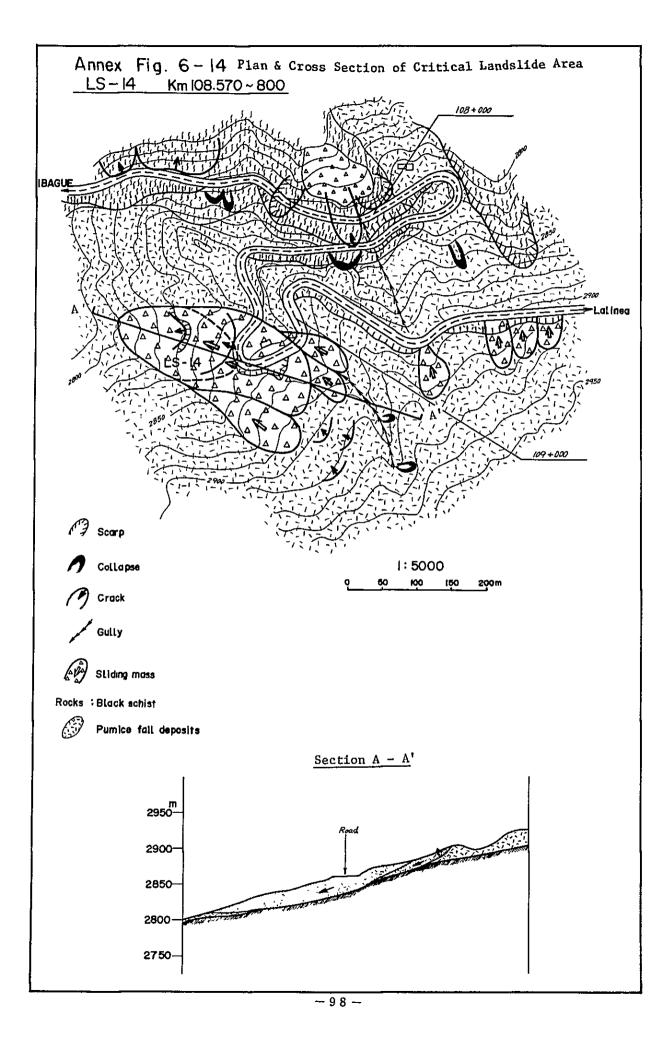


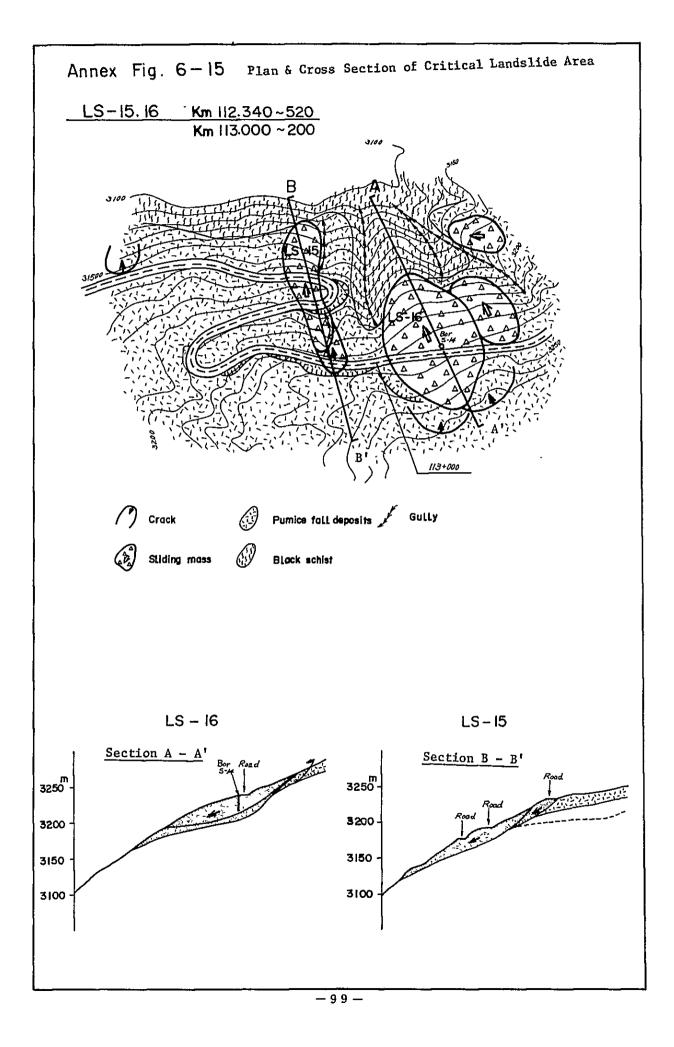
-95-

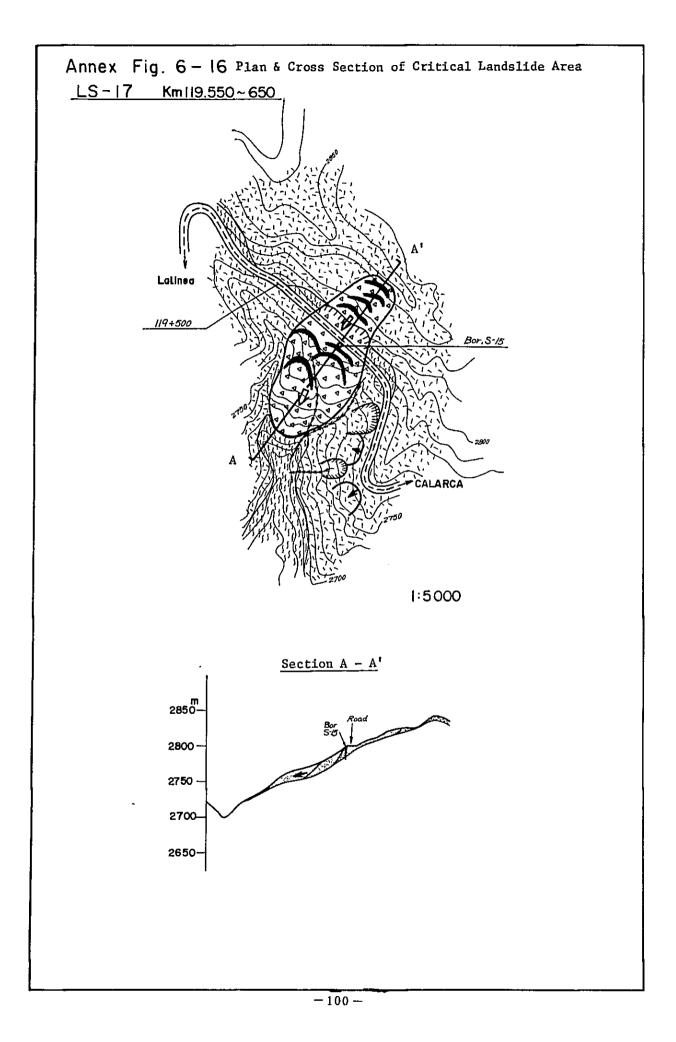


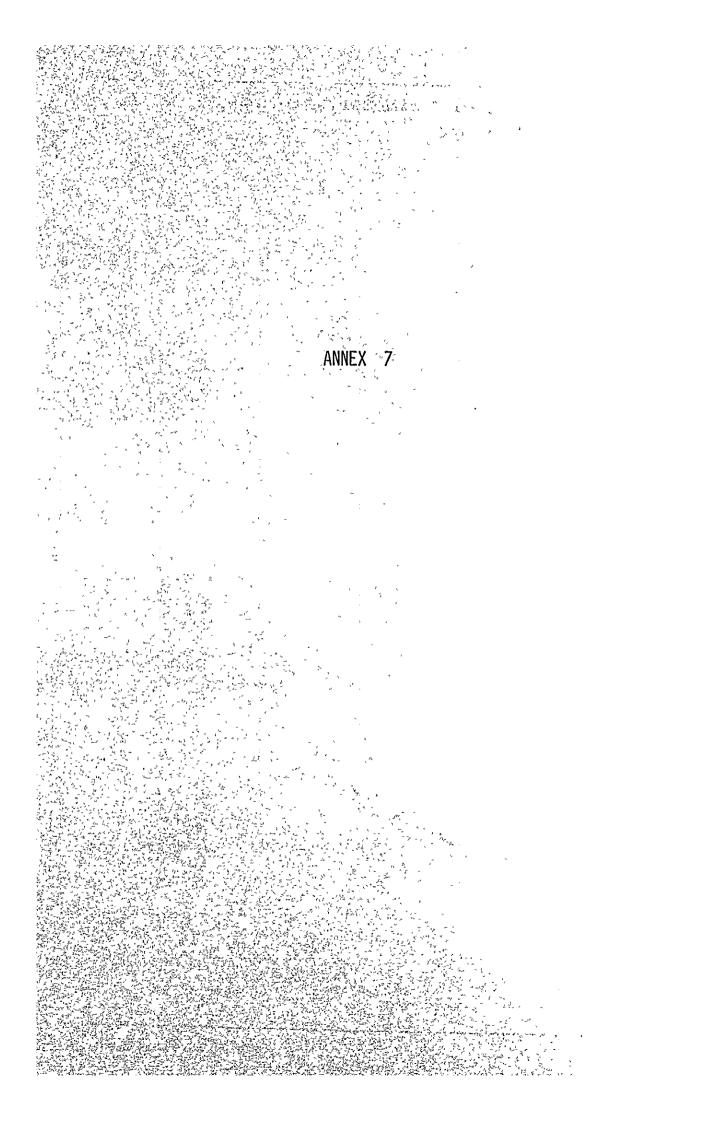


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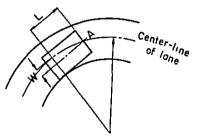


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Annex 7-1. <u>Widening of Road to Facilitate Passing of Large</u> Vehicles at Curves

The width of the roadway is generally determined by adding an allowance to the maximum width of a vehicle (2.5 m). As illustrated in Annex Fig. 7-1, the front wheels and rear wheels of a vehicle travel different paths when going through a curve. Thus, the vehicle requires a wider roadway when turning a curve than when running straight.

When a vehicle passes along a curve, the widening is determined so as to provide the vehicle with the same margin on each side as when travelling straight based on assumption that the front center (point A) of the vehicle is always on the center line of the lane.



Annex Fig.7-1 Widening for targe-size Vehicles

7-1-1. Widening for Large-Size Truck

The widening for a large-size truck is calculated as follows.

- R: Radius of curvature of the lane center line(turning radius of the front edge center of vehicle)
- W: Widening
- L: Distance from the front edge of vehicle to the rear wheel axle

From Annex Fig. 7-1, the following formula is established.

$$W = R - \sqrt{R^2 - L^2}$$

$$L^2 = 2RW - W^2$$

$$W^2 \text{ is negligibly small compared with 2RW.}$$
Hence, the widening (W) is determined as follows.
$$W = L^2/2R$$

7-1-2. Widening for Semi-Trailers

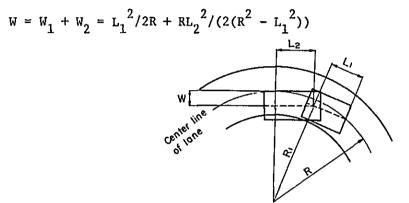
From Annex Fig. 7-2 the widening necessary for the tractor is given by the following formula.

$$W_1 = L_1^2/2R$$

The widening required for the trailer alone is given by the following formula.

$$W_2 = L_2^2/2R_1, R_1 = R - W_1$$

Thus, the widening required is given by the following formula.



Annex Fig. 7-2 Widening for Semi-trailer

Where, R: radius of curvature of the lane center line

- W: widening
- W₁: widening for tractor
- W₂: widening for trailer
- L1: distance from the front of the tractor to the second axle
- L2: distance from the second axle of the tractor to the rear axle of trailer

7-1-3. Specification for Vehicle Used for Determination of Widening

1. Vehicle Specifications

Typical dimensions of vehicles are employed as follows.

Semi-trailer truck : $L_1 = 5.3 \text{ m}$, $L_2 = 9.0 \text{ m}$ Large truck : $L_1 = 8.0 \text{ m}$

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2. Widening

By arrangements with the MOPT, it was decided to use standards as shown in Annex Table 7-1.

7-1-4. Widening

The conditions of passage for large vehicles at a curve are classified into five cases for which the widenings required are determined as shown in Annex Fig. 7-3.

- (1) The passing status of large vehicles along the curves in the existing Ibague-Calarca section was studied using the following assumptions.
 - 1) Running conditions
 - a. The large vehicles pass each other while running on the paved shoulders.
 - b. At the time of passing, one vehicle is permitted to cross into the other's lane.
 - 2) Road conditions

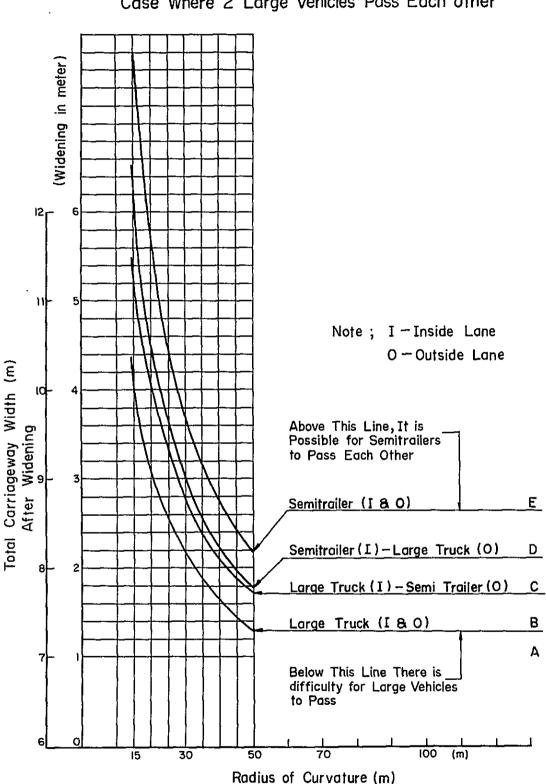
The width of the straight road section is 6 m, of which 5.0 (2 x 2.50 m) is accounted for by the vehicle width, 0.5 m by the passing allowance, and 0.5 m (2 x 0.25 m) by lateral clearance.

3) Passing status of large vehicles on the existing road

The passing status of the large vehicles running along the curves in the existing road is clarified according to Annex Fig. 7-3, and Annex Table 7-3.

(2) Widening Required for Critical Curve Improvement

By simplifying Annex Fig.7-3, the widening for passing service level D is determined as described in Annex Table 7-2.



Annex Fig. 7-3 Widening and Carriageway width for Case Where 2 Large Vehicles Pass Each other

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Annex Table - 7.1 Present Status of Passing Condition and Summary of Improvement Plan

Sub- solution Radius ha Radius (14) Radius (14)		STATION 3)	т х 23	8 1 1 1	, 58 גר גר	с с С	Critical C	urve lm	Critical Curve lmprovement Plan (P1)	lan (Pl)	Minimum Sc	ale Impro	Minimum Scale Improvement Plan (p2)	n (P2)
(1.2) $21,27^{11}$ $9,4^{11}$ B $Good$ $22,17^{11}$ $10,5^{11}$ D $Good$ 23 $11,30^{11}$ B C B C B D C B D C D	Sub- Section	Ka	Radius	Paved Width	Passing 1 Condition	Sight Distance ²)	Radius		Passing Condition	Sight Distance	Radius		Passing Condition	
$(1,1,1)$ $39,22$ 10.7 \dot{v} Good $13,72$ 12.7 v $23,04$ $11,720$ 12.5 D $3,0^m$ 23 1130 E 11300 E 11300	10	61.29	22 ⁺ 27 ^m	е ^{4.} 6	# <u>.</u>	Good	22,27 ^m	10.5 ^m	Q	Good	25 ^m	11 50 ^{tt}		Good
63.04 $17,70$ 10.9 C Md $17,70$ $12,5$ 1 25 1150 Z 63.13 $13,13$ 11.5 C $600d$ $13,13$ $12,5$ D 25 1150 Z 65 32 $25,15,13$ $9,4$ A Bad $25,15,13$ $12,5$ D 2.6^{m} 25 1130 Z 65 88 $9,8$ C $600d$ 24 $10,5$ D $0,61$ 25 1130 Z 67 23 $10,5$ D $600d$ 24 $10,5$ D $11,70$ 25 1130 Z 67 $200d$ 23 $10,5$ D $600d$ 25 1130 Z 67 $200d$ $21,5$ $10,5$ D $600d$ 25 1130 Z 67 $12,2$ $10,5$ D $600d$ 24 $10,5$ D	01	61.71	39,22	10.7	* <u>n</u>	Good			9	Good	35	11 00	ы	Good
(3.13) $18,19$ 11.5 C Good $18,19$ 11.5 C Good $13,13$ 12.5 D 2.6^{11} 25 11.30 E $(5 3)9$ $25,15,19$ 9.4 A $3ad$ $25,15,13$ 2.4 A $3ad$ $25,15,13$ 27.6 1130 E $(5 3)8$ 22 9.8 C Good 24 10.5 D 0.3^{11} 22 11300 E $(5 1)22$ 24 9.8 C Good 24 10.5 D 0.00^{11} 22 11300 E $(5 7)22$ 24 9.9 Bad 29 10.5 D 0.00^{11} 29 11500 E $(5 7)22$ 210.5 D $Good$ 22 10.5 D 0.00^{11} 29 11500 E $(5 7)22$ 29 19.5 D 0.00^{11} 20 1150 <t< td=""><td>02</td><td>63.04</td><td>17,20</td><td>10.9</td><td>U</td><td>Вяд</td><td>17,20</td><td>12.5</td><td>q</td><td>3.0^m</td><td>25</td><td></td><td>ш</td><td>Good</td></t<>	02	63.04	17,20	10.9	U	Вяд	17,20	12.5	q	3.0 ^m	25		ш	Good
65 $23, 15, 13$ 9.4 A Bad $23, 15, 13$ 12.4 24 24 2.6 2.6 2.6 2.6 2.7 212 211 20 2 66<01	02	63.13	18,19	11.5	υ	Good	18,19	12.5	٩	Good	25		Ľ۵	Good
65 88 32 8.8 D Bad D Bad 23 11 20 23 11 20 23 11 20 23 11 20 23 11 20 23 11 20 23 11 20 23 11 20 23 11 20 23 11 20 23 11 20 23 11 20 23 11 20 23 2	03	65 79	25,15,19	9.4	A	Bad	25,15,19	12.5	Q	2.8"	25		ы	Good
66 01 24 9.8 C Good 24 10.8 C Good 24 10.5 D Good 25 11.50 E 67 31 24 9.8 C Good 24 10.5 D Good 25 11.50 E 67 41 29 8.9 B Good 24 10.5 D Good 25 11.50 E 67 62 22 10.5 D Good 24 10.5 D Good 25 11.50 E 67 80 22 19.20 9 B Good 19.20 19.20 11.50 E 68 67 19 9 B Good 19.20 12.5 D Good 25 11.50 E 68 67 19 9 B Good 19.5 D Good 25 11.50 E 68 67 19 9 B 10.5 D	03	65 88	32	8.8	٩	Bad			P	0.3	32		ы	Good
67 24 9.8 C $60od$ 24 10.5 10 $60od$ 25 1150 E 67 12 29 8.9 Bad 29 9.75 0 11 29 1150 E 67 22 20.5 D $Good$ 24 10.5 D $Good$ 25 1150 E 67 22 10.5 D $Good$ 24 10.5 D $Good$ 25 1150 E 68 23 $19,20$ 9 B Bad 24 10.5 D $Good$ 25 1150 E 68 23 10 20 20^{2} 20^{2} 1150 E 68 118 102 B Bad 24 10.5 D $Good$ 25 1150 E 68 110 102	03	66 01	24	9.8	U	Good	24	10.5	D	Good	25		म	Good
67 11 29 8.9 B Bad 29 9.75 D 1.1 29 1150 B 67 24 8.9 B $Good$ 24 10.5 D $Good$ 25 1150 E 67 22 10.5 D $Good$ 24 10.5 D $Good$ 25 1150 E 68 19 9 B $Good$ 19 10.5 D $Good$ 25 1150 E 68 19 B B 24 10.5 D $Good$ 25 1150 E 68 10 24 10.5 D $Cood$ 25 1150 E 68 102 B Bad 24 105 D $Cood$ 25 1150 E 68 102 B Bad 24	03	67 32	24	9.8	U	Good	24	10.5	-	Good	25		ы	Good
67 24 8.9 B Good 25 11 50 25 11 50 E 11 50 25 11 50 E 11 50 E 11 50 E 11 50 11 50 11 50 E 11 50 11	03	67 41	29	8.9	8	Bad	29	9.75	P	а. г.	29		ы	Good
$67 \ 80$ 22 10.5 D $Good$ 12 D $Good$ 25 $11 \ 50$ E $68 \ 53$ $19,20$ $9 \ 9$ B $Good$ $19,20$ $12,5$ D $Good$ 25 $11 \ 50$ E $68 \ 67$ 19 $9 \ 2$ A $Good$ $19,20$ $19,2$ $10,2$ $11 \ 50$ E 1150 E $68 \ 72$ 24 $9 \ 4$ B Bad 24 $10,5$ D $Good$ 25 $11 \ 50$ E $68 \ 90$ 24 $9 \ 5$ B Bad 24 $10,5$ D $Good$ 25 $11 \ 50$ E $68 \ 90$ 24 $19 \ 5$ D $Good$ 25 $11 \ 50$ E $69 \ 64$ $19 \ 10.0$ B $Good$ $12 \ 5$ D $Good$ 25 $11 \ 50$ E 71.06 18 9.4 B	03	67 62	24	8.9	8	Good	24	10.5	-	Good	25		ы	Good
68 53 19,20 9 9 B Good 19,20 19,2 7 1 5	03	67 80	22	10.5	đ	Good			۵	Good	25		pi	Good
$68\ 67$ 19 $9\ 2$ Λ Good 12 D Good 25 $11\ 50$ Z $68\ 72$ 24 $9\ 4$ B Bad 24 10.5 D 2.0^m 25 $11\ 50$ E $68\ 80$ 18 $10\ 2$ B Bad 24 $10\ 5$ D $600d$ 25 $11\ 50$ E $68\ 90$ 24 $9\ 5$ B Bad 24 $10\ 5$ D $600d$ 25 $11\ 50$ E $69\ 54$ 19 10.0 B $Good$ 12.5 D $600d$ 25 $11\ 50$ E $70\ 28$ 19 0.0 B $Good$ 12.5 D $600d$ 25 $11\ 50$ E 71.06 18 9.4 B $600d$ 12.5 D $600d$ 25 $11\ 50$ E	70	68 53	19,20	2	Ħ	Good	19,20	12.5	6	Goad	25		ω	Good
68 24 94 B Bad 24 10.5 D 2.0^{m} 25 1150 E 68 10 10 B $Good$ 18 10.5 B $Good$ 18 125 D $Good$ 25 1150 E 68 90 24 95 B Bad 24 105 D $Good$ 25 1150 E 69 40 19 11.2 C $Good$ 19 12.5 D $Good$ 25 1150 E 70 28 19 0.0 B $Good$ 19 10.50 E 10.50 E 71.06 18 9.4 B $Good$ 12 D $Good$ 25 1150 E	70	68 67	ត		۷	Good	61	12.5	A	Good	25		E)	Cood
68 10 2 B Good 18 12 5 D Good 25 11 50 E 68 90 24 9 5 B Bad 24 10 2 11 50 11 50 E 69 36 19 10.0 B Good 19 12.5 D 600d 25 11<50	04	68 72	24		£	Bad	24	10.5	A	2.0	25		<u>ب</u>	Good
68 90 24 9 5 B Bad 24 10 5 D 2.0 ^m 25 11 50 E 69 36 19 10.0 B Good 19 12.5 D Good 25 11 50 E 69 64 19 11.2 C Good 19 12.5 D Good 40 10.50 E 70 28 19 10.0 B Good 19 12.5 D Good 25 11 50 E 71.06 18 9.4 B Good 18 12.5 D Good 25 11 50 E	04	68 80	18		8	Good	18		۵	Good	25		ш	Good
69 36 19 10.0 B Good 19 12.5 D Good 25 1150 E 69 64 19 11.2 C Good 19 12.5 D Good 40 10.50 E 70 28 19 10.0 B Good 19 12.5 D Good 25 1150 E 70 28 19 10.0 B Good 19 12.5 D Good 25 1150 E 71.06 18 9.4 B Good 18 12.5 E Good 25 1150 E	04	68 90	24		£	Bad	24		a	2.0"	25		23	Good
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70 28 19 10.0 B Good 19 12.5 D Good 25 11 50 E 71.06 18 9.4 B Good 18 12.5 E Good 25 11 50 E	50	69 64	19	11.2	υ	Good	61	12.5	A	Good	40	10.50	р	Good
71.06 18 9.4 B Good 18 12.5 E Good 25 11.50 E	90	70 28	19	10.01	m	Good	61	12.5	٩	Good	25		ы	Good
	90	71.06	18	9.4	д а	Good	18	12.5	ы ы	Good	25		141	Good

Note: 1) Refer to Table 9-4 in Chapter 9. 2) Good - more than 30 meters. Bad - less than 30 meters. 3) STATION is relative to predetermined Wm post for construction.

Annex Table - 7.1 (Cont'd.) Present Status of Passing Condition and Summary of Improvement Plan

(F2)	Sight Distance	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
1	Passing Condition D	<u>н</u> а	<u>س</u>	e4	<u>ы</u>	ы	<u>ы</u>	ы	<u>ы</u>	ы		3	ы	ы	р <u>а</u>		ы	<u>ш</u>	<u>ы</u>	M	м	81	21	ы
ile Improve	Paved I Width Co	11 50 ^m	11 00	11 50	11 00	11 50	00 17	11.00	11 50	11 50	11 50	11 50	11 50	11 50	11 50	11 50	11 50	11 50	11 50	11 50	11 50	11 50	11 50	11 50
Minimum Scale Improvement Flan	Redius	25 ^m	34	25	35	25	35	35	26	25	25	25	25	25	25	25	25	25	25	25	25	25	25	28
 	Sight Distance	Good	1.0 ^m	Good	1.6 ^m	1.0 ^m	Good	Good	0.7"	Good	0.8"	Good	Good	Good	Good	1.6ª	1.2 ^m	Good	1.8 ^m	Good	1.6 ^m	Good	Good	1.1 ^m
ovement Pl	Passing Condition	a		9	D	۵	A	Ð	A	A	A	Q	D	Ð	A	þ	8	Ð	٩	Ð	â	۵	A	Ð
irve Impre	Paved Width	E		12.50		10.50	10.50		9.75		_	14.00	12.50					12.50			10.50	10.50		
Critical Curve Improvement Plan (Pl)	Radius	Ħ		27,19		20,29	24		26			19,14	29,19,26					19			22	21		
	Sight Distance	Good	þađ	Goođ	Bad	Bađ	Good	Good	Bad	Good	Bad	Good	Good	Good	Cood	Bad	Bad	Good	Bad	Good	Bađ	Good	Good	Bad
8 C 8	Passing Condition	-		U	9	U	<u>д</u>	Ð	m	<u>م</u>	q	<u>д</u>		•	A	ß	0	#1	9	۵	щ	£	P	0
s t n	Paved Width (10.7	0.6	10.4	10.5	10.2	8.7	10.5	9.1	20.5	20.5	10.5	10.3	10.5	10.5	10.5	10.5	E.01	11.2	10.9	9.7	9.7	10.5	9.9
E x 1	Radius	29 , 24 m	₽ ₽E	27,19	36,24,37	20,29	24	24	26	50	20,25	19,14	29,19,26	24,23,31	50	22	24	19	21	21	22	21	29,20	28
STATION	<u>ا</u>	74 24	74 89	75 50	75 97	77 13	78 21	78 25	78 97	79.04	19 61	81 37	83 11	83 60	83 83	84 44	84.56	86 35	86.43	86 52	94.30	95.38	96.19	96.46
	Section	80	98	60	0f	10	10	10	10	10	10	11	n	5	13	EI	£	13	13	Ē	14	14	14	14

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1	STATION	Ext	8 C L n	8 5 1 8 1 1	t u a	Critical Curve Improvement Plan	ve Improv	rement Plan	(F1)	Hintman		Scale Improvement Plan (P2)	lan (P2)
Section	đ	Redius	Paved W1dth	Passing Condition	Sight Distance	Radius	Pavad Width	Condition	Distance	Redlus	Pased -	Condition	Sight Distance
14	96 52	23 ^m	10.5 ^m	•	Bad	Ħ	E	6	2.0 ¹¹¹	25 m	11 50 ^m	2	Good
57	97 88	26,24	10.8	£	Good			٩	Good	25	11 50	ы	Good
16	100 0 <u>9</u>	27	10.L	A	Bad			6	1.0"	27	11 50	ш —	Good
17	101.23	51	9.8	V	Good	ង	12.50	٩	Good	Impos	Impossible		
17	102.01	25	8.9	£1	Good	25	9.75	a	Good	25	11 50	<u>ы</u>	Good
17	102.08	28	9.7	<u>р</u>	Bad			a	0.5	28	11 50	ы	Good
	103.55	34	8.8	P.	Bad			a	0.5	34	11 00		Cood
18	104.94	21	9.5	m	Bad	21	10.50	9	1.5"	25	11 50	ស ស	Good
18	105.27	21	11.0	<u>п</u>	Good			a	Good	25	11.50	<u>ଘ</u>	Goad
18	105.96	14	14.1	<u> </u>	Bad			9	3.6 ^B	25	11 50	ม	Good
18	106.57	20,16	11.5	с 	Good	20,16	12.50	A	Good	25	11.50	21	Cood
18	107.06	26	10.01	P	Bađ			9	1.0 ^m	26	11.50	8	Good
18	108.10	22	9.2	<u>م</u>	Bađ	22	10.50	•	2.6 ^m	25	11.50	р а	Good
18	108.64	20	11.0	A	Bad			Ð	1.5	25	11.50	ស	Good
18	110.20	29	8.5		Bad	29	9.75	A	0.6 ^m	29	11.50	81	Good
18	110.47	25	8.7	#	Good	25	9.75	P	Good	25	11.50	£۵	Good
18	110.77	31	9.2	۷	Bad	91 91	12.50	P	0.5	55	11.50	рЦ	Good
18	110.86	22,13,23	10.5	<	Good	22,13,23	14.00	A	Good	25	11.50	e1	Good
18	111.47	24	10.5	۵	Good			A	Good	25	11.50	ស	Cood
18	111.66	16	12.5		Good			Ą	Good	25	11.50	81	Good
18	112.40	20	10.5	9	Good			A	Good	25	11.50	<u>ы</u>	Good
18	112.69	23	10.5	9	Good			Q	Good	25	11.50	<u>я</u>	Good
18	115.63	20	8.6	V	Good	20	0.6	a	Good	25	11.50	21	Good
18	116.62	ม	12.5	9	Bad			a	0.8	25	11.50	બ	Good
18	116.98		9.6	•	1005	ţ	;	<i>t</i>		1	_	,	

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	STATION	8 × 1	8 t i n	g Sta	C 12 8	Critical Cu	urve Impro	Curve Improvement Plan	in (P1)	Minimum :	Scale Improvement Flan	OVEDERL F1	(* *) III
Sub- Section	kn	Radius	Paved Width	Passing Condition	Sight Distance	Radius	Paved Width	Fassing Condition	Sight Distance	Radius	Paved W1dth	Passing Condition	Sight Distance
18	117.15	20 m	10.5	٩	Good	Ę	ß	A	Good	25 m	11.50	р	Good
18	117.37	18	10.5	đ	Good	18	12.5	A	Good	25	11.50	ы	Good
18	117.60	23	10.5	D	Good			<u>م</u>	Good	25	11.50	ы	Good
18	117.86	า	12.5	Q	Bad			A	0.6 ^H	25	11.50	ш	Good
18	118.71	۲ ۲	12.5	P	Good			G	Good	25	11.50	<u>ш</u>	Good
18	118.74	ង	12.5	A	Bad			A	3.1 ^m	25	11.50	ង	Good
18	118.80	20	10.5	a	Good			•	Good	25	11.50	ы	Good
18	119.14	20	10.5	n	Good			<u>م</u>	Good	25	11.50	ш	Good
18	£E.911	20	11.8	4	, Bad			٥	0.5"	52	11.50	ฒ,	Good
18	88.011	ส	10.5	F A	, Bad			A	2.0	25	11.50	ы	Goođ
18	120.13	20	10.5	e	Good			a	Good	25	11.50	ы	Gapd
18	120.46	20	10.5	•	Bad			Ð	0.6	25	11.50	ы	Good
18	120.75	ង	12.5	P	Goođ			A	Good	25	11.50	5 2	Good
18	120.95	21 21	12.5	a	Bad			<u> </u>	0.9 ^m	25	11.50	8	Good
18	122.70	ม	12.5	a	Bad			A	5.0 th	25	11.50	ы	Good
18	123.85	ت	12.5	<u>n</u>	Bad			ρ	1.5 ^m	25	11.50	ы	Poop
18	124.06	13	12.0	_	Bađ	13	14.0	<u>р</u>	_ 3.4 ^н	25	11.50	ы	Good
18	124.37	รา	12.5	а 	Good			a	Good	25	11.50	ม	Good
18	125.85	25	8.8	B	Good	25	9.75	6	Good	25	11.50	ម	Cood
18	125.95	ม	12.5		Good			٩	Good	25	11.50	ы	Good
18	129.10	5	12.0	ს	Bad	15	12.50	A	2.1 ⁿ	25	11.50	ы — -	Good
18	129.92	15	12.5	Q	Good		 	•	Good	25	11.50	ш	Good
ព	130.06	20	9.7	PÅ	Good	20	10.5	2	Good	25	11.50	E1	Good
18	01.021	ม	10.5	#1	Bad	15	12.5		1 3.0 ^m	- 26	11.50	ţ,	- -

Annex Table 7-1 (Cont'd.) Present Status of Passing Condition and Summary of Improvement Plant

-

Sub-	STATION	E x 1	stin	8 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	а В	Impro	Critical Curve Improvement Plan (P1)	Curve an (P1)		I	Minimum Scale Improvement Plan	l Scale Plan (2)	1
Section	Ę,	Radius	Paved Width	Passing Condition	Sight Distance	Radius	Paved Width	Passing Condition	Sight Distance	Radius	Paved Width	Passing Condition	Sight Distance
19	130.18	21 1	11.1	م -	Good	15 11	12.5 ^m	ß	Good	25 a	11.50	ы	Good
18	130.58	50	10.5	۵	Good			٩	Good	25	11.50	ы	Good
18	131.26	SI	11.5	υ	Bad	15	12.5	4	3.2 th	25	11.50	ы	Good
18	131.50	ង	8.01	£٩	Bađ	51	12.5	۵	4.0 ^m	25	11-50	ы П	Good
18	131.65	50	0.6	¥	Good	50	10.5	٩	Good	52	11.50	<u>ه</u>	Good
18	132.09	51	11.2	A	Good	ม	12.5	P	Good	25	11.50	ц	Good
18	132.26	20	11.2	9	Bad			Q	1.4 ^m	25	11.50	ы	Good
18	01.EE1	20	9.5	A	Bad	20	10.5	а	1.4	25	11.50	ы	Good
18	133.99	2	10.5	F	Bad	51	12.5	A	2.8 th	25	11.50	ы	Good
18	134.51	25	9.7	à	Good			Å	Good	25	11.50	ы	Good
18	135.08	18	10.6	e.	Bad	18	12.5	6	1.8 ^m	25	11.50	ы	Good

•

Condition
Passing
н
Note

Description	A truck, or a bus or a tractomula on the fuside lane vs a truck or a bus or a tractomula on the outside lane. Triffic on the station	at a time. Traffic on the outside lane slows down to half speed.	A truck of a bus on the inside lane vs a tractomula on the outside lane, or a tractomula on the inside lane vs a truck of a bus of a tractomula on the outside lane. Traffic on the inside lane must stop and wait, then proceed must a side of the sust	dans slows down to half speed. A truck or a bus on the inside lane vs a truck or a bus on the outside lane can proceed in both directions without stopping nor vaiting.	A tractomula on the inside lame vs a truck or a bus or a tractomula on the outside lame. Traffic on the finite lame must stop and vait, then proceed one at a time. Traffic on the new lambda lame where the stope is a time.	A truck or a bus on the inside lane vs a truck or a bus on the outside lane can proceed in both directions without stopping	1 71	where and ward, then proceed one at a time. Traffic on the outside lane slows down to balf speed.	A Traffic on the both sides can proceed with no stopping.	
y Timija	Slow_down Step	Slow down Stop	Slow down	Slow down Stop /	 /	slow down Stop	/	slow down // Stop //	/	
Trúck	Slaw down Stop	Slow down Stop	/	Stow down Stop		Slow down Stop	/	/		 ;
Outside lane Inside lane	Truck	Twile	Truck	Toule	Truck	Turla	Truck	Tunila	Truck	Tmula
	•	t	A		U		A		μ	
	<u> </u>			uo11	puod 2	atsseq			-	

2 Sight Distance

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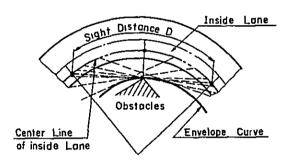
Good : "30 m or more Bad : Less than 30 m

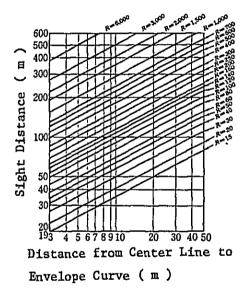
- The value in the column of sight distance shows the length to be widened for keeping sight distance 30 m. რ
- Station is relative to predetermined Km Post for Construction. 4

-

In the Ibague-Calarca section where the mountain slopes lie close on the inside of sharp curves, the stopping sight distance is insufficient. At these points, driving is hazardous and drivers are forced to slow down. Because the level of road service has fallen in parts, improvement is imperative. In this case the distance from the center of the lane to the envelope locus described by obstacles hindering the line of sight (See Annex Fig. 7-4) is shown in Annex Fig. 7-5. The widenings required for maintaining sight distances are given in Annex Table 7-1. These values are slightly higher than those from Annex Figure 7-5. (See Annex Fig. 7-4)

Annex Fig. 7-4 Sight Distance at Sharp Curve Annex Fig. 7-5 Sight Distances at Obstacles





ANNEX 7-3 Design Life of the Pavement Overlaid in 1980 ~ 1981 by the Rehabilitation Project

1. Ibague - Calarca Section

Design life of the pavement overlaid in 1980 - 1981 is esteimated by using "Thickness Design - Full Depth Asphalt Pavement Structures for Highways and Streets" of Asphalt Institute MS-1 as follows;

Given: (1) Initial Daily Traffic (IDT) = 2,282 vehicles per day in 1980

- (2) Number of heavy trucks = 2,282 x $\frac{50}{100}$ x $\frac{56}{100}$ = 640
- (3) Average Gross weight = 30,000 Lbs.
- (4) Annual growth rate of traffic = 5.0% and
- (5) Single Axle equivalent = 18,000 Lbs.
- (6) Old pavement consists of 4 inches asphaltic concrete in poor condition and 6 inches granular base.
- (7) Overlay thickness surfaced in 1980 1981 = 3 inches

Calculation:-

- (1) Design subgrade strength value CBR = 8%
- (2) Effective Thickness Te = Full depth

Asphalt pavement thickness = T_A

	Thickness of Pavemen layers inches	t	Convers Factor	sion		Те	
	3	x	1.0		=	3.0	
	4	x	0.7		=	2.8	
	6	x	0.3		=	1.8	
		То	tal			7.6	
(3)	Initial Traffic Number	r (ITN)	= 310	(from	Fig.	III-l)	1)
(4)	Design Traffic Number	(DTN)	= 200	(from	Fig.	IV-1)	2)
(5)	Adjustment Factor	$\frac{200}{310} = $	0.64				
			• •		~		3

(6) Annual growth rate is 5.0% by interpolation from Table III-3³⁾ design life of the pavement overlaid in 1980 - 1981 is estimated to be ten (10) years.

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2. Melgar - Ibague Section

Design life of the pavement overlaid in 1980-81 is estimated by using Asphalt Institute MS-1 as follows;

Given: (1) IDT = 5,344 vehicles per day in 1980.

- (2) Number of heavy trucks = 5,344 x $\frac{50}{100}$ x $\frac{40}{100}$ = 1,070
- (3) Average gross weight = 26,000 Lbs.
- (4) Single axle equivalent = 18,000 Lbs.
- (5) Annual growth rate of traffic = 5.0%
- (6) Old pavement consists of 3.5 inches asphaltic concrete in poor condition and 6 inches granular base.
- (7) Overlay thickness = 3 inches (Surfaced in 1980 1981)

Calculation:-

(1) CBR Value = 8%

(2) $T_e = T_A$ 3 inches x 1.0 = 3.0 4.0 inches x 0.7 = 2.8 6 inches x 0.3 = 1.8 Total 7.6 inches

- (3) ITN = 470 (from Fig. III-1)¹)
- (4) DTN = 200 (from Fig. IV-1)²)
- (5) Adjustment factor $\frac{200}{470} = 0.42$
- (6) Annual growth rate = 5.0%

By interpolation from Table III -3^3 , design life of the pavement overlaid in 1980-81 is estimated to be seven(7) years.

- Note: 1) Fig. III-1 of Asphalt Institute Manual Series MS-1.
 - 2) Fig. IV-1 of Asphalt Institute Manual Series MS-1.
 - 3) Table III-3 of Asphalt Institute Manual Series MS-1.

Annex 7-4 Pavement Design Procedures

7-4-1 Payement Design for New Construction

```
The design criteria to be followed are those described in the
    Asphalt Institute Manual Series (MS-1).
(1) Medium Scale Improvement Plan (Ibague-Calarca Section)
  1) Ibague-Coello. (Km 56 - Km 70) section
    Given Initial Daily Traffic (IDT) is 2282 vehicles per day in 1980.
    Assume annual growth rate = 5%
          IDT = 1674 in 1987
    Number of Heavy Trucks = 3210 \times \frac{50}{100} \times \frac{56}{100} = 900
    Average Gross Weight = 30,000 1bs
    Single Axle Equivalent = 18,000 1bs
    a) CBR = 20\%
    b) ITN = 460 (Initial Traffic Number)
    c) DTN = 460 x 1.67 = 770 (Design Traffic Number)
                           (by Interpolation from Table III-3) 1)
    d) TA = 6.5 inches Thickness of asphalt concrete (Fig. V-1) ^{2)}
    e) Minimum thickness of asphalt concrete is considered to be 3 inches
           6.5 - 3.0 = 3.5 inches
    f) 3.5 inches is substituted by granular base
           3.5 inches x 2.0 = 7 inches Say 20cm, base
            * Substitution Factor From Design Manual
   2) Coello - Q. Perales (Km 70 - Km 101) section
         Traffic condition is the same as that of Ibague-Coello section.
       1) CBR = 8\%
       2) ITN = 460
       3) DTN = 770
       4) TA = 9.0 inches (from Fig. V-1)
       5) Minimum thickness of asphalt concrete is considered to be 3 inches
             9.0 - 3.0 = 6.0 inches
       6) 6.0 inches is substituted by 3 inches granular base and 3 inches
          subbase.
               3.0 inches x 2.0 = 6 inches
                                              say 15cm base
               3.0 inches x 2.7 = 8 inches
                                              say 20cm subbase
```

Note : 1) Table III-3 of Asphalt Institute Manual Series (MS-1) 2) Fig. V-1 of Asphalt Institute Manual Series (MS-1)

- (2) Large Scale Improvement Plan
 - 1) Girardot Bypass Given initial Daily Traffic (IDT) is 2250 vehicles per day in 1980. Assume annual growth rate = 5%IDT = 3,016 in 1986Number of Heavy Trucks = 3,016 x $\frac{60}{100}$ x $\frac{50}{100}$ = 905 Average Gross Weight = 27,000 Lbs. Single Axle Equivalent = 18,000 Lbs. a) CBR = 4%b) ITN = 390 (Initial Traffic Number) c) DTN = 390 x 1.67 = 650 (Design Traffic Number) (by Interporating from Table III-3)¹⁾ d) TA = 11.5 inches Thickness of asphalt concrete (from Fig. V-1)²⁾ Minimum thickness of asphalt concrete is considered to be e) 3 inches. 11.5 - 3.0 = 8.5 inches f) 8.5 inches is substituted by granular base. 3.0 inches $x 2.0^* = 6$ inches say 15 cm Base 5.5 inches x 2.7 * = 14.8 inches say 40 cm Subbase * Substitution Factor from Design Manual. Note : 1) Table III-3 of Asphalt Institute Manual Series (MS-1)

2) Fig. V-1 of Asphalt Institute Manual Series(MS-1)

2) Ibague Bypass

Given Initial Daily Traffic (IDT) is 1,241 vehicles per day in 1980. Assume annual growth rate = 5%

IDT = 1,746 in 1987 Number of Heavy Trucks = 1,746 x $\frac{50}{100}$ x $\frac{56}{100}$ = 490 Average Gross Weight = 30,000 lbs Single Axle Equivalent = 18,000 lbs. a) CBR = 8%

- d) TA 9.0 inches Thickness of asphalt concrete (from Fig. V-1)²⁾
- e) Minimum thickness of asphalt concrete is considered to be 3 inches.

9.0 - 3.0 = 6.0 inches

f) 6.0 inches is substituted by granular base
 3.0 inches x 2.0^{*} = 6 inches say 15 cm Base
 3.0 inches x 2.7^{*} = 8 inches say 20 cm Subbase

* Substitution Factor from Design Manual

3) Coello and La Linea Bypass

Traffic condition is the same as Ibague-Coello section in Medium scale improvement plan.

- 1) CBR = 8%
- 2) ITN = 360
- 3) DTN = 600
- 4) TA = 9.0 inches (From Fig. V-1)²⁾
- 5) Minimum thickness of asphalt concrete is considered to be 3 inches. 9.0 3.0 = 6.0 inches.
- 6) 6.0 inches is substituted by granular base and subbase.

3.0 inches x 2.0 = 6 inches say 15cm base
3.0 inches x 2.7 = 8 inches say 20 cm subbase

Note : 1) Table III-3 of Asphalt Institute Manual Series(MS-1)

²⁾ Fig. V-1 of Asphalt Institute Manual Series (MS-1)

7-4-2 Overlay Thickness Design for the Existing Road Section

The design criteria to be followed are those described in the Asphalt Institute Manual Series (MS-17)

- (1) Calarca-Buga
 - 1) Calarca-Barragan

Assume the first year of overlay is 1985. Number of Heavy Trucks = $2910 \times \frac{50}{100} \times \frac{45}{100} = 654$ Average Gross Weight = 40,000 lbs Annual Growth Rate = 5%, and Single Axle Equivelent = 26,000 lbs

Existing pavement consists of 3 inches of asphalt concrete in poor condition, and 6 inches of granular base, where CBR value is 8%. Overlay thickness for 20 years Design Period is calculated as follows.

```
a) ITN = 250 (from Fig. III-1)
b) DTN = 250 x 1.67 = 420 (from Table III-4)
c) Rebound Deflection = 0.040* inch
d) Overlay Thickness = 2.8 inches = 3 inch (from Fig. IV-3)
```

* Rebound Deflection calculated from Benkelman Beam Test Results shown in Annex Fig. 6-1.

2) Barragan-Secilla

Number of Heavy Trucks = 1416 x $\frac{50}{100}$ x $\frac{45}{100}$ = 320

a) ITN = 250	(from Fig. III-1)
b) $DTN = 420$	(from Table III-4)
c) Rebound Deflection = (0.034 inch
d) Overlay Thickness = 2	.0 inch (from Fig. IV-3)

3) Sevilla-Uribe

The traffic condition is the same as that of Calarca-Barragan section.

```
a) ITN = 250 (from Fig. III-1) 1)
b) DTN = 420 (from Table III-4) 2)
c) Rebound Deflection = 0.042 inch
d) Overlay Thickness = 3.0 inch (from Fig. IV-3) 3)
```

Note : 1) Fig. III-1 of Asphalt Institute Manual Series (MS-17) 2) Table III-4 of Asphalt Institute Manual Series (MS-17) 3) Fig. IV-3 of Asphalt Institute Manual Series (MS-17)

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4) Andalucia - San Pedro

Number of Heavy Trucks = $\frac{8246}{2} \times \frac{50}{100} \times \frac{42}{100} = 865$ Average Gross Weight = 26,000 lbs. 1) ITN = 360 (from Fig. III-1) ¹⁾ 2) DTN = 360 x 1.67 = 600 (from Table III-4) ²⁾ 3) Rebound Deflection = 0.045 inch 4) Overlay Thickness = 3.8 inch = 4.0 inch (from Fig. IV-3)

The Rebound Deflection is calculated from the Benkelman Beam Test Results shown in Annex Fig. 6-1 by a procedure which is

described as follows,

7-4-3 Procedure For Calculation of Rebound Deflection.

(1) Calarca - Barragan

$$\overline{x} = \frac{5}{65} = \frac{39 \cdot 5}{65} = 0.61^{\text{mm}}$$

$$s = \frac{n(5x^2) - (5x)^2}{n(n-1)} = \frac{65x28 \cdot 26 - (39 \cdot 50)^2}{65x64} = \frac{1836 \cdot 9 - 1560 \cdot 25}{4160} = 0.26^{\text{mm}}$$

$$f = 0.92 \quad (\text{Av. temperature } 35.64^{\circ}\text{C})$$

$$(\overline{x+2s})f = (0.61 + 2 \times 0.26) \times 0.90 = 1.02^{\text{mm}} = 0.040 \text{ inch}$$

 $\bar{x} = 0.47$ s = 0.24 f = 0.90 (Av. temp. 34.6°C) (x+2s)f = (0.47 + 2 x 0.24) x 0.91 = 0.86^{mm} = 0.034 inch

(3) Sevilla - Uribe

x = 0.55 s = 0.31 f = 0.92 (Av. Temp 34^oC) (x+2s)f = (0.55 + 2 x 0.31) x 0.92 = 1.08^{mm} = 0.042 inch

(4) Andalucia - San Pedro

$$x = 0.59$$
 $s = 0.38$ $f = 0.84$ (Av. temp. 39.9°C)
(x+2s)f = (0.59 + 2 x 0.38) x 0.84 = 1.13^{mm} = 0.045 inch

Where	x	:	Sample mean value
	s	:	Standard deviation
	n	:	Number of individual test values
	f	:	Temperature adjustment factor

Benkelman Beam Test Results

(From Annex Fig. 6-1)

1) Calarca - Barragan

			$\sum x^{1}$ $\sum x^{2}$
	135.0 ^{km} - 141.0 ^{km}	10 ^{Point}	Zx Zx 7.9 7.14
		10	5.8 3.58
	141.0 - 146.0 146.0 - 151.0	10	4.8 2.47
			5.8 4.35
	451.0 - 156.0	10	
	156.0 - 161.0	10	
	161.0 - 166.0	10	5.6 3.08
	166.5 - 168.5	5	2.1 1.23
		65	39.5 ^{mm} 28.26 ^{mm2}
2)	Barragan - Sevilla		
)	Darragan Ocvarza		
	168.5 - 173.5	10	5.5 4.37
	173.5 - 178.5	10	6.2 3.70
	178.5 - 183.5	10	3.7 2.13
	183.5 - 188.5	10	3.6 1.46
	188.5 - 193.5	10	4.7 2.31
		50	23.7 ^{mm} 13.97 ^{mm2}
3)	<u>Sevilla – Uribe</u>		
	193.5 - 198.5	10	6.1 4.19
	198.5 - 201.0	5	2.3 1.47
	201.0 - 206.0	10	3.1 1.55
	206.0 - 211.0	10	4.4 2.76
	211.0 - 216.0	10	7.7 6.57
	216.0 - 220.5	7	4.9 4.09
		52	28.5 ^{mm} 20.63 ^{mm2}
4)	<u>Andalucia - San Pedro</u>		
	79.0 - 84.0	10	3.6 1.64
		10	4.0 2.48
	84.0 - 89.0 89.0 - 94.0	10	7.8 7.12
	89.0 - 94.0 94.0 - 99.0	10	8.2 8.24
		40	23.6mm 19.48mm ²

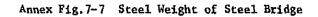
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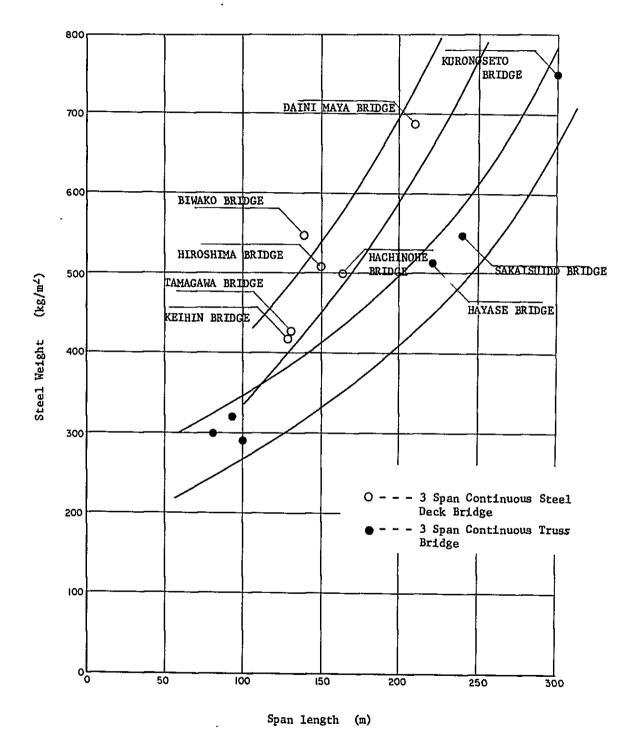
Note : 1) x is individual test value.

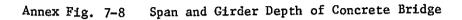
120 ê § Š 80 20 60 20 40 30 20 9 Post-tensioned (T Beam) Box Girder (Continuous) 3 Box Girder (Simple) Span length T Beam (Simple) **Pre-tensioned** Rigid Frame Hollow Slab Hollow Slab Slab SIab Type Concrete Bridge Concrete Bridge κετυζοτοεά Prestressed

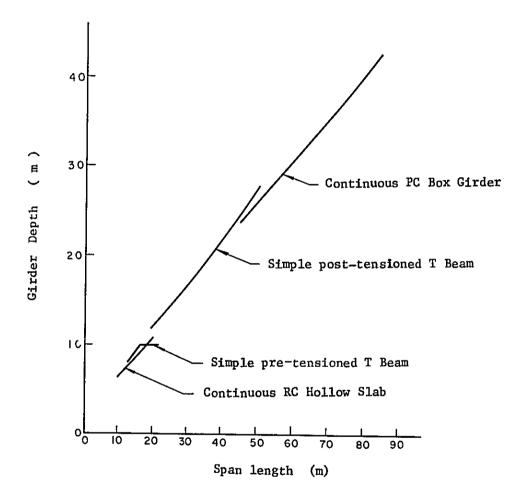
Recommended Span for Concrete Bridges

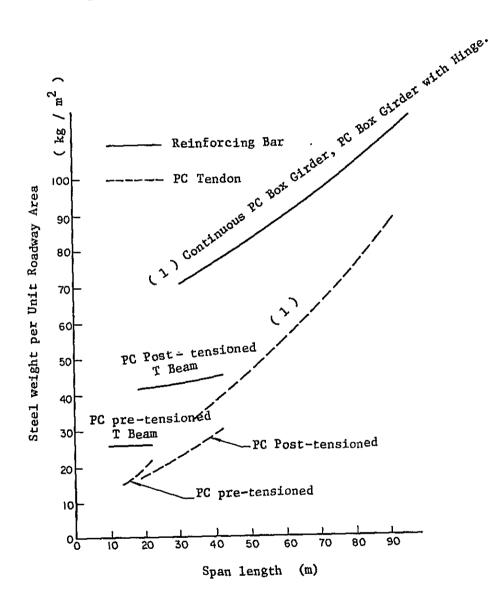
Annex Fig. 7-6







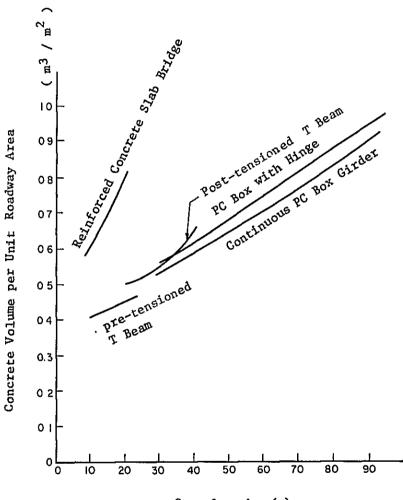




Annex Fig. 7-9 Span Length and Steel Weight per Unit Roadway Area

-

Annex Fig. 7-10 Concrete Volume per Unit Roadway Area



Span length (m)

		E00000	1850 ^{m3} 130 ^t 1360 ^{m2}				
	3-Span Continuous P.C. Box Girder	260,000 140,000 60 00 0 00 0 00 0 00 0 00 0 00 0	Substructure Concrete 18 Reinforcement 1 Form 13	\$221,427,000 \$ 22,567,000 \$243,994,000	: method) High Level Long	negligible	
EK KIG UNGDATENA	3-Span Continuo		Superstructure Concrete 2930 ^{m3} P.C. Gable 257 ^t Reinforcement 187 ^t Form 9830 ^{m2} Pavement 2340 ^{m2}	Superstructure Substructure Total	Erection (Cantilever method) High Level Construction period Long	Maintenance cost is negligible	Recommended
COMPARATLY E ANALYSIS OF BRIDGE OVER RID MAGUALENA	3-Span Continuous Steel Truss	10,000 10,000 10,000 10,000 140,0000 140,0000 140,0000 140,0000 140,0000 140,0000 140,0000 140,0000 140,0000 140,00000 140,0000000000	SuperstructureSubstructureSteel Weight920 tConcrete1130 m3Steel Weight920 tSteinforcement90 tConcrete360 m3Reinforcement90 tReinforcement29 tForm1200 m2Form3400 m2Pavement2340 m2	Superstructure \$270,443,000 Substructure \$ 15,157,000 Total \$285,600,000	Erection High Level Construction period Short	Painting cost is necessary	
	Descriptions	TYPICAL CROSS SECTION AND SIDE VIEW	APPROXIMATE MATERIALS QUANTITIES	APPROXIMATE CONSTRUCTION COST	PRACTICABILITY OF ERECTION	MAINTENANCE	CONCLUSION

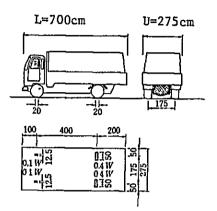
COMPARATIVE ANALYSIS OF BRIDGE OVER RID MAGDALENA

Annex Fig. 7-11

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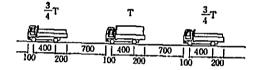
Annex Fig. 7-12 Bridge Live Loads

T-Load

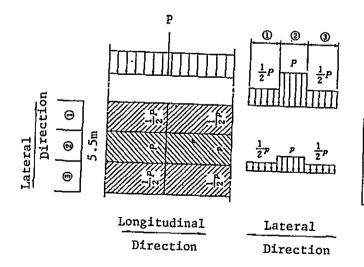


LOAD	W (t)	0.1W(kg)	0.4W(kg)
т-20	20	2000	8000
T-14	14	1400	5600

W ; Total Weight of Truck and Load.



L-Load



- P; Concentrated Load
- P ; Uniform Load

1047	P	P (kg	/m ²)
LOAD	(kg/m)	(≦80	l>80
L-20	5000	350	430-L*
L-14	70%	of above	

* 430-L≥300 kg/m²

ļ	•	r⊿inex Table	e 7 - 2 -		revel	(1) Preventive Worns'	Legend
Sect		Geology	ogy	TD Å	Ca	Type and extent	Tvne of expected damage (T
5 4		Sur face	bedrock	5 	2	of preventive works	L. Lizadslide
1	61,820~61,850	Soil	granodiorite	9 - W	8	@ =4, L=30m	
6	61,820-61,860	*	2	М – ©	B	0.224 m²	3. Kock avalanches 4. Rock [a]]
e	62000-62045	*	*	В-1	B	@11=6. L=45m	5. Failure of shoulder and road
4	62520-62680	*	2	0-T	v	% LS - 1	
s2	62800~62830	Pumice flow deposit	2	© ⊢ L	۷	@11=6.L=30m	Extent of damages (ED)
9	63,200~63,385	Soil	z	W − Ø	۷	Ф827 m²	L: Large scale
2	63,385-63,575	2	2	Q - S	в	<u>Ф</u> 850 m'	M : Medium scale
8	63,625-63,660	*	2	W - @	U	Q196 س	S : Stall scale
cn.	63610-63830	*	2	S – (9)	C	© 3300 m²	Prohibition of Orchington (E
10	63860-63960	•	×	N - 9	¥	@1000 m²	
11	63880-63900	2	2	С – С	IJ	©) 1 2 0 л/	B: Medium probabily C: The second
12	63900~63960	2	z	(S) – M	υ	()11=4, L=60m	V PLOBADILLY
13	64,015~64,020	*	z	S 1 (9)	B	4020m²	, , , , , , , , , , , , , , , , , , ,
14	64,010~64,030		*	9 - S	IJ	@400m²	I ype of preventive works © Concrete block retaining wall
15	64,120-64,300	Sol 1	*	М- С	υ	©9H=4, L=90m	
16	64,180~64,220		z	W - (2)	υ	@134 m′	(J) Uravity type retaining wall (A) InvertedT type relaining walf
17	64,340~64,375	2	*	M – ©	B	09500 m ⁰	© Crib wall
18	64,420~64,580	Pumice flow, Soil	8	W – Ø	c	@716 m²	
19	64,495-64,525	2	2	s - S	ß	@ II = 4 · L = 3 0 m	Rock fence Drout faced
20	64,580~64,590	t	2	(G) – M	a	(2)H=3, L=20 m²	
21	64,590-64,640	Sand and gravel	1	M – ©	IJ	ឃិ600 ភា	U Piling works C Foat protection
22	64,915~65,000		i	W - (\$	<	@ 3 6 0 m², @ 11 = 1, L = 8 5 m	C Sedement control dam
23	65,020-65,300	*	1	S - (2)	=	@2240 m²	
24	65,300~65,480	1	granodiori le	(2) – S	A	@ 4,5 0 0 m²	Culverts Converts
25	65,320~65,330	2	*	@ - S	۷	(311 = 4, L = 7m	
						💥 Preventive works for landslide are	

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Q)

frame

X Preventive works for landslide are shown in Table 7-15

		Annex Table	le 7 – 2 –	(3)	reve	Preventive Works	Legend
	Station	Geo	Geology	0 ^{- 4}	04	Type and extent	Type of expected damage
뤽		Sur face	bedrock	C E		of preventive works	1. Landslide
	65,375~65,385	completely weathered gr.	granodiorite	Ю – М	۷	⊕H=4, L=10 m, QW=4, L=30 m	
	45,420~65,425	Ł	z	w - 9	۷	④!!=4, L=10 m, WW=4, L=30 m	A. Rock avaianches 4. Rock fail
1	65,503-65,510	2	2	S - S @ - S	<	⊕H=4, L=7 m	S. Failure of shoulder and road
I	65,480~65,820	z	*	W - ©	=	@ 2'1 0 0 m'	or Deptis 110%
30	65,610~65,618	2	2	s - 9	<	(3H=4, L=8 m	Extent of damages (FC
1	65,820~65,830	2	2	W - 9	U	() =4, L=10m	L: Large scale
32	65,840~65,880	*	2	N- @	f	@ 1.0 0 0 m²	M : Medium scale
33	65,900~66,220	2	ž	W - ©	4	Q1342 m'. @H=1.5. L=300 m	S : Small scale
34	66,020~	*	*	N - 9	<	()]!=4. L=20m	Probability of Orcurrence
35	66,200~66,300	2	*	© - S	<	©700m²	
36	66,300~66,380	2	2	8 - 0	<	© 447 m ⁴ , ® H = 1.5 , L = 80 m	B : Medium probabiliy C : T
37	66,220~	z	u	W - @	۷	©11=4. L=15m	
38	66,260~	=		S - (9)	<	©H=4, L=10m	
39	66,290~	z	*	W - 9	<	@l[=4, L=15m, @W=4, L=25	Deventive wor Deventive wor (D) Concrete block retaining wall
ę	66,380~	2	2	8 - 8	۷	©H=3, L=10m	
1	66,385~66,450	*	*	8 - 8	υ	@)150 m²	U Uravily type retaining wall Inverted - T type retaining wall
42	66,685~66,840	501	2	W - Ø	U	(D) 184 m²	 Crib wall Flauble tune will with concrete
43	66,865~66,880	completely weathered gr.	2	N - ©	٨	②]]] = 4 , L = 1 5 m	
1	66,915~66,925	z	2	s – Ø	8	③H=3, L=10m	 Rock fence Grout faced
45	66,925~67,030	2	2	© - S	ပ	Ф 5 8 7 m'	
46	66,985~67,015	*	*	W - 9	n I	(0150 m²	U Filing works D Foot protection
5	67,030-67,075	2	z	(2) – S	<	@11=4, L=45m	(b) Sediment control dam (b) Weissenses model
48	67,075~67,085	*	2	@8	۲	©11=3, L=10m	
67	67,085~67,095	*	*	8-0	- -	(J) 1 0 0 m ¹	() Cuiverts () Snrav annication of sred
20	67,095-67,120	*	z	S 1 (9)	<	<pre>③li=3. L=25m, @li=1.5. L=25m</pre>	
1						₩ Preventive works for landslide are show in Table 715	
		ł					

- (CI) sage
- ur rence (PO)
- tive works ung wall
- g wałl ıning*wall
- h concrete frame

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		Annex Table	le 7 – 2 –	(3)	reve	Preventive Works	Legend
Sect		Geo	Geology	TD	C	Type and extent	Tune of expected damage
5 2		Sur face	bedrock	8 <u>0</u>	2	of preventive works	
51	67,120~67,200	completely weathered gr-	granodiorite	Q - S	V	(0358 m ¹ , (8) l = 1.5, L = 80 m	
52	67,215~67,260	2	2	(\$) – N	8	Gli=7. L=45m	3. Kock avalanches 4 Rock [a]]
53	67,260~67,325	2	2	W - (?)	<	③H=3, L=65 m, @II = 1.5, L=65m	5. Failure of shoulder and road
54	67,350-67,500		2	(2) - S	<	0.671 m²	b. UEDIIS 110W
55	67,380~67,400	1 1	2	ନ - ଓ	8	<pre>③ll=4, L=20m</pre>	Extent of damages (
26	67,450~67,480		*	W-©	c	@H=4, L=30m	L : Large scale
57	67,500~67,510	2	2	- Г (9 – Г	C	011=4, L=15 m. 0W=4, L=10m, 0L=8	M : Medium scale
28	67,510~67,650	•	2	(2) – S	C	@1120 m	S : Small scale
59	67,650~67,660	soil	*	7 - Q	8	(3)11=4, L=40 m	Drohahilitu of Occurroo
60	67,660-67,710	pumice flow gravel. sand and gravel	2	(2) – S	<	() 2 2 4 m ² , () 11 = 1.5 , 1 = 5 0 m	
61	67,680~67,695	Ł	2	9 - 8	8	2)1(=6. L=15m	N : Mediun probability
62	67,780~67,850	2	2	W - ®	C	⊕ 2000 m², ⊕ 7,000 m²	· · how probability
63	67,840~67,880	501J	*	N-0	υ	Q 200 F	-
64	67,990~68,000	*	2	() - L	в	Q11=4,L=20m,QW=4, L=40m	Iype of preventive w Concrete block retaining wall
65	68,020~68,060	pumice (low sand and grave).	2	3 - S	۲	¢ 1,000 m²	
99	68,120~68,145	2	1	W - ®	<	③H=3, L=25 m	③ Gravity type retaining wall ④ Inverted ~T type retaining'w
67	68,145~68,250	soul sand and gravel	1	8 - ®	-	Ф246 п /	-
68	68,250~68,340	2	granodiorite	S – (2)	C	① 4 0 2 ㎡	
69	68,340~68,365	2	2	W - (2)	B	@112m ¹ . @H=1.5 . L=25 m	Rock fence Rock fence Arout farmed Ar
20	68365-68400	completely weathered gr-	*	W - (2)	V	@H=3, L=35m, @H=1.5, L=35m	-
5	68430~68450	*	Ł	W - ®	æ	@ 2 0 0 m ¹	UD Piling works UD Foot protection
72	68450-68540	*	2	@-8	4	(0 4 0 2 m ² , (6) H≈ 1.5, L=9 0 m	
73	58,540-68,550	2	2	W - (9)	a	@L=8 m	UP Watercourse works Dank protection works
74	68,560~68,570	soil	2	- Г 9	m	@li=4.L=30m	(b) Culverts
75	68,570~68,620	*	2	W - (2)	-	t) 2000 m. (9 8,000 m²	Soil removal works
J						* Preventive works for landslide are shown in Table 7-15	

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Legend

- expected damage (TD)
- layer fall lanches

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- of shoulder and road low

it of damages (ED)

- ale scale cale

ty of Occurrence (PO)

- obability probabiliy babiliy
- of preventive works block retaining wall
 - - rall
- type retaining wall →T type retaining'wall
- type wall with concrete frame
- nce aced 1 inder ("Gabian") works

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- tection
- control dam

- rse works Iection works

l.egend	Tvne of expected damage (TT)			3. Rock avalanches 4. Rock falt	5. Pasture of shoulder and road		Extent of damages (ED)	L : Large scale	M : Medium scale	S : Small scale	Brohanility of Orentrance (PO)		A . IIIgn prosability B : Medium probabily	C . Dow progacity	1	• Concrete block relating wall		 Uravity type retaining wall Inverted -T type retaining wali 	© Crib wall		Rack fence G Grout faced		D Piling works D Foot protection		us watercourse works (2) Bank protection works	(b) Culverts (c) Surav ann ication of seed		;
Preventive Works	Type and extent	of preventive works	⊕ 2,000 m², ⊕ 8,000 m²	0.2.2.4 m²	©390 m'	р ш 0 6 (0)	0358 н/	Ф 3.13 гг	Ф268 т	Ф 9 0 ш	@ 1,4 0 0 m²	Ф 5 5 9 m/	()]]=4. L=20m	@ 2000 m²	©449 m²	@4,500 m/	@1230 m²	③11=3, L=10m	@ 1,000 m²	(g) 2 0 0 m²	(Øll=1.5, L=285 m	()) =4, L=40m, ())L=20m	(c)]]=7. L=5.5 m	@li=4, L=25m	₩LS-2	©11=10. L=200m	Ф.380 m²	* Preventive works for Londshide are shown in Table 7-15
reven	C	2	υ	υ	V	<	ບ	8	V	4	2	<	n	ပ	υ	<	m	<	U	fi .	<	<	ß	n	<	8	1	
(4) F	TD %	a O	(Z) – S	(1) – S	W - ©	S 1	S - S	(2) - S	(2) – N	Q - S	W - ®	N - ®	7 - (9)	м - ©	N - ©	S - (Ê)	S - S	W - 0	Q - S	9 - S	N - 9	1 - Q	Ю - М	Ю – Ю	n – 0	и и 90	N - (2)	
e7-2-	eology	bedrock	granodiorite	•	*	2	ž	ž	2	2	2	2	*	*	black schist	black schist chert ime stone	black schist granodiorite	black schist	amphibolite	2	2	granodiorite błack schist	amphibol i te	2	black schist amphibolite	alter nation of gr and bisch	2	
Annex Table	Geol	Sur face	soi l	completely weathcred gr.	£	2	soil	Ł	2	2	compictely weathered gr.	*	soil	completely weathered gr-	sotl	z	completely weathered gr.	pumice (low deposit	soll	weathered	2	soil	2	z	2	E	z	
4	Station	(IGI)	68720-68800	68,900-68,950	69,050~69,090	69,130~69,150	69,150~69,230	69,230-69,300	69,300~69,360	69,380~69,360	69,400~69,540	69,540~69,665	69,690-69,700	69,700~69,900	69,900-70,000	70,000~70,225	70,225~70,500	70,515~70,525	71,300~71,425	71,425~71,445	71,445-71,730	71,735~71,760	71,470~71,525	71,705~71,730	71,770-72240	72400~72600	72695-72780	
	Sect	z	16	22	78	52	80	81	82	83	84	85	86	87	88	68	06	16	52	63	94	95	96	57	98	66	100]

ł	Tvne			4 4 Roc	S Pai		,	L : Lar	M : Med	шл 	- Droh				;	- 3 e		5 : 9 0 	55 00 00				2 2 9 9 			99 99		}
Preventive Works	Type and extent	of preventive works	(311=4, L=20m	t}]1=4, L=25m	@H=4, L=65m	(0.537 m²	Ф 268 m²	©11=10, L=170m	0716 m²	% [' 8 - 3	0.581 m²	(2) 1 = 4, L = 100 m	()H=4, L=30m	@ 1,7 8 9 m'	@716m ⁴	@179m²	©H=6, L=110 m	0246 m². (6) 1, 100 m²	※LS-4	()H=4, L=120m	③11=3, L=25 a, ④H=15, L=25 m	@1,115 m²	@134.m ⁴	©45 <i>⊪</i> /	() 6 2 6 m²	*FS-5	③H=3, L=70m	# Preventive works for landslide are
Preve	C	2	۷	v	V	0	V	С	ບ	V	υ	B	<	B	IJ	8	ပ	V	V	۷	V	υ	υ	υ	U	n	Y	
(2)	10	χ Ω	(6) – N	Ч - (9)	<u> </u>	(2) – M	(2) – S	W - D	N - ©	л-0	W - @	0 - S	W - 9	@ - 8	2 - S	S - (2)	W - (2)	0 - L	л-Ф	n-1-0	7 - C	۹- S	2 - S	Q - S	W - ®	n-1	3 - B	
le 7 – 2 –	ogy	bedrock	al ternation of grandbl sch	2	2	*	*	z	2	2	blak schist	2	blak schist chert	blak schist	2	2	2	btak schrst graphite schrst	2	2	blak schist	2	2	2		black schist green schist	*	
Annex Table	Geology	Sur face	pumice flow sort	2	2	1108	۲ ۲	E	2	2	2		sand and gravel	pum ce flow. so i	2	soil	weathered rock	1	sot		weathered rock.	2	2	*	weathered	501	Ł	
7		((1))	72785-72795	72830-72840	72995-73060	73060-73220	73220-73280	73280-73450	73400~73560	73670~73920	73930~74,060	74,100-74,200	74,260~74,280	74,400-74,800	74,900-75,060	75,100~75,140	75,180~75,290	75,290~75,400	75,400~75,505	75,505~75,515	75,530~75,555	75,55~75,720	75,790~75,820	75,900~75,910	76,380~76,520	76,520-76,840	76,860~76,930	
	Sect	<u>8</u> 2	101	102	103	104	105	106	107	108	109	110	Ξ	112	113	114	115	116	117	118	611	120	121	122	123	124	125]

- andsiide
- urface layer fall ock avglanches
 - ock fall
- ailure of shoulder and road
 - cbris flow
- Extent of damages (ED)
- arge scale
 - edium scale
 - mali scale

pability of Occurrence (PO)

- lilgh probabllity Medlun probablly Low probabilty

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- Type of preventive works oncrete block retaining wall

 - eaning wall
- ravity type retaining walt nverted ~T type retaining'wall

 - rib wall
- lexible type wall with concrete frame
 - ock nel
- ock fence
- rout faced
- ire cylinder (Gabion)
 - iling works

 - aat protection
- ediment control dam

- latercourse works lank protection works

 - ulverts
- pray application of seed
 - oil removal works

shown in Table 7–15

	TVDE	L. Lan		4. Koc	E Fat		ш 	L: Lar	M : Med	. S.	- Broh			•	F	ڙ '' 9 		54	ະ ອ ອ		0 00 Ye		2 2 9 9	8 8 8 8 6		5 8 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		I
Preventive Works	Type and extent	of preventive works	(G) L) = 8'm	~		(Ď184 m/	(1)470 m², (8) H = 1.5 , H = 105 m	03H=4, L=15m, (3W=4, L=30m	@ll=6, L=80m	0 6 1 5 m	056 m', @H=15, L=10m	@307m	@11=3. L=10m	Ф246 т	Ф90щ	@H=4, L=10m	@358 m ²	-% T S - 6	Ф626 m	Ø11=4, L=20m, WW=4, L=100m	hm 0 1 7 9 m	Ш.335 m²	ф.280 т	0)125 m²	@11=7, L=60m	€H=7, L=65 m	<pre>③li=3, L=35m, @li=15, L=35m</pre>	* Preventive works for landslide are shown in Table 7-15
reve		2	۷	υ	4	υ	<	V	n	m	<	B	V	ç	=	e	D	<	U	m	۷	Ð	B	U	-	<	<	
(9)	0 «	۳ <mark>۵</mark>	(i) – S	W - (2)	W - ®	W - ©	W - ®	Ю – М	Q – M	(2) – M	2-8	S - (2)	(G) – S	S - S	(2) – S	N - 9)	Q - S	Ú – L	M-(2)	9 - F	(2) – M	(2) – S	9 - M	Ю – Ю	(j) – S	W - (9)	(Q - S	
e 7 – 2 –	ogy	bedrock	black schist green schist	black schest	æ	2	2	2	2	2	2	2	z	*	z	Ŀ	"	al ternation of grand bl-sch-	2	2	Ł	t	z	2	z	black schist	*	
Annex Table	Geology	Sur face	301]	2	E	2	weathered	soil	2	2	*	weathered	lios	pumice flow soil deposit	2	2	2	2	2	2	2	2	2	ž	z	2	2	
A	C tation	(Ka)	76,945-76,955	77,020-77,120	77,125~77,135	77,200~77,255	77,285-77,390	77,390~77,410	77,320-77,400	77,410~77,520	77,520~77,530	77,530-77,585	77,585-77,595	77,595-77,650	77,650~77,670	77,710~77,720	77,750~77,830	77,830~78,080	78,100-78,240	78,260	78,260~78,300	78300~78400	78360~78400	78460-78485	78,540~78,600	78,600~78,665	78605-78640	
4	Sect	ź	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	

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e of expected damage (TD)

- andslide urface layer [a]]
- ock avalanches
- ock fall
- atture of shoulder and road
 - thris flow

Extent of damages (ED)

- arge scale
 - edium scale
 - nail scale

ability of Occurrence (PO)

- Iligh probability Mediun probabily Low probabilty
- Type of preventive works
 - oncrete block retaining wall
 - aning wall
- fravity type retaining wall nverted --17 type retaining'wall
- rıb wall
- lexible type wall with concrete frame
 - tock net
 - ock fence
- rout faced
- 'ire cylinder (Gabion)
- iling works
- oot pratection ediment control dam
- alercourse works
- - ank protection works
- ulverts
- pray application of seed wit removal works

			-				
Sect		Geology	ogy	01 4	C	Type and extent	Type of expected damage (1)
ē ā		Sur face	bedrock	a 🖸	2	of preventive works	Le Landalide
151	78,640~78,660	pumice [lew soil deposit.	black schist	@ - 8	=	① 9 0 m²	
152	78740~78790	weathered rock.	2	3 - S	v	(d) 5 0 0 ml	-3. Kock avalanches 4. Rock fall
153	79,000-79,040	pumice flow depositi. weathered rock.	2	W - ®	0		5. Failure of shoulder and road 6 Datais flow
154	79,040~79,100	we a thered rock	green schist black schist	W - 9	<	① 1=3 (b) =1.5 (c) 1=4 L=6 0m (b) L=3 5 m (b) L = 2 0 m	
155	79,100~79,180	weathered rock	green schist	@- 8	υ	@480 m²	Extent of damages (ED)
156	79,120~79,160	soi l	2	Ю – Ю	υ	Ф280 m ⁷	L t Large scale
157	79,300~79,380	pumice flow deposit	black schist	(2) – (2)	ບ	மு358 ள ²	N: Medium scale
158	79,380~79,390	pumice Ilow deposit. soit	2	W - 9	۷	(b) H=4 (b) W=4 (b) 8 m	S : Small scale
159	79,420-79,520	weathered rock	2	W - (9)	U	ற 6 ப் 0 கர்	Brohahility of Orcurrence (B)
160	79,520~79,620	*	black schist green schist	@-8	υ	@200 m²	
191	79,625~79,635	sail	2	9 - N	<	$\mathbf{O}_{L=15m}^{H=4} \mathbf{O}_{L=20m}^{W=4}$	A - LINE PROBULLY
162	79,640~79,650	pumice flow deposit	green schist	W - ®	ပ	Ф 34 m²	An ingenoid worr
163	79,710~79,760	•	*	3 - C	ບ	Ф300 m ¹	
164	79,720~79,745	soil	2	М – ©	E.	00112m/	D Concrete block retaining wall
165	79,760~79,980	*	black schist	(Z) – S	U	01,230 m	
166	79,980~80,055	2	*	W - @	e	①335㎡ ® L=15 ①335㎡ ® L=75m	 Uravity type retaining wall Inverted - T type retaining wall
167	80,030~80,060	2	2	W - 9	<	()H=7, L=30m	© Crib wall © Planible true will with converte free
168	80,150~80,155	2	2	() - S	-	$\mathbf{t}_{\mathbf{t}}^{\mathbf{H}=4} \qquad \mathbf{t}_{\mathbf{t}}^{\mathbf{W}=4} \mathbf{t}_{\mathbf{t}}^{\mathbf{H}=4}$	
169	80,165~80,380	pumice (1ow deposit.	al ternation of gr.and b). sch.	Q - S	æ	©) 1,7 2 0 m²	Back fence Drout faced
170	80,400~80,420	*	2	9 – N	B	⟨JH=5, L=20m	
171	81,040~81,330	weathered rock	2	(3) – L	v	(D2270 m, (BH=1.5, L=290m	U Filing works D Foot protection
172	81,330~81,390	soil	Ł	(2) – L	v	@335.mf	Sediment control dam AN W
173	81,400	z	2	(6) N	۷		
174	81,430~81,500	2	Ł	1-0)	۷	※153~7) (G) Culverts d? Sprav application of seed
175	81,500~81,590	weathcred	"	(1) – M	۷	(D604 m²	D Soll removal works
						☆ Preventive works for landslide are shown in Table 7-15	

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Preventive
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		Lar Lar		4 N NO	5 E			L: La	M : Mec		Dr. Dr. Dr.			•	۲ 	8 9 		5 i 9 0	00		2°° © 0		2 2 9 9 	9 8 9 8		0 9 9 9		1
Preventive Works	Type and extent	of preventive works	@2100m	※1, S - 8	@H=3. L=60m	③H=5, L=100 m	()604 m @H=1.5, L=90 n	(D872 m² (BH=1.5, L=130 m	②H=6, L=60 m	@11=6, L=50m @11=1.5, L=50m	(D363 m) (BH=1.5, L=65 m	D531 m² (®H=1.5, 1,=95 m	©ll≤6, L=110m. @ll=15, L=110m	④H≠5, L=200 m	① 4 7 5 m², @ [i=1,5, L=8 5 m	@ 1,0 0 0 m	(D.89.4 m²	$(3) \frac{11=4}{L=20m} = 0 \frac{W=4}{L=30m} = 0 \frac{W=8m}{M}$	@ 1'0 0 0 ^{ur} ,	(ý) 1,2 8 0 m²		11=4 W = 4 11=30m W = 40m (0 L = 8 m	Ult=4 L=15m	(1)224 m/ (6) L ≕8 m	©1 ≠10, L=85 m	@ 11=4, L=10m, @ W=4, L=20m	(D 9 0 m²	3% Preventive works for lardistrice are shown in Table 7-15
reve	6	2	υ	~	υ	D	<	m	D	υ	V	ų	U	υ	B	υ	U	<u>ه</u>	=	<	n	â	1	a	4	۲	υ	
(8)	٩ <u>۲</u>	8 <u>0</u>	(f) - S	7 - (î)	M - ©	W - (9	W - ®	W - (2)	M - (2)	(S) – M	M - Ø	W - (2)	W - ©	(S) - S	(S) – S	(Z) – S	@ - S	(6) – N	@ - 8	() – S	М – ©	(Q - L	(9) – S	@ - 8	W − ®	М – (9)	(2) – S	
le 7 – 2 –	ogy	bedrock	green schist	green schist black schist	green schist	2	z	1	pumice flow deposet (hard	2	2	2	2	black schist	:	z	z	2	*	*	4	2	Rreen schist	pumice flow deposit (hard)		z	*	
Annex Table	Geology	Sur face	wea the red rock	weathered	soil pumice flow deposit	*	*	2	punsice flow deposit	2	z		2	soil	pumice flow deposit	z	2	z	2	2	2	z	2	z	2	*	puint ce flow deposit sand and gravel	
7	Ctation Ctation	(Ka)	81,590~81,800	82000~82300	82600~82660	82600~82800	82660-82750	82750~82880	82940~83100	83,100~83,150	83,160~83,225	83225-83320	83320~83430	83400~83600	83450~83535	83535~83660	83660~83820	83,820-83,830	83880~83920	83920-84.080	84,200~84,320	84,250~84,260	84,940~84,950	85,140~85,190	85,290~85,375	85,380-85,390	85,400~85,420	
ĺ	Sect	z	176	177	178	621	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	

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be of expected damage (TD)

- urface layer fall ands) ide
 - ock avalanches

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- ock (all
- allure of shoulder and road

 - ebris flow

Extent of damages (ED)

- arge scale
- edium scale
 - mail scale

vability of Occurrence (PO)

- lligh probability Medium probabily Low probabilty
- Type of preventive works
 - oncrete block relatning wall
 - canıng wall
- ravity type relațning wall
- nverted T type retaining'wall
 - trib wall
- lexible type walt with concrete frame
 - ock net
 - ock fence
- rout faced
- 'rre cyfinder (Gabion)

 - iling works

 - 'oot protection lediarent control dam
- atercourse works
- ank protection works
- ulverts
- pray application of seed oil removal works

															_				_					æ		
Type and extent	of preven	$0^{11=4}$ $W=4$ $W=4$ 0^{1} $L=20^{m}$ $W=8^{m}$	0.201 m²	@ 1,6 5 0 m²	@156 #/	(1) = 1, $L = 35$ m	@400 m²	Фзз5 к, ©Н=1.5, L=75 п	©1,=8 m	Ф 984 т	©H=10, L=40m	©H=10, L=95 m	@11=4, 1=15m, @W=4, 1=30m	@2100m	(3) li=3, L=15m, (3) H=1.5, 1,=15m	(1)140 m²	(1)280m	©)H=10, L=65m	(1) 6 3 7 m	(3)H=3, L=40m	(Д. 2. 3. 5. m²	@H=4, L=20m	()112 m'. ()H=1.5, L=50 m	(3)]=3, L=10m, (3)]=1.5, L=10	(1) R 2 5 m²	(D 2 4 6 m', @ 1]=1.5 , L=5 5 m
Q)	V	υ	4	=	-	a	υ	υ	0	=	a	æ	V	J	ຄ	=	в	ບ	٧	c	υ	<	8	Ð	۷
0 %	ĒD	() – I	Q - S	(3) – S	@-8	Ю- Л	S 1 🕞	2 - S	(2) - S	S 1 (2)	9 - L	0 - L	N - (9)	м - ©	S - (9)	S - 2	() - S	м - ©	Q - S	(1) – N	Ø-₩	N - 9	W - (2)	(E) = S	<u>()</u> - S	W - ®
ogy	bedrock	pumice flow deposit	black schist	2	2	2	2	2	2			2	2	t	2	2	2	2	2	2	*	*	2	z	green schist	2
Geology	Sur face	pumice flow deposit. sand and gravel.	2	weathered	sorl	*	weathered rock	2	\$ 10\$	2		soul weathered rock	z	weathered	Ł	×	2	soil	sol 1 weathered	ż	*	soi l	2	2	weathered rock	
Station	(Ka)	85,430~85,440	85,450~85,480	85,570~85,680	85,690~85,725	85,690~85,725	85,780~85,830	85,885~85,960	85,965~85,975	86,040~86,260	86,040~86,080	86,260-86,355	86,360~86,370	86400-86540	86,540~86,555	86,555~86,580	86,885~86,720	86,750~86,815	86,218~87,000	87,000-87,040	87.140-87.210	87,240~87,250	87,250~87,300	87,300~87,310	87,420-87,475	87,475-87,530
Sect	đ	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225

Works
Prevent ive
(6)
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Table
Anirex

Type of expected damage (TU)

- Landslide
- Surface layer fail
 - k Rock avalanches L Rock fall
- . Failure of shoulder and road
 - i Debris flow
- Extent of damages (ED)
- M: Medium scale L : Large scale
 - 3 : Small scale

Probability of Occurrence (PO)

- A : Iligh probability B : Mediun probabily C : Low probabilty
- Type of preventive works) Concrete block retaining walf

 - Leaning wall
- Gravity type retaining wall Inverted -T type retaining'wall
 - - Crib wall
-) Flexible type wall with concrete frame
 - Rack net

 - Rock fence
- Grout faced
- Wire cylinder (Gabion)
 - Piling works

 - Foot protection
- Sediment control dam
- Watercourse works
 - Bank protection works

 - Culverts
- Spray application of seed
 - Suil removal works

			-			
Sect		Geology	ogy	10	04	Type and extent
	(Ka)	Sur face	bedrock	8 Q W	5	of preventive works
226	87,530-87,570	soi 1	green schist	W – (5)	<	@H=4. L=40m
227	87,530~87,590	soul weathered rock	2	@ - S	υ	①335 ㎡, ⑥!! = 1.5 , l, = 60 m
228	87,630~87,660	weathered	black schist	W - ©	8	@ 6 0 0 m²
229	87,700-87,850	weathered	2	0 - S	U	@2250 m²
230	87,850~87,885		*	(D - L	8	(0196 ㎡, ©ll=1.5, L=35 m
231	87,885~87,895	2	2	© – S	υ	©H=4, L=10m
232	87,900~87,915	weathered	2	W - @	E	0.69 m², (b) H = 1.5 , L = 1 5 m
233	88,010~87,055	2	2	W - ©	n	①201 ㎡, ⑥ H=1.5 . L≈15 m
234	88310~88350	2	2	() – S	n	©li≓6, L=40 m
235	88,350-88,380	\$01	2	@ - S	<	(2)H = 6, L = 30 m
236	88380-88440	÷	*	(2) – S	=	@H=6, L=60m
237	88490-88550	2	*	W - @	U	③H=3, L=60 m
238	88,580~88,610	2	2	N - ©	B	(b) =10, b=30 m
239	88,650~88,660	sorf sand and gravel	2	W @	۷	₩=4, L=30m,@L=8m
240	88690~88735	weathered rock	2	() - S	۷	@ 4 5 0 m²
241	88790~88800	soi1	*	(®) – S	0	ሁ₩= 4, L=30 m, ው՞L=8 m
242	88,890~88,940	weathered	2	@ - 8	C	@ 750 m
243	88950~89,000	soil	Ł	N - 9	<	<pre>⑤II=10, L=50 m</pre>
244	89,120-89,150	weathcred	green schrat	N - ©	υ	@168 ㎡
245	89,220-89,360	weathered rock		@–3	C	மு 6 2 6 ள்
246	89,360~89,400	weathered	2	9 - S	B	@ 4 0 0 m²
247	89,400~89,850	weathcred	2	3 - S	S	<u> (</u>) 2516 m/
248	93000~93080		black schist	3 - S	IJ	Ø 1,6 0 0 m²
249	93,080~93160	×	2	3 – S	۷	@)960 m ¹
250	93,160-93,170	1 jos	11	W - (9)	ß	Q11=4, L=15m, QW=4, L=20m
						2011

Works
Prèventive
- (10)
7 - 2
Table 7
Annex

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Type of expected damage (TD)

- 1. Landslide 2. Surface layer fall
- 3, Rock avalanches 4. Rock (all
- S. Failure of shoulder and road 6. Debris flow
- Extent of damages (ED)
- L : Large scale
 - M: Medium scale

 - S : Small scale

Probability of Occurrence (PO)

- A : Iligh probability D : Medlum probabily C : Low probabilty
- Type of preventive works
 - Concrete block retaining wall
 - Leaning wall
- Gravity type retaining wall
- Inverted T type retaining wall
 - Crib wall
- Flexible type wall with concrete frame
 - Rock net
 - Rock fence
- **Urout faced**
- Wire cylinder (Gabion)

 - Piling works

 - Foot protection Sediment control dam
 - - Watercourse works
- Bank protection works
- Spray application of seed Culveris
 - Soit removal works

	Α	aunex Table	e 7 - 2 -	(11) H	reve	Preventive Work.	Legend
Sect	 	Geology	ogy	5.		Type and extent	Tvne of exnected damage
5 <u>7</u>	((x))	Sur face	bedrock	а О 8 Ш	2	of preventive works	L. Landstide
251	93205-93340	weathered rock	green schist	8-0	=	@2025 m	
252	93260-93300	2	2	N - (9	=	●H=7. L=40m	A Rock avalancnes 4 Rock [al]
253	93345~93360	105	*	9-1-0	<	0311=4. 1,=16m 00W=4, L=50m	5. Failure of shoulder and road a Dahrie flow
254	93,420~93,490	weathered rock	black schist	@-8	υ	@1.400m²	
255	93520~93590	r tos	2	N - (2)	=	@H=3, 1,=70m	Extent of damages (E
256	93590~93640	weathered rock	2	N - @	=	(D224 m, @11=1.5, 1,=50 m	la : Large scale
257	93640~93680	*		@- S	=	@17,9 ㎡	M : Medium scale
258	93680~93710	soil	2	(2) – S	a	© {{ = 3, L = 30 m	aleas light : S
259	93710-93760	weathered rock	al ternation of gr-& bl-sch	N - ©	8	@ 750 m ³	Probability of Orcurrenc
260	93760~93820	\$01]		W - ©	fl	©ll≈6, L=40m, ®ll=L5. L=40m	A : Illah mahakili.
261	93,820~93,880	weathered rock	2	W - Ø	U	0402m	B: Medium probabily C: Low probabily
262	93840~93910	sorl	*	N - 9	8	@ II=5. L=70 m	
263	93680~93890	2		W - 9)	~	toH=4, L=20m W=4, L=30m, to L=8m	T.m. of promotion un
264	93,890~93,950	weathered rock	2	W - (2)	ບ	(D)2.68 m ² , (B) { = 1.5, L = 6.0 m	D Concrete block retaining wall
265	93950~94,050	Ł	*	9 - I	<	© ki≠10, L=100m, 40500m	
266	93,980~94,080	\$ 105	2	W - Ø	υ	(0 6 7 1 m	 Uravity type retaining watt Inverted - T type retaining wat
267	94,100~94,320	purmice (low deposition weathered rock		Q - S	V	@3000 m ^t	 Crib wall Pirvible type wall with concre
268	94,180~94,230	weathered rock	black schist	W – (\$	V	(\$)13 = 10, L = 100 m	
269	94,330~94,350	\$01]	alternation of gr-& bl-sch	W - (9)	D	Q11=4, 1=20m	 Rock fence Orout faced
270	94,540~94,620	weathered rock	green schist	S - C	υ	@ 8 0 0 m²	•
271	94,540-94,600	sort	Ł	W - 9	5	(j)H=5, L=60 m	W Filing works W Foot prolection
272	94,620~94,630	2	alternation uf gr-& bl-seh	9-F	8	ØN=4, L=30 m	(3) Sediment control dam dd Walarrayse works
273	94,675~94,800	soil weathered rock	E	W-0	٧	@3,750 m²	
274	94,670~94,760		*	©-1	<	ΦH≠6, L=90m, @H=7, L=90m	46 Culveris 48 Spray application of seed
275	94,840~95,000	weathered roc	green schist	S – (£)	U	(j) 8 9 4 m²	
						X Preventive works for fandslide are	

lge (TU)

(ED)

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Preventive works for landslide are shown in Table 7+15

	Type of expected damage (11)			3. Rock avalanches 4. Rock fall	5. Failure of shoulder and road 6. Dehrie finw		Extent of damages (ED)		M : Medium scale	o : omail scale	Probability of Orcurrence (20)		B: Medlum probabily C: r	All the second work and		D Concrute block relating wall		 Uravity type retaining wait Inverted - T type retaining wait 	 Crib wall Flexible type wall with concrete frame 		 Bock fence Crout faced 	-	OD Filing works OD Foot protection	(3) Sediment control dam (b) Weissenses marks	G Bank protection works	US Culverts OD Spray application of sced		
Preventive Works	Type and extent	of preventive works	@ll≠5, L=20m	©H=10, L=80m	0) 201 m², © 3.15 m²	@ 5 5 0 m²	Ф910 m	©H=4, L=10m, @H=L5, L=10m	t3H=4, L=20m, (3W=4, L=50m	@ 1,6 0 0 m ¹	டு 640 ளீ	@11=3. L=80m. @11=1.5. L=80m	(9) 8,5 0 0 m²	$\mathbf{O}\mathbf{H}=7, \ \mathbf{L}=30\mathrm{m}$	②Ⅱ=6. L=80m	ழி 179 ளூ, டு 280 ளீ	(g) 5 2 5 m²	(1)201 m²,(6)315 m²	(j)]1 ≤ 5, L = 40m	(Û 291 ㎡, Ĝ 455 ㎡	(g) 8 0 0 m ¹	①760m ³ , ④11=1.5, L ≠ 170m	@11=7. L=15m	<u>0</u> 693 m², ®Н= 1.5, L≍155 m	©H=10, L=90m	(@) 1.8 0 0 л ⁴ ·	(d) =7. L=100m, @11=6. L=100m	* Preventive works for landslide are shown in Table 7-15
reve		2	=	υ	в	ß	υ	V	B	<	υ	<	<	E	υ	4	U	<	Y	c	ß	IJ	R	<	6	B	B	
(12) H	0 °	х Сі ш	₩ - Ø	W-©	@ - M	W - ()	G - S	W - 9	(G - L	8 - ®	(j) - S	ŋ-₽	W - @	N - (\$	(G – M	s - S	S – (2)	W - @	W – (Ŝ)	W - Ø	(Q) – S	3 - C	W ← (S)	W – ©	1-B	W - (F)	(G) − L	
37-2-	eo logy	bedrock	green schist	alternation of gr.& bl.sch	2	green schist	2	2	2	2	2	2	2	8	2	black schist	*	2	٤	2	Ł	2	×	2	2	green schist	2	
Annex Table	Geol	Sur face	weathcred rock	2	punice flow deposit weathered rock	weathcred rock	2	2	z	2	2	*	2	soil	2	weathcred rock	z	soil	z	×	weathered rock	z	z	z	sot i	weathered rock	Ł	1
A	Stat.on	(Ka)	94,850~94,900	94,970~95,050	95,000~95,045	95,045~95,110	95.240-94,370	95,370~95,380	95,390~95,400	95,400~95,560	95,560-95,640	95,780~95,860	95,860~96,200	96,010-96,040	96,100-96,180	96,245~96,285	96,285~96,320	96.320~96.365	96,320~96,360	96,365-96,430	96430-96470	96,520~96,690	96,630~96,645	96,645~96,800	96,710~96,755	96,800~96,920	96,820~96,920	
	Sect	2 g	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300]

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301 5 301 5 302 8				•	2	lype and extent
┠──┼──┼─	((x))	Sur face	bedrock	* <mark>0</mark>	2	of preventive works
<u> </u>	96,920~96,980	weathered rock	green schist	S - ®	U	@ 6 0 0 m²
╂──	96,985~97,040	soil	black schist	₩-9	=	<pre>① II = 5 . L = 5 5 m</pre>
_	96,980~97,130	2	2	(2) - S	υ	(0 6 7 1 m²
304 5	97,140~97,190	2	z	W ~ (\$)	0	<pre>④11=7, L=50m</pre>
305	97.320~97.440	2	2	2 - 2	v	(3) H = 3, L = 120 m
306	97,385~97,440	*	2	W - (9)	υ	@ii=5. L=55m
307	97,450-97,530	weathered rock	2	3 - S	B	()358m', ()11=1.5. L=80m'
308	98,560~97,580	soll	*	W − (\$)	۷	()]H=7. L=20m
309	97,590~97,720	weathered rock	2	S - ©	ບ	00581m²
310	97,730~97,820	lias	porphyri te black schist	0 - L	~	ж Г S – 6
311	97,820-97,900	weathered rock	black schist	W ~ €	v	(0 4 4 7 m ² , (8) 11 = 1.5 , 1. = 8 0 m
312	9 7,9 0 0 - 9 7,9 2 0	solt	2	(ĝ – Ъ	V	(311=4, L=20m, (3W=4, L=50m)
313	97,935-98,000	sol1 weathcred rock	z	3 - S	۷	()363 m², (8)11=1.5, L=65 m
314	98,000~98,090	2	2	S ~ (2)	B	©503 m², ®H=1.5, L=90 m
315 (98,200~98370	weathered rock	2	@ - S	υ	@ 1'2 00 ألم
316	98,200~98,290	*	ł	W – (\$)	f	(1) $11 = 7$, $L = 90 \text{ m}$
317	98,310~98,325	501	black schist	® – M	v	@H=5, L=15m
318	98,370~98,480	pum er flow deposit soil	5	(2) – S	υ	(0.492 m²
319	98,480~98,650	weathered rock	ŧ	@ - S	ບ	0.760 m²
320	98,480~98,550	soil	*	6) – S	Ð	@li=5. L=70m
321	98,570~98,635	2	8	М – (Ŝ)	m	④II=5, L=65m
322	98,770-98,885	weathered rock	*	W - (C)	<	@920 m²
323	98,765~98,855	•	2	(\$) – S	æ	① H = 5 . L = 90 m
324	98,920~98,960	2	٤	8 - B	B	(D224 m'
325	98,950~99,060	soil	2	(S) – M	۲	<pre>③H=5, L=110m</pre>
						** Preventive works for landslide are shown in Table 7-15.

Works
Preventive
(13)
7 - 2 -
Table 7
Annex

Type of expected damage (TD)

- 1. Landslide
- Surface layer fall
 Rock avalanches
 - 4. Rock fail
- 5. Failure of shoulder and road 6. Debris flow

Extent of damages (ED)

M : Medium scale L : Large scale

S : Small scale

Probability of Occurrence (PO)

- A : High probability B : Medium probabiliy C : Low probability
- Type of preventive works
 - Concrete block retaining wall
 - Leaning wall
- Gravity type relaining wall
- Inverted T type retaining'wall
 - Crib wall
- Flexible type wall with concrete frame
 - Rock net
 - Rock fence
- Grout faced
- Wire cylinder (Gahton)
 - Piling works

 - Foot protection
- Sediment control dam
- Watercourse works
 - **Uank protection works**
 - .
- Culverts
- Spray application of seed 99
 - Soil removal works

	A	Annex Table	e 7 – 2 –	(14) F	reve	Preventive Works	a D a T a
Sect	Station	Geology	ogy	0 ª		Type and extent	Tyne of expected
2 4		Sur face	bedrock	a Ci	2	of preventive works	1. Landslide
326	98,960~99,060	soit	black schist	(2) - S	υ	() 5 5 9 m ¹	
327	99,065~99,085	*	2	Q - N	۷	(J)]≤5, L=20m	3. Kock avalanches 4. Rock fall
328	99.090~99.170	weathered rock	2	6 – S	в	@800 m	5. Failure of shoulder e Datais Disc
329	99,200~99,300	soi l weathered rock	2	S – (2)	υ	D447m	
330	99.390~99.410	*	*	W - (S)	<	④H±5 , L=20m	Extent of dar
331	99,440~99,580	pumice flow soil deposit	Ł	S - S	υ	(j) 6 2 6 m²	la : Large scale
332	99,800~99,865	2	2	(ŝ – ŝ	8	©H=10, L=65 m	M : Medium scale
333	99.890~99.940	2	1	W - @	υ	②H≤4, L=50m	S : Small scale
334	001001-000001	weathered rock	*	@- S	J	(D 8 0 0 m²	Prohahilitv af O
335	100110~100140	z	t	(1) – S	В	@450 m²	· Ilish stabulit
336	100185-100225	*	a	(j) – S	۲	(1) 1 7 9 m ² , (1) 1 = 1.5, L = 40 m	B: Medium probabily C: Low probability
337	100225~100365	2	al tof gr & bl-sch	() - S	υ	Ф 8 1 0 щ	•
338	100,400~100,700	2	black schist	S - (P)	υ	Ø 1.5 0 0 m²	ł
339	100,750~100,900	volcanic aslı	al toof gr & bl.sch	W - @	υ	(1) 3 3 5 m², (3) (1=1.5, L=5 0 m	Iype ui prever D. Concrete block reta
340	021101~000001	2	2	W - (2)	<	③H=10, L=270m. ⑧H=1.5, L=50m	
341	101230~100240	sand and grarel	*	() – I ()	<	(J)H=4, L=60m, (JW=4, L=200m	 Uravity type retain Inverted - T type re
342	101250~101350	volcanic ash weathered rock	green schist	N - ©	۲	(J) 5 5 9 m², (B) [1=1.5, 1,=50 m	Cribwall Planikla tune will
343	101350~101550	*	alt.of gr & bi.sch	7-0	v	01-S1茶	
344	016101~006101	2	black schist	W - (9)	ß	(∳W=4, L=40m, (∲L=8m	 Bock fence Orout faced
345	101950~102000	5	green schist	Q - S	ß	பு 7 5 0 m	
346	102070~102120		z	3 - S	<	@750 m²	U Filing works C Fool protection
347	102120~102220	volcante ash	2	S-2	υ	0447 m²	
348	102220-102230	*	2	(e) – S	۷	û∳W≃4. L=10m,@L=8m	
349	102330-102400	2	2	N - ©	υ	@H=5. L=70m	(1) Cuiverts . (1) Sprav and ication o
350	102650~102750 weathered rock black schist	weathered rock	black schist	M - ©	٧	() 5 5 9 m², () 11 = 1 5, L = 1 0 0 m	(B) Soil removal works
ļ					İ	** Preventive works for landslide are shown in Table 7-15	

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ed damage (TD)

- er and road

amages (ED)

Occurrence (PO)

- ventive works etaining walt
- aining wall : cetaining'wall
- with concrete frame
- (norqe
- dam
- works 1 of seed iks

Jat 10 Sur face bedrock black schist ∞ $102330^{-1}10230$ weathered rock black schist $(0^{-1}L)$ Λ 102330^{-102300} volcanic ash π $(0^{-1}L)$ Λ 103140^{-102300} vealthered rock black schist $(0^{-1}S)$ C 103460^{-102300} π black schist $(0^{-S}S)$ C 103460^{-103340} π black schist $(0^{-S}S)$ C 103460^{-103530} π black schist $(0^{-S}S)$ C 103460^{-103530} π black schist $(0^{-S}S)$ B 103470^{-103530} π π π π π 103470^{-103530} π π π π π π 103470^{-103500} π π π π π π 10430^{-104070 π π π π π π 103470^{-104070 π π π π <	Sect		Geology	ogy	10 0	Ç	Type and extent
102230-102240 weathered rock black schist w $0)-L$ A 1022600-102290 Volcanic atil m $0)-L$ A 102360-102290 Volcanic atil m $0)-L$ A 103140-103230 Weathered rock black schist $0-S$ C 103320-103450 m black schist $0-S$ B 103460-103530 m black schist $0-S$ B 103460-103530 m m $0-S$ B 103460-103530 m m $0-L$ A 103460-103530 m m $0-L$ A 103460-103530 m m $0-L$ A 103460-104310 m m $0-L$ A 103470-104310 m m $0-L$ A 1034870-104310 m m $0-L$ A 104430-104370 m m $0-S$ 0 104430-104370 m	8₽	5131100 (Ka)	Sur face	bedrock	A D M B	D	of preventive works
102860-102360 volcanic asli solution ω <t< td=""><td>5</td><td>102830-102840</td><td>weathered rock</td><td>black schist</td><td>1</td><td>В</td><td>= 4 . L =</td></t<>	5	102830-102840	weathered rock	black schist	1	В	= 4 . L =
103140-103230walferict ach κ $(3)-S$ C103320-103450 κ black schist $(0-S)$ C103320-103540 κ black schist $(0-S)$ B103370-103530 κ κ $(5-M)$ B103370-103530 κ κ $(5-M)$ B103370-103530 κ κ $(5-M)$ B103470-103530 κ κ $(5-M)$ B103370-103370 κ κ $(5-M)$ B103370-104330 κ κ κ $(5-M)$ B103470-104300 κ κ κ $(5-M)$ B104045-104010 κ κ $(5-M)$ A104130-104300 κ κ $(5-M)$ A104130-104300 κ κ $(5-M)$ A104400-104400 κ κ κ $(5-M)$ A104400-104400 κ κ κ $(5-M)$ A104400-104400 κ κ κ $(5-M)$ A104500-105500 κ κ <td< td=""><td>20</td><td>102860-102980</td><td>volcanic asli soil</td><td>2</td><td>1</td><td>۷</td><td>11 - S T 💥</td></td<>	20	102860-102980	volcanic asli soil	2	1	۷	11 - S T 💥
103320-103450 μ black schist $(\Psi - S)$ C103460-103540 μ $hack schist(\Psi - S)B103470-103530\muhack schist(\Psi - S)B103450-103870\mu\mu(\Psi - S)B103450-103870\mu\mu(\Psi - S)B103450-103870\mu\mu(\Psi - S)B103470-104300\mu\mu(\Psi - S)B10445-104470\mu\mu(\Psi - S)B10445-104470\mu\mu(\Psi - S)B10445-104470\mu\mu(\Psi - S)B10445-104470\mu\mu(\Psi - S)B104430-104430\mu\mu(\Psi - S)B104430-104430\mu\mu(\Psi - S)B104430-104500\mu\mu(\Psi - S)B104430-104500\mu\mu\mu(\Psi - S)104430-105300\mu\mu\mu(\Psi - S)104430-104500\mu\mu\mu(\Psi - S)104430-105300\mu\mu\mu(\Psi - S)104430$	53	103,140-103230	volcanic ash weathered rock	×	1 1	υ	8
103460-103540 n black schist 0-S B 103470-103530 n n n 0-S B 103470-103530 n n n 0-S B 103470-103530 n n n n n 103550-103850 n n n n n 103550-103870 n n n n n 103550-103870 n n n n n 10345701030 n n n n n n 104430-104430 n n n n n n 104430-104430 n n n n n n 104430-104430 n n n n n n n 104430-104430 n n n n n n n 104430-104430 n n n n n n n	4	103320-103450	z	black schist porphyrite		υ	581
103470-103530 μ μ μ θ -MB103350-103350 μ μ θ -LA103350-103350 μ μ θ -LA103350-103350 μ μ θ -LA1033570-104300 μ μ θ -MB104400-104130 μ μ θ -MB104400-1041300 μ μ θ -MA104400-1041300 μ μ μ θ -MA104400-1044300 μ μ μ θ -MA104400-1044300 μ μ μ θ -MA104430-104500 μ μ μ θ -MA104430-104500 μ μ θ -MA104430-104500 μ μ θ -MA104430-104500 μ μ θ -MA104430-104520 μ μ θ -MA104430-104520 μ μ θ -MA104430-104520 μ μ θ θ 104430-104520 μ μ μ θ 104430-105560 μ μ μ θ 105430-105560 μ μ μ θ 105430-105560 μ μ μ θ 105430-105560 μ μ μ θ </td <td>S</td> <td>103460-103540</td> <td></td> <td>black schust</td> <td>1</td> <td>B</td> <td>800</td>	S	103460-103540		black schust	1	B	800
1034550-103350 κ κ κ $(3-5)$ B103850-103370 κ porphyrite $(3-1)$ A103870-104300 κ κ $(3-1)$ A103870-104300 κ κ $(3-1)$ B104400-104130 κ κ $(3-M)$ B104403-104300weathered rockporphyrite $(3-M)$ A104430-104430 κ κ $(3-N)$ A104430-104430 κ κ $(3-N)$ A104400-104400 κ κ $(3-N)$ A104400-104500 κ κ $(3-N)$ A104400-104500 κ κ $(3-N)$ A104400-104500 κ κ $(3-N)$ A104430-104500 κ κ $(3-N)$ A104430-104500 κ κ $(3-N)$ A104430-104500 κ κ $(3-N)$ A104400-104500 κ κ $(3-N)$ A104400-104500 κ κ $(3-N)$ A104400-104500 κ κ κ $(3-N)$ A104530-105300 κ κ κ $(3-N)$ A105430-105560 κ κ κ $(3-N)$ A105530-105100 κ κ κ $(3-N)$ A105530-105560 κ κ κ $(3-N)$ A105530-105560 κ κ κ $(3-N)$ A105530-105560 κ κ κ <t< td=""><td>9</td><td>103470~103530</td><td>2</td><td>2</td><td>W - (\$)</td><td>в</td><td>11 11 11 11 11 11 11 11 11 11 11 11 11 11</td></t<>	9	103470~103530	2	2	W - (\$)	в	11 11 11 11 11 11 11 11 11 11 11 11 11 11
103350-103370 κ porphyrite $(\textcircled{m} - L_{L} \ A)$ 103370-104300 κ $(\emph{m} - L_{L} \ A)$ $(\emph{m} - L_{L} \ A)$ 104000-104130 κ $(\emph{m} - L_{L} \ A)$ $(\emph{m} - L_{L} \ A)$ 104000-104130 κ $(\emph{m} - L_{L} \ A)$ $(\emph{m} - L_{L} \ A)$ 104130-104130 κ $(\emph{m} - L_{L} \ A)$ $(\emph{m} - L_{L} \ A)$ 104400-104430 κ κ $(\emph{m} - R)$ $(\emph{m} - R)$ 104430-104430 κ κ $(\emph{m} - R)$ A 104430-104430 κ κ $(\emph{m} - R)$ A 104430-104430 κ κ $(\emph{m} - R)$ A 104430-104450 κ κ α A 104430-104420 κ κ α A 104430-104420 κ α α A 104430-104420 κ κ α α 104430-104420 κ α α α 104440-1044700 <td>-</td> <td>103650-103850</td> <td>2</td> <td>2</td> <td>11</td> <td>в</td> <td>(0894 m', @11 = 1.5, L = 200 m</td>	-	103650-103850	2	2	11	в	(0894 m', @11 = 1.5, L = 200 m
103.870-104.000 κ κ ω ω Δ 104.000-104.1300 κ κ ω ω B 104.045-104.070 κ ω ω ω B 104.045-104.070 κ κ ω ω B 104.045-104.070 κ κ ω ω B 104.1300-104.070 κ κ ω ω A 104.300-104.500 κ κ ω ω A 104.400-104.500 κ κ ω ω A 104.630-104.500 κ κ ω ω A 104.630-105.600 κ κ ω ω B 105.630-105.600 κ κ ω ω ω C 105.820-105.600 κ κ ω ω ω ω ω 105.820-105.600 κ κ ω ω ω ω ω ω 105.820-105.800 κ κ ω ω ω ω ω ω ω 105.820-105.800 κ κ ω ω ω ω ω ω ω ω 105.820-105.800 κ κ ω ω ω	ŝ	103850~103870	2	porphyrı te		V	=; , L=
1044000-104.130 κ	6	103870~104,000	2	2	1	۲	581 m ²
104.045-104.070 $mathered rock porphyrite m b A 104.130-104.300 mathered rock porphyrite m m A 104.130-104.430 m m m m m A 104.30-104.430 m m m m m A 104.30-104.500 m m m m m A 104.430-104.500 m m m m m A 104.430-104.500 m m m m m A 104.430-104.500 m m m m m A 104.440-104.700 m m m m m A 104.440-104.700 m m m m m A 104.450-104.850 m m m m m A 104.450-104.850 m m m m m M A 104.460-104.850 $	0	104000-104130	*	2	N - ®	æ	2
104.130 ^{104.300} weathered rock porphyrite $@ - M$ A 104.130 ^{104.300} κ n $@ - S$ B 104.400 ^{104.500} κ n $@ - S$ B 104.400 ^{104.500} κ π m a^{-N} A 104.430 ^{104.500} κ π π π A 104.430 ^{104.500} κ π π π A 104.630 ^{104.700} $solt$ κ π Φ^{-N} A 104.630 ^{104.700} κ π Φ^{-N} A A 104.630 ^{105.600 κ π Φ^{-N} A A 105.430^{105.750 κ π Φ^{-N}}}	1	104045~104070			W - (9)	Ð	5. L=
104340-104433 ~ ~ ~ ~ % <	2	104,130~104,300	weathered rock	porphyrite	1	<	
104400-104500 ~ ~ 6-S B 104430-104520 ~ ~ 6-N A 104430-104700 ~ ~ 6-N A 104430-104700 ~ ~ 6-N A 10450-104700 ~ ~ 6-N A 10450-104700 ~ ~ 6-S A 10450-104700 ~ ~ 6-S A 10450-104700 ~ ~ 6-S B 104825-104880 ~ ~ 6-N A 104825-104880 ~ ~ 6-S B 104825-104880 ~ ~ 6-N B 105360-105560 ~ ~ 6-N B 1055300-105560 ~ ~ 6-N A 105530-105560 ~ ~ ~ 6-N A 105530-105560 ~ ~ ~ 6-N A 105530-105560 ~ ~ ~ 6-N A 105530-105580 ~ ~ ~ <td< td=""><td>5</td><td>104340~104430</td><td>2</td><td>2</td><td>1</td><td>B</td><td>(9) 9 0 0 H</td></td<>	5	104340~104430	2	2	1	B	(9) 9 0 0 H
104430-104520 ~ <	4	104400~104500	2	2	11	n	@II=5, 1=100m, \$H=4, L=100m
104,630~104,710 ν ν ν ν λ Δ 104,640~104,700 so11 ν ∞ Δ Δ 104,700 so11 ν ω Δ Δ 104,700~104,825 weathered rock ν ω Δ Δ 104,700~104,825 weathered rock ν ω Δ Δ 104,825~104,800 ν ν ω ω Δ Δ 105,180~105,300 ν ν ω ω Δ Δ Δ 105,180~105,300 ν ν ω ω ω Δ Δ Δ 105,360~105,560 ν ν ω ω ω ω Δ Δ 105,430~105,560 ν ν ω ω ω ω ω ω 105,530~105,750 ν ν ω ω ω ω ω ω 105,230~105,750 ν ν ω ω	5	104430-104520	z	2		۲	(Û402m², (®H=1.5, L=90m
104640-104700 soit ~ 6-S A 64 104700-104700 soit ~ 0 S C 0 1044700-104800 ~ ~ 0 S C 0 104825-104800 ~ ~ ~ 0 N A 0 105180-105300 ~ ~ ~ ~ 0 N A 0 105360-105560 ~ ~ ~ ~ 0 N B Ø 0 1054300-105560 ~ ~ ~ ~ Ø B Ø Ø 1054300-105560 ~ ~ ~ % Ø Ø Ø 1055300-105560 ~ ~ ~ % % Ø Ø 1055320-105510 ~ ~ % % Ø Ø Ø 1055200-106510 ~ ~ % % Ø Ø Ø	6	104,630-104,710	2	2	1.1	<	() =3, L=80m
104.700-104.825 weathered rock ~ 0 C 0 104.825~104.860 ~ ~ 0 A 0 105.180-105.300 ~ ~ ~ 0 B 0 105.180-105.300 ~ ~ ~ ~ 0 B 0 105.360-105.300 ~ ~ ~ ~ 0 B 0 0 105.360-105.560 ~ ~ ~ % B 8 0 0 105.430-105.560 ~ ~ ~ % % 8 8 0 0 105.530-105.560 ~ ~ ~ % % % % 0 0 0 105.530-105.500 ~ ~ ~ %	-	104640-104700	\$ 10s	*	li.	V	. L=6 0
104B25~104B60 ~ <	8	104,700~104,825	weathered rock	2	1	υ,	©1.250m²
105.180~105.300 ~ ~ ~ ~ 0 0 105.360~105.400 votcanic ash black schist © B Ø Ø 105.430~105.560 ~ ~ ~ % 8 Ø Ø 105.430~105.560 ~ ~ ~ % 8 Ø Ø 105.830~105.750 ~ ~ % % % Ø Ø 105.820-106.710 ~ ~ % % Ø Ø Ø 105.820-106.210 ~ ~ % % % Ø Ø 1062.00-106.280 ~ ~ % % % Ø Ø	6	104825~104880	z	2	1.	~	() = 3, L=55m, () = 15, L=55m
105.360~105.400 volcanie ash black schist \$\$\$\$ -M B \$\$\$\$\$\$\$\$ 105.430~105.560 " " " \$	•	105,180~105,300	2	2	l I I	B	0537 m', @11=1.5, L=120m
105430~105560 v v @ - S B @ 1 105530~105550 v v @ - L A Ø 1 105520~106210 v v % - M C Ø 1 106200-106280 v v % - M B Ø	-	105360~105400		black schust		B	, L=40
105530-105750 ~ ~ U~L A ØI 105820-106010 ~ ~ ~ Ø Ø 106200-106280 ~ ~ % Ø M B	~	105430~105560	2	*		8	(6) il=1 0, 1,=1 3 0 m
105820-106210 ~ ~ ~ © M C © 1 106200-106280 ~ ~ ~ © M B ©		105530-105,750	2	z	l i	v	0, L=2
106200-106280 ~ ~ @ - M B @	4	105,820-106,010	2	×	ίι	c	L=19
	c,	106200-106280	×	*	(2) – N	B	କ୍ତି 1.1 2 0 m
							** Preventave works for landslide are shown in Table 7-15

Works
Preventive
(15)
1 2
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Tabl
Annex

Type of expected damage (TD)

- 1. Landslide
- 2 Surface layer fall 3. Rock avalanches
 - 4. Rock (all
- 5. Failure of shoulder and road 6. Debris flow

Extent of damages (ED)

M : Medium scale S : Small scale L : Large scale

Probability of Occurrence (PO)

- A: Iligh probability B: Medium probabily C: Low probabilty
- Type of preventive works
 - Concrete block retaining wall
 - Leaning wall
- Gravity type retaining wall
- Inverted -T type retaining wall
 - Crib wall
- Flexible type wall with concrete frame
 - Rock net
 - Rock fence
- Grout faced
- Wire cylinder (Gabion)
 - Piling works
- - Foot protection
- Sediment control dam
- Watercourse works
 - Bank protection works
 - Cafverts
- Spray application of seed 99
 - Soil removal works

, .			eeo I ogy	2.	C	Type and extent
<u>5</u> 2	Station (Ka)	Sur face	bedrock	ч Ш	2	of preventive works
376	106200~106280	volcante ash	black schist	7-0	<	₩PS-12
377	106350-106400	2	Ł	(\$) - 1	υ	©11=10, L=50m
378	106470~106540	2	*	7 - D	V	¥LS-13
379	106875~106910	*	2	W - (\$)	8	(j) =5. L=35 m
380	107040-107150	t	2	S - (2)	υ	(D.4.9.2 m
381	107,310~107400	*	*	м - Ф	۷	©11=10, L=90m
382	107500~107660	2	*	(j) – S	υ	Ф 1:600 m²
383	107,570~107,640	2	2	Ю - (Ĵ)	<	@H=7, L=70m
384	107,640~107,800	2	2	W - (\$)	B	@H=7, L=160m
385	107850~107880	2	*	S ~ (?)	8	@11=5, L=30m
386	107,950~108,000	2	*	W (\$)	۷	(j)11=7, L=30m
387	108010-108040	2	2	(\$) - S	B	()]]=7, L=30m
388	108330-108380	×	2	S – (2)	V	() 3 3 5 m
389	108570-108800	2	2	'T - (t)	в	祭 LS~14
390	108901~109150	2	2	Q - S	υ	0.559 m²
391	109,151~109,300	2	2	(2) - S	v	(3)H=3, 1,≓150m
392	109,500~109,800	2	2	Ø S	г	(j) 1,3 4 2 m
393	109,810~109,910	2	z	₩-©	٧	@11=5, 1,=60m
394	000011-016601	*	2	S - S	B	(3)[1=3, 1,=100m
395	110,100~110200	soll volcanic ash	2	N - (S)	٧	(5)11=10, L=200m
396	110240-110290	2	*	(2) – S	V	0) 2 2 4 m ¹
397	110290~110360	*	z	N - 9	8	©1 =10, 1,=140m
398	110,90~110,450	*	*	\$ - (2)	<	Ш268 m² 、
668	110450~110540	2	z	2 - 2	C	(1)201 m²
	110540~110590	*	2	N - (2)	8	(1)224 m²

Works
t i ve
Prevent
(16)
5
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t ~
e
Tab
Annex

Type of expected damage (TD) Legend

1. Landslide

2. Surface layer [all

3. Rock avalanches

4. Rock fall

5. Failure of shoulder and road 6. Debris, flow

Exterit of damages (ED)

L t Large scale

Ni: Medium scale

S : Small scale

Probability of Occurrence (PO)

A [±] Ill _Rh probability U [±] Mediun probabily C [±] Low probability

Type of preventive works Concrete block retaining wall

Leaning wall

Gravity type retaining wall Inverted – T type retaining wall

Crib wall

Flexible type wall with concrete frame

Rock net

Rock Jence

Grout faced

Wire cylinder (Cabion)

Piling works

Foot protection

Sediment control dam

Watercourse works

Bank protection works

Cuiveris

Spray application of seed Soil removal works

				. 1		
Sect	Station	Geology	ogy	0 %	0d	Type and extent
2 E		Sur face	bedrock	Ē	 	of preventive works
401	110,700~111100	soil voicanic ash	black schust	@-S	υ	(D) 894 m²
402	111330-111400	volcanic ash	2	(2) – S	1	(1)391 m ¹
403	111,730-111840	2	2	S - S	n	(D 4 9 2 m ²
404	111840-112000	*	Ł	©-S	ນ	(1) 3 5 8 m²
405	112000-112050	ł	Ł	W-(\$)	۲	(i)H=5, L=50m
406	112200~112340	×	t	8 - ®	υ	@783m²
407	112340~112520	z	*	0- F	V	梁LJS-15
408	113,000-113200	2	*	л - Г Ф - Г	<	※LS~1 6
409	114,340~114,450	weathered	di abase	() – S	ų	@2.2.0.0 m²
410	114,550~114,600	2	2	@ - S	ບ	(D 2 2 4 m²
411	114,650~114,700	soil	2	W - @	B	(1) З 9 1 гг/
412	114860-114940	2	z	W - (2)	υ	()358㎡, ()]1=1.5, L=80m
413	115070-115100	volcanic ash	black schist	W - (\$)	æ	(j)H=5, L=30m
414	115,125~115,150	2	2	2 - S	۷	Ф168m'
415	115200~115400	2	2	Q - S	Ð	(0.671m/,®]l=1.5, L=200m
416	115400~115500	*	2	В – М	4	©H=5,.L=100m
417	115540~115500	2	z	W - ©	8	(J)]]=7, L=60m
418	115700~115770	Ł	2	(\$) — Г	۷	(011=7. L=140m
419	116360-116430	2	k	Q – S	υ	(û 3.1.3 m'
420	116,600~116,550	æ	~	W − \$	υ	@ ki=7, L=50m
421	116900~116980	z	2	S - (2)	B	()) 3 5 8 m
422	117,20~117,160	2	*	9 - M	£	④II=5, 1,=40m
423	117,170-117300	*		S - (2)	ပ	(D) 5 8 1 m ¹
424	117470-117520	2	Ł	(2) – S	В	© 3 3 5 m²
425	117700-117790	2		W - (2)	B	Ϣ402㎡, ϢH=1.5, L=90 m
					:	X Preventive works for lamislide are shown in Table 7-15

2 - (17) Preventive Works Anney Table 7

Type of expected damage (TU)

Legend

- 1. Landslide
 - 2. Surface layer fail
 - 3. Rock avalanches
- 4 Rock fall
- 5. Failure of shoulder and road 6. Debris flow

Extent of damages (ED)

- L : Large scale
- M : Medium scale S : Smail scale

Probability of Occurrence (PO)

- A : Ilight probability B : Medium probabily C : Low probabilty
- Type of preventive works
 - Concrute block retaining wall
 - Leaning wall
- Gravity type retaining wall
- Inverted T' type retaining' wall
 - Crib wall
- Flexible type wall with concrete frame
 - Rock net
 - Rock fence
- Grout faced
- Wire cylinder (Oablon)
 - Puling works

 - Foot protection
- Sediment control dam
- Watercourse works
 - Bauk protection works

 - Culverts
- Spray application of seed
 - Soil removal works

l.egend	Type of expected damage (T))	i Landslide		3. Rock avalanches 4. Rock fall	5. Fatture of shoulder and road ביביביניבי		Extent of damages (ED)	L : Large scale	M : Medium scale	S : Small scale	Brohability of Orginization (DO)		D: Medium probabily C: t	61110001d worr - 0	Time of the second of the second	Denorate block retaining wall		 Untavity type relating wait Inverted - T type retaining wall 	 Crib wall Flauble two will with concrete frame 		 Back fence G Grout faced 	-	W Filing works W Foot protection	(1) Sediment control dam (1) Waterrouren worke		de Culverts Of Soray application of seed	de Soil removal works	
Preventive Works	Type and extent	of preventive works	×18-17	$\textcircled{m} 11=3 \qquad \textcircled{m} 11=1.5 \qquad \textcircled{m} 11=3.5 \ \rule{m} 11=3.5 \ $	@H=s. L=s0m	0.246 m²	()!!=5, !,=80m	Ф.268 м'	@179щ	QH=5, L=30m	@313m	@]]=5, L=40m	(3)H=3, L≓40m	() 6 2 6 m², () H=1.5, L=1 4 0 m	¥ LS-18	m 0 0 0 (J)	())]]=7, L=50m	(D 6 0 4 m²	⊕H=7, L=90m	(3) И=3, 1,=140 m	بس 0 & O)	r™0600	(i) 1=5, L=30 m	(j) [=7, [,=4 0 m	(j) 3 3 5 m²	QD 3,6 0 0 m	() H=7, L=30m	1% Preventive works for landslide are shown un Table 7–15
Preve	C d	2	-	<	<	8	υ	υ	۷	۷	υ	<	۷	v	V	V	U	ບ	v	8	ບ	J	υ	ß	8	۷	C	
(18)	TD &	a O	7 - 0	W - 9	W - @	ß – S	\$-\$	@-8	(Z) – S	W - (S)	@- S	Ю - Ю	W - ®	W - ®	() — Г	W - (\$)	W – (\$)	@ - S	(\$) – N	Q - S	B – S	S - (Ş)	(S) – S	(S) ~ N	W - (2)	© - 1	(S) – M	
e 7 – 2 –	ogy	bedrock	black schust	2	z	2	×	2	Ł	z	Ł	2	*	*	e	t	z	2	z	۲	x	Ł	Ł	¥	ž	, r	#	
Annex Table	Geology	Sur face	volcanic ash	2	z	2	E	×	z	2	Ł	2	"	*	и	z	Ł	z	2	æ	Ł	£	2	Ł	*	2	Ł	ł
A	Station	(Ka)	117,130~118,120	118,150~118,220	118350~118400	118420-118475	118520~118600	118600~118660	118660-118700	118710~118740	118740~118810	118810-118850	119220-119260	119310-119450	119550~119,650	119,650~119,780	119950~120000	120150~120330	120250~120340	120410~120550	120430-120450	120520-120550	120,720-120,750	120,780~120,820	120,820~120,870	120850~120970	121,030-121,060	
	Sect	뭘	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	

ſ	Tvne of	1. Landslide		4 Rock fall	5. Failure o		Exten	L : Large sca	M : Medium so	0 : 00011 80	Probab i Li		B Nedlun			D Concrete		O Gravity 1 O Inverted	Crib wall		(C) Rock fend	•	D Foot prot	-		dð Culverts da Sprav apr	C 2011 rem	1
Preventive Works	Type and extent	of preventive works	(0)]=7. $L=80m$	Ф1,610 m²	@H=7, L=100m	(j)H=5, L=50m	@H=5. L=250m	@11=5, L=150m	@H=5, L=70m	@H=7, L=20m	@H=7, L=20m	(())))))))))))))))))))))))))))))))))))	@134m'	③H=3, L=30m	@H=s, 1=20m	(J)H=5, L=20m	(J)H=5. L=30m	@H=7, L=60m	@H=7, L=150m	()H=7, L=150m	0671m'.	@H=5. L=50m	GH=5, L=40m	@1,610m²	@11=10, L=60m	Ш716н [;]	©11=10, Ъ=70m	XF Preventive works for landslide are shown in Table 7-15
reve	Ċ	2	c	υ	a	υ	8	C	B	B	v	=	υ	8	U	U	υ	m		=	U	υ	C	ల	<	υ	υ	
(19) F	0 ¥	5 G	(5) – M	(2) - S	Ю – Ю	\$-\$	(S) – M	S-S	6 - S	W - 9	W - ®	(G) – M	(2) - S	N − ())	\$ - \$	(ŝ) – S	(t) – S	W - ©	W-(5)	(f) – L	Q - S	W - (\$)	W - (3)	(2) - S	(Q - L	8 - ®	W - Ø	
7 - 2 -	ogy	bedrock	black schist		*	2	2	2	2	2	2	*	2	*	2	2	E	*	2	*		*		2	*	*	*	
Annex Table	Geology	Sur face	volcanic ash	*	*	z	2	2	2	2	2	2	•	2	z	1	z	2		2	2	z	2	2	#		2	
Aı	Station Station	(m) (ka)	121270-121350	121,400~121880	121,850-122050	122700-122750	123050-123300	123500~123650	123650~123720	123800-123820	123840-123860	123870-123930	124,030-124,060	124,150~124,180	124,190~124270	124,300, 124,320	124,370-124,400	124,620-124,680	124850-125000	125,025-125100	125250-125400	125480-125530	125740-125780	125860-126220	126,050-126,110	126220-126380	126450-126520	
1	Sect	5 2	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475]

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Preventive Works	Type and extent	of preventive works	<pre>③ i=3, L=50m</pre>	மு7 8 3 ரு	③H=3, L=125m	④H=5. L=65m	③H=3. L=100m	©1[=10, L=100m	ри 1 2 9 ^{нг} ,	00134 m²	@1.342 m²	0.839 m²	()11=5, 1.=60m	0235 <i>*</i> *	@134 m²	©H=10, L=70m	① 1.6 7 7 m²	(3)11=3, 1,=100m	(j) 1,5 6 5 m²	()]]=7, L=50 m	0537 m²	(3)11=3, 12=50m	(1) 3 3 S m ¹	л ^щ 0 6 (Т)	() 3 3 5 m²	© 1,500 m²	Ф1,118 "	* Preventive works for landslide are shown in Table 7-15
Preve	G	2	υ	c	a	ß	E	£	υ	υ	m	υ	R	υ	B	8	υ	B	υ	ล	C	æ	ပ	B	ບ	=	<u>_</u>	
(20)	TD •	а Ш	(2) – M	(2) ~ S	W - 0	Ю-М	@-8	N - ()	S - S	\$-\$	@ - 8	@ - 8	9 - W	@ - 8	W - ®	M - ₩	@ - S	м-Э	(2) – M	10 - W	3 - S	0-W	M – Ø	(2) – S	(2) – W	0 - S	(2) – S	
e7-2-	ogy	bedrock	black schist	1	2		*	1	2	2	2	2					2	2	2	2	1	2	2	2	2	2	2	
Annex Table	Geology	Sur face	volcanic ash	2	2	:	2	*	£	2	2	2	2	2	2	2		2	2	*	Ł	2	*	2	2	*	2	
ţ		(Ka)	126,610~126,660	126900-127,075	127075-127200	127,310-127,375	127580~127680	127,680~127,780	127,970~128,050	128050~128080	128,150~128,450	128,450~128,700	128760-128820	128800-128870	128,870~128,900	128930~129000	129,000~129500	129520-129620	129,620~129900	129950-130000	130000-130,120	130180-130230	130230-130330	130330~130350	130350~130450	130450~130600	130600-130800	
	Sect	ź	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500]

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q	damage
Legend	expected
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Lands lide

Surface layer fail

Rock avalanches

Rock fall,

Failure of shoulder and road

Debris flow

Extent of damages (ED)

Large scale

Medium scale

Small scale

obability of Occurrence (PO)

lligti probability Medium probabily Low probabilty

Type of preventive works Concrete block retaining wall

Leaning wall

Gravity type retaining wall Inverted -- T type retaining'wall

Crib wall

Flexible type wall with concrete frame

Rock net

Rock fence

Urout faced

Wire cytinder (Oubion)

Puling works

Foot protection

Sediment control dam

Watercourse works

Bank protection works

Culverts

Spray amplication of seed Soil removal works

	A	Annex Table	e7-2-	(21)	Pøeve	(21) P y eventive Works	пере.1
Sect	Ctation	Geology	ogy	0 s	C a	Type and extent	Tune of expected
5 z		Surface	bedrock	ΕD	2	of preventive works	1. Landslide
501	130960~131,000	volcanic ash	black schist	(i) - S		@400 m²	
502	001151-070151	z	2	(Z) - S	13	(1) 134 m²	3. Rock avalapches 4. Rock falt
503	131400-131420	volcanic ash weathered rock	green schist	W - Ø	B	@11=3, L=20m	5. Pailure of shoulder and
504	131,420~131,625	32	2	() – S	υ	(D) 4 7 0 m²	
505	131,625-131,675	*	z	W - (2)	V	(0 2 2 4 m², (0) ll = 1.5, L = 5 0 m	Extent of dama
506	131,725~131,810	z	black schest	W - (2)	B	() 3 8 0 m ² , () 11 = 1.5, L = 8 5 m	L : Large scale
507	131,810~132,000	z	green schist	W - (₿)	۷	@ 1,9 0 q m'	M : Medium scale
508	132000-132040	z	drabase	W - ©	۷	@ 800 m	S : Small scale
509	132150-132340		2	M - ©	Y	@H=3, L=190m, @H=1.5, L=100m	
210	132340~132520	2	2	(2) – S	Ð	Ф 8 0 5 m²	
511	132520-132750	2	green schist	N - (î)	9	© 2,300 m ²	A : IIIgh probability B : Medium probabily C
512	132900-133000	*	diabase	Q - S	B	©H=3, L=100m	
513	133000-133200		z	(Z) – S	υ	@894 m'	-
514	133380~133420		2	(Z) – S	Ð	0179m ⁴	I ype of prevent O Concrete block retain
515	133680~133710	u	ŧ	(2) – S	υ	©134m	
516	133830~134120		"	(2) - S	B	Ю1,621, л	③ Oravity type retainin ④ Inverted - T type reta
517	134,400~134,800	2	×	Q - S	υ	Q1.789m	
							C Rock net
							B Rock fence
							O Pitlng works
							(b) Culverts (t) Same mulication of a
						X Preventive works for landslide are	

scted damage (TD)

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shown in Table 7-15

	Extent of Damage: L	arge, Probability:	High	(U)	NIT: \$'000)
No.	Station	Classification	Preventive Work (A)	Corrective Work (B)	(<u>A - B</u>)
4	K62.520-K62.800	Landslide	9,881	8,229	(+)1,652
5	K62.800-K62.830	Fall	505	3,147	(-)2,642
95	K71.735-K71.760	Debris flow	1,101	7,617	(-)6,516
98	K71.770-K72.240	Landslide	25,438	23,021	(+)2,417
102	K72.830-K72.840	Debris flow	510	2,318	(-)1,808
108	K73.670-K73.920	Landslide	4,328	12,857	(-)8,529
116	K75.290-K75.400	Fall	1,575	3,957	(-)2,382
117	K75.400-K75.505	Landslide	5,636	5,262	(+) 374
118	K75.505-K75.515	Debris flow	2,446	2,318	(+) 128
119	K75.530-K75.555	Fall	253	2,623	(-)2,370
141	K77.830-K78.080	Landslide	7,766	12,639	(-)4,873
177	K82.000-K82.300	Landslide	19,283	15,167	(+)4,116
201	K85.430-K85.440	Debris flow	1,424	2,318	(-) 894
253	K93.345-K93.360	Debris flow	1,041	7,617	(-)6,576
265	K93.950-K94.050	Failure of Valleyside	7,206	7,477	(-) 271
274	K94.670-K94.760	Failure of Valleyside	6,332	7,085	(-) 753
285	K95.780-K95.860	Fall	1,168	2,523	(-)1,355
310	K97.730-K97.820	Landslide	9,384	4,421	(+)4,963
312	K97.900-K97.920	Debris flow	408	7,617	(-)7,209
352	K102.860-K102.980	Landslide	3,975	5,974	(-)1,999
358	K103.850-K103.870	Failure of Valleyside	581	7,617	(-)7,036
373	K105.530-K105.750	Landslide	15,011	11,035	(+)3,976
376	K106.200-K106.280	Landslide	5,547	3,976	(+)1,571
378	K106.470-K106.540	Landslide	3,179	3,497	(-) 318
407	K112.340-K112.520	Landslide	5,638	9,187	(-)3,549
408	K113.000-K113.200	Landslide	3,037	10,099	(-)7,062
418	K115.700-K115.770	Failure of Valleyside	7,494	6,302	(+)1,192
438	K119.550-K119.650	Landslide	9,497	4,865	(+)4,632
44y	K120.850-K120.970	Failure of Valleyside	23,890	8,260	(+)15,630
473	K126.050-K126.110	Failure of Valleyside	4,094	5,519	(-)1,425
	Total		187,628	214,544	(-)26,916

Extent of Damage: Large Probability

Note: This is a list of locations at which there is high probability for slope failure.

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Annex Table 7-3 (2) Comparison of Direct Cost between Preventive Work and Corrective Work

Extent of Damage: Medium, Probability: High

(Unit: \$'000)

	Extent of Da	mage: Medium, Prob	ability: High	(Unit:	\$'000)
No.	Station	Classification	Preyentive Work (A)	Corrective Work (B)	(A) - (B)
6	K63,200-K63,385	Fall	2,273	1,021	(+) 1,252
10	K63,860-K63,960	Fall	123	478	() 355
22	K64,915-K65,000	Failure of valley side	511	3,917	(-)3,406
26	K65,375-K65,385	Debris flow	633	4,817	(-)4,184
27	K65,420-K65,425	Debris flow	633	4,817	(-)4,184
33	K65,900-K66,220	Fall	3,687	1,532	(+)2,155
34	K66,020	Debris flow	408	4,817	(-)4,409
37	K66,220	Debris flow	306	4,817	(-)4,511
39	K66,290	Debris flow	663	4,817	(-)4,154
43	K66,865-K66,880	Fall	137	376	(-) 239
51	K67,120-K67,200	Fall	983	478	(+) 505
53	K67,260-K67,325	Fall	658	478	(+) 180
66	K68,120-K68,145	Fall	253	478	(-) 225
70	K68,365-K68,400	Fall	511	478	(+) 33
78	K69,060-K69,090	Fall	682	478	(+) 204
82	K69,300-K69,360	Fall	468	478	(_) 10
85	K69,540-K69,665	Fall	977	1,021	(-) 44
91	K70,515-K70,525	Land slide	101	239	(-) 138
94	K71,445-K71,730	Debris flow	1,274	6,371	(-) 5,097
101	K72,785-K72,795	Debris flow	408	4,817	(-) 4,409
111	K74,260-K74,280	Debris flow	611	4,817	(-) 4,206
128	K77,125-K77,135	Debris flow	1,628	4,817	(-) 3,189
130	K77,285-K77,390	Fall	1,291	1,021	(+) 270
131	K77,390-K77,410	Debris flow	735	4,817	(-) 4,082
144	K78,260-K78,300	Fall	313	478	(-) 165
149	K78,600-K78,665	Failure of valley side	3,479	3,917	(-) 438
154	K79,040-K79,100	Debris flow	1,172	4,817	(-)3,645
158	K79,380-K79,390	Debris flow	1,180	4,817	(-)3,637
161	K79,625-K79,635	Failure of valley side	592	783	(-) 191
167	K80,030-K80,060	Failure of valley side	1,606	2,350	(-) 744

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Note; This is a list of locations at which there is a high probability of slope failure.

Annex Table 7-3 (3) Comparison of Direct Cost between Preventive Work and Corrective Work

	4	edium, ilobability		(OUTC)	,,
No.	Station	Classification	Preventiye Work (A)	Corrective Work (B)	(A) - (B)
		1			
175	K81,500-K81,590	Fall	1,056	478	(+) 578
180	K82,660-K82,750	Fall	1,458	478	(+) 980
184	K83,160-K83,225	Fall	925	478	(+) 447
198	K85,290-K85,375	Fall	5,800	478	(+)5,322
199	K85,380-K85,390	Debris flow	490	4,817	(-)4,327
213	K86,400-K86,540	Fall	853	1,021	(-) 168
219	K87,000-K87,040	Fall	405	478	(-) 73
222	K87,250-K87,300	Fall	3,609	478	(+) 3,131
225	K87,475-K87,530	Fall	676	478	(+) 198
226	K87,530-K87,570	Failure of valley side	366	3,133	(-)2,767
239	K88,650-K88,660	Debris flow	1,160	4,817	(-)3,657
243	K88,950-K89,000	Failure of valley side	3,412	3,917	(-) 505
263	K93,880-K93,890	Debris flow	1,567	4,817	(-) 3,250
268	K94,180-K94,230	Failure of valley side	6,823	3,917	(+) 2,906
273	K94,675-K94,800	Fall	1,524	478	(+) 1,046
281	K95,370-K95,380	Debris flow	136	4,817	(-) 4,681
286	K95,860-K96,200	Fall	1,041	2,043	(-) 1,002
291	K96,320-K96,365	Fall	679	3,612	(-)2,933
297	K96,645-K96,800	Fall	1,904	1,021	(+) 883
308	K97,560-K97,580	Failure of valley side	1,071	1,567	(+) 496
311	K97,820-K97,900	Fall	1,139	478	(+) 661
317	K98,310-K98,325	Failure of valley side	436	1,175	(~) 739
322	K98,770-K98,885	Fall	374	1,021	(-) 647
325	K98,950-99,060	Failure of valley side	3,194	7,833	(-) 4,639
327	K99,065-K99,085	Failure of valley side	581	1,567	(-) 986
330	K99,390-K99,410	Failure of valley side	681	1,567	(-) 986

Extent of Damage: Medium, Probability: High

(Unit: \$'000)

Note; This is a list of locations at which there is a high probability of slope failure.

Annex Table 7-3 (4) Comparison of Direct Cost between Preventive Work and Corrective Work

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		ge: Medium, Prob	Preventive	(Unit:	T
No.	Station	Classification	Work (A)	Corrective Work (B)	(A) - (B
350	K102,650-K102,750	Fall	1,424	478	(+) 946
362	K104,130-K104,300	Fall	416	1,021	(-) 605
365	K104,430-K104,520	Fall	1,105	478	(+) 627
366	K104,630-K104,710	Fall	810	478	(+) 332
369	K104,825-K104,880	Fall	803	478	(+) 325
381	K107,310-K107,400	Land slide	6,141	2,298	(+) 3,843
383	K107,570-K107,640	Failure of valley side	3,747	3,917	(-) 170
386	K107,950-K108,000	Failure of valley side	1,606	3,917	(-)2,311
393	K109,850-K109,910	Failure of valley side	1,742	3,917	(-)2,175
395	K110,100-K110,200	Failure of valley side	13,646	3,917	(+)9,729
405	K112,000-K112,050	Failure of valley side	1,452	3,917	(-)2,465
416	K115,400-K115,500	Failure of valley side	2,904	3,917	(-)1,013
427	K118,150-K118,220	Debris flow	1,594	4,817	(-) 3,223
428	K118,350-K118,400	Failure of valley side	1,452	3,917	(-)2,465
433	K118,710-K118,740	Failure of valley side	1,162	3,133	(-)1,971
436	K119,220-K119,260	Fall	405	478	(-) 73
437	K119,310-K119,450	Fall	1,720	1,021	(+) 699
439	K119,650-K119,780	Failure of valley side	5,973	7,833	(-)1,860
442	K120,250-K120,340	Failure of valley side	4,818	3,917	(+) 901
459	K123,840-K123,860	Failure of valley side	1,071	1,567	(-) 496
505	K131,625-K131,675	Fall	615	478	(+) 137
507	K131,810-K132,000	Fall	233	1,532	(-) 1,299
⁵ 09	K132,150-132,340	Fall	2,774	1,021	(+) 1,753
	Total		128,040	197,120	(-)69,080

Note; This is a list of locations at which there is a high probability of slope failure.

Annext Table 7-3 (5) Comparison of Direct Cost between Preventive Work and Corrective Work

		amage: Large, P	robability: Mediu	m (UNIT:	\$'000)
No.	Station	Classification	Preventive Work (A)	Corrective Work (B)	A - B
3	K62,000-K62,045	Failure of Valleyside	757	3,525	(-) 2,768
64	K67,990-K68,000	Debris flow	980	1,602	(-) 622
74	K68,560-K68,570	Debris flow	611	1,602	(-) 991
86	K69,690-K69,700	Debris flow	408	1,602	(-) 1,194
124	K76,520-K76,840	Land slide	6,337	14,817	(-) 8,480
143	K78,260	Debris flow	1,838	1,602	(+) 236
195	K84,250-K84,260	Debris flow	1,914	1,602	(+) 312
210	K86,040-K86,080	Failure of	2,729	12,227	(-) 9,498
211	K86,260-K86,355	Valleyside Fall	6,482	3,235	(+) 3,247
230	K87,850-K87,885	Fall	499	2,460	(-) 1,961
272	K94,620-K94,630	Debris flow	611	1,602	(-) 991
282	K95,390-K95,400	Debris flow	1,123	1,602	() 479
298	K96,710-K96,755	Failure of Valleyside	6,141	3,525	(+) 2,616
300	K96,800-K96,920	Failure of Valleyside	7,035	7,479	(-) 442
389	K108,570-K108,800	Land slide	2,272	10,731	(-) 8,459
468	K125,025-K125,100	Failure of Valleyside	8,029	6,302	(+) 1,727
Tot	al Direct Cost	· · · · · · · · · · · · · · · · · · ·	47,766	75,513	(-) 27,747

Extent of Damage: Large, Probability: Medium (UNIT: \$'000)

Note; This is a list of locations at which there is a medium probability of slope failure.

Annex Table 7-3 (6) Comparison o

Comparison of Direct Cost between Preventive Work and Corrective Work

	Extent of Dama	ige: Medium, Proba	bility: Medium	1 (Unit: \$'	000)
No.	Station	Classification	Preventive Work (A)	Corrective Work (B)	(A) - (B
1	K61,820-K61,850	Failure of valley side	275	2,828	(-)2,553
17	K64,340-K64,375	Fall	35	478	(-) 443
20	K64,580-K64,590	Debris flow	203	251	(-) 48
29	K65,480-K65,820	Fall	624	2,043	(-)1,419
32	K65,840-K65,880	Fall	406	12	(+) 394
46	K66,985-K67,015	Debris flow	115	4,817	(-)4,702
52	K67,215-K67,260	Failure of valley side	2,409	3,525	(-)1,116
69	K68,340-K68,365	Fall	307	478	(-) 171
71	K68,430-K68,450	Fall	24	478	(-) 454
73	K68,540-K68,550	Debris flow	731	4,817	(-)4,086
75	K68,570-K68,620	Fall	1,348	478	(+) 870
84	K69,400-K69,540	Fall	172	1,021	(-) 849
96	K71,470-K71,525	Failure of valley side	2,944	4,308	(-)1,364
97	K71,705-K71,730	Failure of valley side	229	1,958	(-)1,729
99	K72,400-K72,600	Land slide	13,646	5,107	(+) 8,539
100	K72,695-K72,780	Fall	664	478	(+) 186
132	K77,320-K77,400	Failure of valley side	1,346	3,917	(-)2,571
133	K77,410-K77,520	Fall	1,075	1,021	(+) 54
139	K77,710-K77,720	Debris flow	204	4,817	(-)4,613
146	K78,360-K78,400	Failure of valley side	214	3,133	(-)2,919
164	K79,720-K79,745	Failure of valley side	196	1,958	(-)1,762
166	K79,980-K80,055	Fall	921	478	(+) 443
170	K80,400-K80,420	Failure of valley side	581	1,567	(-) 986
181	K82,750-K82,880	Fall	2,105	1,021	(+) 1,084
191	K83,820-K83,830	Debris flow	1,442	4,817	(-) 3,375
194	K84,200-K84,320	Fall	1,171	1,021	(+) 150
205	K85,690~K85,725	Failure of yalley side	1,873	2,742	(-) 869

Extent of Damage: Medium, Probability: Medium (Unit: \$'000)

Note; This is a list of locations at which there is a medium probability of slope failure.

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Annex Table 7-3 (7) Comparison of Direct Cost between Preventive Work and Corrective Work

Extent of Damage: Medium, Probability: Medium

: Medium (Unit: \$'000)

No.	Station	Classification	Preventiye Work (A)	Corrective Work (B)	(A) - (E
212	K86,360-K86,370	Debris flow	735	4,817	(-)4,082
217	K86,750-K86,815	Failure of valley side	4,435	3,917	(+) 518
228	K87,630-K87,660	Fall	74	478	(-) 404
233	K88,010-K87,055	Fall	418	478	(-) 60
238	K88,580-K88,610	Failure of valley side	2,047	2,350	(-) 303
250	K93,160-K93,170	Debris flow	592	4,817	(-)4,225
252	K93,260-K93,300	Failure of valley side	2,141	3,133	(-) 992
255	K93,520-K93,590	Fall	709	478	(+) 231
256	K93,590-K93,640	Fall	615	478	(+) 137
259	K93,710-K93,760	Fall	92	478	(`-) 386
260	К93,760-К93,820	Fall	852	478	(+) 374
262	K93,840-K93,910	Failure of valley side	2,033	3,917	(-)1,884
271	K94,540-K94,600	Failure of valley side	1,742	3,917	(-)2,175
276	K94,880-K94,900	Failure of valley side	581	1,567	(-) 986
278	K95,000-K95,045	Fall	679	478	(+) 201
279	K95,045-K95,110	Fall	223	478	(-) 255
287	K96,010-K96,040	Failure of valley side	1,606	2,350	(-) 744
296	K96,630-K96,645	Failure of valley side	803	1,175	(-) 372
299	K96,800-K96,920	Fall	221	1,021	(-) 800
302	K96,985-K97,040	Failure of valley side	1,597	3,917	(-)2,320
316	K98,200-K98,290	Failure of valley side	4,817	3,917	(+) 900
321	K98,570-K98,635	Failure of valley side	1,888	3,917	(-)2,029
351	K102,830-K102,840	Debris flow	408	4,817	(-)4,409
356	K103,470-K103,530	Failure of valley side	1,742	3,917	(-)2,175

Note; This is a list of locations at which there is a medium probability of slope failure.

Annex Table 7-3(8)

Comparison of Direct Cost between Preventive Work and

Corrective Work

Extent of Damage: Medium, Probability: Medium (Unit: \$'000)

No.	Station	Classification	Preyentive Work (A)	Corrective Work (B)	(A) - (B)
					· · · · · · · · · · · · · · · · · · ·
360	K104,000-K104,130	Fall	947	2,980	(-)2,033
371	K105,360-K105,400	Failure of valley side	366	3,133	(-)2,767
375	K106,200-K106,280	Fall	1,166	1,021	(+) 145
379	K106,875-K106,910	Failure of valley side	1,016	2,742	(-)1,726
384	K107,640-K107,800	Failure of valley side	8,564	7,833	(+) 731
397	K110,290-K110,360	Failure of valley side	9,552	3,917	(+)5,635
400	K110,540-K110,590	Fall	391	478	() 87
411	K114,650-K114,700	Fall	683	478	(-)1,479
417	K115,540-K115,600	Failure of valley side	3,212	3,917	(-) 705
422	K117,120-K117,160	Failure of valley side	1,162	3,133	(-)1,971
425	K117,700-K117,790	Fall	1,105	478	(+) 627
447	K120,780-K120,820	Failure of valley side	2,141	3,133	(-) 992
448	K120,820-K120,870	Fall	585	478	(+) 107
453	K121,850-K122,050	Failure of valley side	5,353	7,833	(-)2,480
455	K123,050-K123,300	Failure of valley side	7,260	11,750	(-)4,490
458	K123,800-K123,820	Failure of valley side	1,071	1,567	(-) 496
460	K120,870-K123,930	Failure of valley side	3,212	3,917	(-) 705
462	K124,150-K124,180	Land slide	304	717	(-) 413
466	K124,620-K124,680	Failure of valley side	3,212	3,917	(-) 705
467	K124,850-K125,000	Failure of valley side	8,029	7,833	(+) 196
478	K127,075-K127,200	Land slide	1,266	3,192	(-)1,926
479	K127,310-K127,375	Failure of valley side	1,887	3,917	(-)2,030
481	K127,680-K127,780	Land slide	6,823	2,554	(+)4,269

Note; This is a list of locations at which there is a medium probability of slope failure.

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Annex Table 7-3 (9) Comparison of Direct Cost between Preventive Work and Corrective Work

	Extent of Damage:	Medium, Probabil	ity: Medium	(Unit: \$	1000)
No.	Station	Classification	Preyentiye Work (A)	Corrective Work (B)	(A) - (B)
486	K128,760-K128,820	Failure of valley side	1,742	3,917	(-)2,175
488	K128,870-K128,900	Fall	234	478	(-) 244
489	K128,930-K129,000	Land slide	4,776	1,788	(+)2,988
491	K129,520-K129,620	Land slide	1,013	2,554	(-)1,541
493	K129,950-K130,000	Failure of valley side	2,676	3,917	(-)1,241
495	K130,180-K130,230	Fall	506	478	(+) 28
503	K131,400-K131,420	Fall	203	478	(-) 275
506	K131,725-K131,810	Fall	1,044	478	(+) 566
511	K132,520-K132,750	Fall	282	1,532	(-)1,250
<u> </u>	Total		148,964	215,747	(-) _{66,783}

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Note; This is a list of locations at which there is a medium probability of slope failure.

Annex

Table 7	- 4 PREVENTIVE AND COL	RRECTIVE WORKS: QUANTITIES	(Page 1)
Station	Preventive Works	Corrective Works	Remarks
No.5 K62.800- K62.830	Slope protection 30 ^m (Concrete leaning wall)	Removal of fall mass 900 ^{m3} Gravity wall H=4m 30 ^m	Need at least 2 days for reopening one lane
No.95 K71.735- K71.760	Concrete gravity dam 40m H=4m Concrete Lining Channel 20m W=4m	Retaining Wall H=10m 20m (Crib type) P.C.T.Bridge L=20m 1 Span	3 days for reopening one lane
No.102 K72.830- K72.840	Concrete gravity dam 25m H=4m	Retaining Wall B=10m 10m (Crib type) R.C.Bridge L=10m 1 Span	2 days for reopening one lane
No.108 K73.670- K73.920	Horizontal drilling 360m Collecting drain 190m Pipe drainage 600 dia. 300m Gravity wall H=3m 240m Miscellaneous work	Removal of sliding mass 11,200m ³ Gravity wall H=4m 280m Half bridge 56m Paving and Miscellaneous	3 days for reopening one lane
No.116 K75.290- K75.400	Slope protection 246m ² (Concrete block) Slope protection I,100m ² (Concrete frame work)	Removal of fall mass 1650m3 Gravity wall H=4m 55m Paving and Miscellaneous	2 days for reopening one lane
No.119 K75.530- K75.505	Gravity wall H=3m 25m Rock fence 25m	Removal of fall mass 750m3 Retaining wall H=4m 25m Half bridge 25m	2 days for reopening one lane
No.141 K77.830 K78.080	Collecting drain 120m Pipe drainage 600 dia. 200m Retaining wall H=10m 100m Miscellaneous work	Removal of sliding mass 11,000 m3 Gravity wall H=4m 275m Half bridge 55m Paving and Miscellaneous	3 days for reopening one lane
No.201 K85.430- K85.440	Concrete gravity dam 20m H=4m Concrete lining channel W=4m 20m Box Culvert 4.5mx4m 8m	Retaining wall H=10m 10m (CRIB TYPE) R.C. Bridge L=10m 1 Span	2 days for reopening one lane
No.253 K93.345- K93.360	Concrete gravity dam 16m H=4m Concrete lining channel 50m W=4m	Removal of fall mess (Crib type) P.C.T.Bridge L=20m 1 Span	2 days for reopening one lane

Annex

Table 7-4 (Cont'd)

PREVENTIVE AND CORRECTIVE WORKS: QUANTITIES

(Page 2)

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Station	Preventive Works	Corrective Works	Remarks
No.265 K93.950- K94.050	Retaining wall H=10m 100m (Crib type) Gabion 600 dia. 1=6m 500m2	Half bridge 75m R.C.Bridge L=10m 1 Span	5 days for recpening one lane
No.274 K94.670- K94.760	Retaining wall H=7m 90m Slope protection 90m (Concrete Leaning wall)	Half bridge 70m R.C.Bridge L=10m	5 days for reopening one land
No.285 K95.780- K95.860	Gravity wall H=3m 80m Rock fence 80m	Removal of fall mass 1,200m3 Gravity wall H=4m 40m Half bridge 20m	7 days for reopening one lane
No.312 K97.900- K97.920	Concrete gravity dam. 20m H=4m Concrete Lining Channel 50m	Retaining wall H=10m 20m P.C.T.Bridge L=20m 1 Span	3 days fo r reopening one lane
No.352 K102.860- K102.980	Horizontal drilling 180m Collection drain 100m Pipe drainage 600 dia. 300m Gravity wall H=3m 40m Miscellaneous work	Removal of sliding mass 5,200m3 Gravity wall H=4m 130m Half bridge 26m Paving-and Miscellaneous	2 days for reopening one lane
No.358 K103.850- K103.870	Retaining wall H=5m 20m	Retaining wall H=10m (Crib type) 20m P.C.T.Bridge L=20m 1 Span	3 days for reopening one lane
No.378 K106.470- K106.540	Steel Pile H-200x200 582m Collecting drain 170m Pipe drainage 600 dia.250m Miscellaneous work	Removal of sliding mass 3,200m3 Gravity wall H=4m 80m Half bridge 16m Paving and Miscellaneous	2 days for reopening one lane
No.407 K112.340- K112.520	Pile fundation 3.0m dia. 108m	Removal of sliding mass 8,000m3 Gravity wall H=4m 200m Half bridge 40m Paving and Miscellaneous	2 days for reopening one lane
No.408 K113.000- K113.200	Horizontal drilling 230m Collecting wall 3.5m dia. 26m Collecting drain 140m Pipe drainage 600 dia. 250m Miscellaneous work	Removal of sliding mass 8,800m3 Gravity wall H=4m 220m Half bridge 44m Paving and Miscellaneous	3 days for reopening one lane
No.473 K126.050- K126.110	Retaining wall H=10m 60m (Crib type)	Half bridge 50m R.C.Bridge L=10m 1 Span	5 days for reopening one lane

Annex 7-5 Comparative Cost Study for Disasters Occasioned by Slope Failure

(1) Detouring and Waiting Traffic

If the road is closed by slope failure or some other reason, some traffic will detour to the northern route via Manizales -Honda - Bogota. Annex Table 7-5 presents some of the daily traffic, which will divert to the northern route in 1980. Annex Table 7-6 indicates the distances between Uribe and Bogota: one through the project road and the other through the northern route. Assuming that the traffic growth rate is 5% per annum, the traffic cost in 1986 is calculated as follows:

Type of Veh.	Number of Veh.	The Existing Route Traffic Cost/day	The Northern Route Traffic Cost/day	Difference in Traffic Cost/day
				pesos
Autos	303	1,352,621	1,653,030	300,409
Bus	200	1,826,843	2,278,265	451,422
Truck	643	6,365,746	7,935,038	1,569,292
TMula	342	6,388,351	7,959,974	1,571,623
1	,488	15,933,561	19,826,307	3,892,746

Annex Table 7-7 represents the traffic which would wait for the reopening of the road. It is assumed that they will wait rather than detour, since the distances between origin and destination of this traffic are quite less than those in the case of detouring. The time related costs in VOC in 1986 are estimated for the traffic as:

Auto :	171 veh x 401.9 = 68,725/day
Bus :	5 " x 1,944.4 = 9,722/d-y
Truck:	438 " x 1.451.9 =635,932/day
TMula:	110 " x 3,260.5 =358,655/day

Total	724	1,073,034/day
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OD pairs in the	Т	raffic	of AADT	in 1980		
aggregated zones	Auto	Bus	Truck	Tmula	Total	
l(Bogota) - 8 (Risaralda)	25	48	59	1	133	
- 5 (Quindio)	47	7	83	8	145	
- 6.7(Valle)	57	97	292	206	652	
- 13 (Popayan)	16	11	20	12	59	
ll (Santander, etc)						
- 8	11	-	4	-	15	
- 5	2	-	-	6	8	
- 6.7	56	-	27	9	92	
- 13	8	-	7	-	15	
Total	222	163	492	242	1,119	
Source: From the OD Tabl Annex Table 7-6 <u>Road Di</u>				- Bogota		
		Betweer				
		Betweer	n Uribe	Percent	 9% Total	-
Annex Table 7-6 <u>Road Di</u>	stance 1%	Between Gradi 3%	n Uribe Lent in 5%	Percent 7%		
Annex Table 7-6 <u>Road Di</u> Jribe - Calarca - Ibague - - Espinal - Bogota	stance 1% 148.0 (0.40	Between Gradi 3% 0 64.6 7)(0.17)	n Uribe	Percent 7% 50.1	42.0 364.0 0.115)(1.000)	(Kı

Annex Table 7-5 Detouring Traffic in Case of Road Closure

Source: Inventory data, MOPT.

Annex Table 7-7 Waiting Traffic in Case of Road Closure.

OD pairs in the	Traffic of AADT in 1980				
aggregated zones	Auto	Bus	Truck	TMula	Total
2 - 5. 6. 7. 8. 13	29	2	91	36	158
3 - 5. 6. 7. 8. 13	12	-	19	6	37
4 - 5. 6. 7. 8. 13	77	2	177	36	292
12-5.6.7.8.13	6	-	48	-	54
Total	124	4	335	78	541

Source: From OD tables, February 1980.

Remarks: The time related cost are obtained from Annex Tables 9-1 and 9-8. They are shown below as the cost per year.

	Fixed cost	Dep & Int	Total/Year
			pesos
Auto	69792	76895	146687
Bus	554642	155066	709708
Truck	421496	108432	529928
TMula	730273	459794	1190067

If they are divided by 365, the daily-time-related cost are estimated:

Auto	401.9/day x 124 = 49836	
Bus	1,944.4 " x 4 = 7778	
Truck	1,451.9 " x 335 = 486387	
TMula	3,260.5 " x 78 = 254319	
	Total 798320 ¹⁾	

Note: 1) The total traffic cost in 1986 is estimated by multiplying the growth rate (refer to Annex Table 4-4) to the above cost of each vehicle type. The cost in 1986 is:

3,892,746 + 1,073,034 = 4,965,780 pesos/day

(2) Evaluation of Preventive Work Against Slope Failure

The road is oftenclosed by landslides or by failure of the subgrade. Deterioration of the slope ranges from minor failure of the shoulders and ditches, which would not interfere with the traffic but would only augument the cost of road maintenance, to the extensive scale of slope failure which would interrupt the traffic for many days. As mentioned above, the slope failures and collapses of Type L and M are considered to be of an extent which would interrupt the traffic for many days. The costs of preventive work and corrective work for the slope failures and collapses are summarized as follows.

Frequency Type	<u>A</u>	(\$'000 in 1980)
	No of locations	Preventive work cost	Corrective work cost
LA	30	270,450	252,835
MA	80	187,844	233,238
Total	110	458,294	486,073
Average Cost		4,166	4,419

Frequency Type B

	No of locations	Preventive work cost	Corrective work cost
LB	16	67,450	89,561
MB	84	212,995	256,551
Total	100	280,445	346,112
Average Cost		2,804	3,461

Economic evaluation of the preventive work against failures requires probabilistic inference of their magnitudes and frequencies. At present no such statistical data is available and the study proposes a hypothetical condition for undertaking failure preventive works.

The following assumptions were made.

- (1) At the locations denoted by type A, the failures will occur at least within 20 years, and at type B, within 40 years.
- (2) Once the failure occurs, the road will be closed for 2 days which is required for reopening work.

Thus, failures will occur at 5 or 6 locations per year out of 110 locations of type A, causing road closure for 11 days per year. Likewise, at 2 or 3 places per year for type B, the road will be closed for 5 days per year. The above failures generate the corrective and traffic costs as shown in Annex Table 7-8 and 7-9.

Assuming that the costs required for corrective work, and, detouring and waiting, due to the failures are considered as benefit derived from the preventive work against slope failures, the following results are obtained.

The economic cost includes the cost of detailed engineering study, supervising and contingencies.

		(\$'(000 in 1980 prices)
	Туре А	Туре В	Total
Economic Cost in 1980 prices ('000 pesos)	458,294	280,445	738,739
Net P.W. (1=12%)	189,299	18,377	207,676
B/C (i=12%)	1.54	1.09	1.37
IRR	18%	13%	15%

Consequently, preventive work should be undertaken for both type A and B under the above assumptions.

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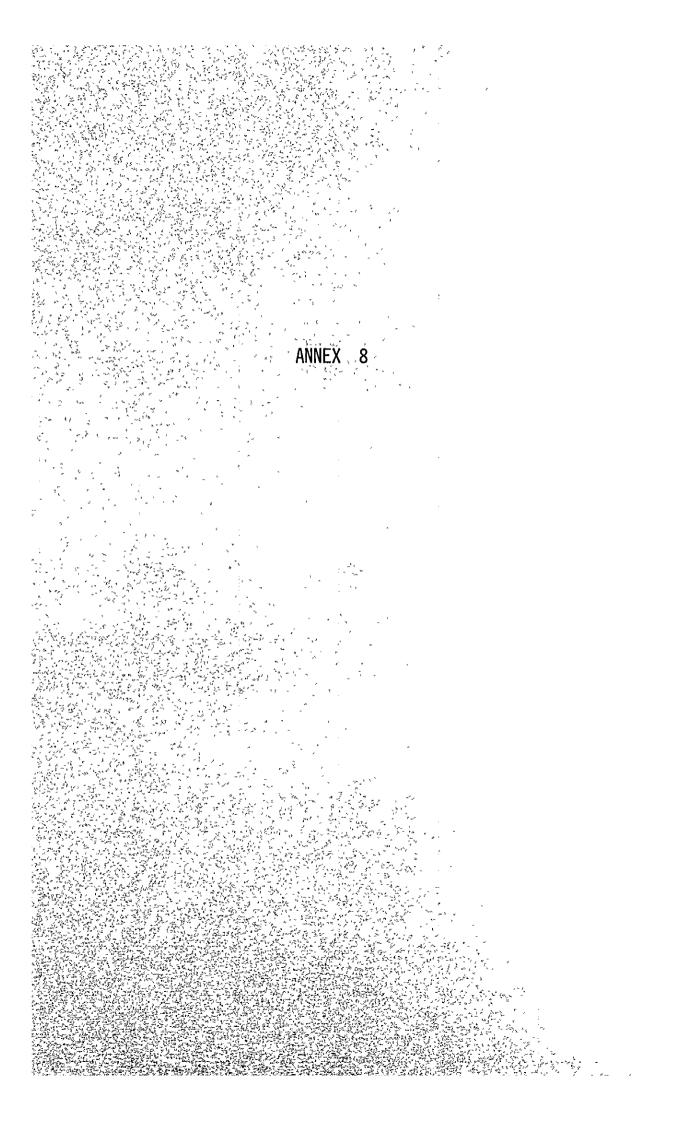
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Annex Table 7-8 Cost Stream for Type A

(\$'000 in 1980 prices)

Year	Preventive Savings		ings	
1ear	work cost	Corrective work	Traffic Cost	<u>Total</u>
'83	14582			
* 84	6250			
' 85	218731			
' 86	218731			
' 87		24305	5735 5	81660
¹ 88		ŧt	60223	84528
' 89		It	63234	87539
'9 0		н	66396	90701
'91		**	69716	94021
'92		11	73201	97506
'93		11	76861	101166
'94		11	80705	105010
'95		11	84740	109045
'96		11	88977	113282
'97		11	93426	117731
'98		81	98097	122402
'99		\$1	103002	127307
' 00		11	108152	132457
'01		IT	113559	137864
'02		**	119237	143542
'03		11	125199	149504
'04		11	131459	155764
'05		It	138032	162337
Total	458294	461795	1751571	2213366
Tot.disc.				
i=12%	350222	-	-	539521
P.W. 1=12%				189299
B/C, i=12%				1.54
IRR				18%

Annex Table		Stream for Type	(9 000 TI	ı 1980 prices)
Year	Preventive work cost	Savi Corrective W.	ngs Traffic Cost	Sub-total
'83	8,924		<u> </u>	
'84	3,824			
'85	133,849			
'86	133,848			
	133,040		06 070	04 705
'87		8,653	26,072	34,725
' 88			27,475	36,028
'89		11	28,244	37,397
'90		••	30,181	38,834
'91		11	31,690	40,343
'92		11	33,275	41,928
'93			34,938	43,591
'94		11	36,685	45,338
195		11	38,519	47,172
'96		24	40,445	49,498
'97		**	42,468	51,121
*98		11	44,591	53,244
'99		4 T	46,821	55,474
2000		11	49,162	57,815
'01		88	51,620	60,273
'02		11	54,201	62,854
'03		tı	56,911	65,564
'04		11		
		11	59,756	68,429
'05			62,744	71,397
Total	280,445	164,407	796,198	970,605
Tot. disc. i = 12%	214,312	-	-	232,689
PW,1=12%	-			18,377
B/C, i=12%				1,09
IRR-		-165 -		13%



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Annex 8-1 Road Maintenance Cost

8-1-1 Effective Operating Man-Days per year 1)

Effective operating man-days are shown as follows:

Holidays15 daysSundays52National Holidays18Absent3Total88 days

365 days - 88 days = 277 days

Real operating days are shown as follows by subtracting rainy days and other days such as administration business.

(1) Operator and assistant

Rainy days and resupplying (estimate)	50 days
Transportation	6
Repairs	26
Administration	6
Total	88 days

277 days - 88 days = 189 days

(2) Laborers

Rainy days Administration	50 days 6
Total	56 days

277 days - 56 days = 221 days

8-1-2 Unit Cost for Equipment, Labor and Materials

The basic cost estimate for equipment, labor and materials is shown in Table 8-1 to 8-4.

SOURCE: 1) MOPT : Costos de Conservacion en la Vial MELGAR - IBAGUE - BUGA.

8- 1-3	Routine.Maintenance Team
(1)	General Maintenance Team (covering 60 km)
	Foreman 1 Laborers 12 Driver 1 Truck 1
(2)	Construction Team (covering 400 km)
	Foreman1Masons2Laborers6Driver1Truck1Concrete1mixer1
(3)	Construction Machinery (covering 1,000 km)
	Bulldozer (D7G)2Motor Grader (3.7 ^m)2Loader1Truck6Water Tanker1Road Roller, Macadam1Air Compressor (5 m3/min)1
8-1-4	Annual Requirement for Routine Maintenance
(1)	(Unit: \$) General Maintenance Team

N	umber	Basic Cost	Total
Foreman	1	104.55x8	836.40
Common Laborers	12	52.28x8	5,018.88
Driver	1	72.94x8	583.52
Truck	1	398.19x8	3,185.52
Tools	1	-	250.68
		Total	9,875.00
Annual operation	221	days	\$2,182,375.00

(2) Construction Team

N	lumber	Basic Cost	Total	
Foreman	1	104.55x8	836,40	
Mason	2	65.34x8	1,045.44	
Common Laborers	6	52.28x8	2,509.44	
Driver	1	72.94x8	583.52	
Truck	1	398.19x8	3,185.52	
Mixer	1	468.54x8	3,748.32	
Tools			125.36	
Materials			1,736.00	(35% of
				Labor Cost)
		Tota	1 13,770.00	

Annual operation 221 days \$3,043,170.00

(3) Clearing of Landslide

	Number	Basic Cost	Total
Foreman	1	104.55x8	836.40
Common Laborers	3	52.28x8	1,254.72
Drivers	2	72.94x8	1,167.04
Operator, bull.	1	116.70x8	933.60
Operator, Loade	r 1	116.70x8	933.60
Trucks	2	398,19x8	6,371.04
Bulldozer	1	3,078.84x8	24,630.72
Loader	1	1,728.55x8 _	13,838.40
		Tota	1 49,955.52

Annual operation 189 days

\$9,441,593.00

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(4) Asphaltic Concrete Patching Team

1) Removal of Old Pavement

N	mber	Basic Cost	Total
Foreman Operator, compr. Mechanic	1	104.55x8 87.53x8 104.55x8	836.40 700.24 836.40
Common Laborers Air Compressor	2 1	52.28x8 339.10x8	836.48 2,712.80
Hand Hammer	1	28.25x8	226.00
		Total	6,148.32
Assuming constru	ction a	ыt 20 л ³ per day	
the cost per m ³			307.42
Loading per mo		2	31.44
Hauling distance	1 Km-n	<u> </u>	22.61
		Total	\$361.47/m3

2) Patching

\$1620.63x2.35=3,808.48/m³ Asphalt mixture (Transport from Plant included) Therefore construction cost per m³ is as follows: 361.47 3,808.48 Total \$4,169.95 Assuming an annual rate of 1.5 percent of total construction $1,000^{m} \times 7^{m} \times 0.015 = 105^{m^2}$ Carriageway $1,000^{m} \times 1^{m} \times 2 \times 0.015 = 15^{m^2}$ Shoulder Total 120m² Annual Requirement per Km is 120^{m^2} x0.10^m x4,169.95 = \$50,039.40 (5) Total Annual Required Cost per 1 Km Taking an ADT 2000 or more 1) General Maintenance Annual Cost 2,182,375+60^{Km}=36,372.92 2) Construction Annual Cost 3,043,170+400^{Km}=7,607.93 3) Removal of Debris Annual Cost 9,441,593+1000^{Km}=9,441,59 4) Asphalt Patching

- Annual Cost per 1 Km =50,039.40
- Direct construction cost Total 103,461.84
- Contingencies 10 percent 10,346.16

Total \$113,808.00

8-1-5 Periodic Maintenance

This periodic maintenance covers areas where local damage to the road base cannot be fixed by patching and also where the entire surface is overlaid every 7-10 years.

(1) Local Repair

Removal of existing pavement and construction of new pavement.

Assuming 5 percent of total construction

Carriageway $1,000^{m} \times 7^{m} \times 0.05 = 350^{m2}$

Necessary reconstruction estimates (Basic price shown in Table 8-1)

Removal of existing pavement Subbase course Base course Paving Prime coat	350^{m2}_{m2} $350^{m2}_{m2} \times 0.20^{-2}_{m2}$ $350^{m2}_{m2} \times 0.15^{-2}_{m2}$ $350^{m2}_{m2} \times 0.05^{-2}_{m2}$	mx144.80 mx689.60 mx957.40 x3,808. x21.67	= 50,428.00 = 48,272.00 = 50,263.50 48=66,648.40 = 7,584.50
		Total	\$223,196.40

(2) Overlay

Construction area per Km

Carrigeway	1,000 ^m x7 ^m		
Paving		.05x3,808.48	= 1,332,968.00
Prime coat	7,000 ^{m2}	x21.67	= 151,690.00
		Total	\$1,484,658.00

(3) Periodic Maintenance Required Total per Km

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Required local repair	223,196.40
Required overlay	1,484,658.00
Direct construction cost Total	1,707,854.40
Contingencies 10 percent	170,785.60

Total \$1,878,640.00

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Annex	Table 8-	1-1	Construction	Cost	Estimate

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		PREPARE	D	ł	
CONSTRUCTION COST ESTIMAT	ſE			SHEET	OF
FEASIBILITY STUDY OF	F THE BOGOI	A – BUE	NAVENTURA RO	DAD PROJECT	
ESTIMATER		CHECK	ED RY		
DESCRIPTION	QUANTITY	UNIT MEAS.	UNIT PRICE	TOTAL.	REMARKS
Item No. G-5 Excavation	Common		ng distance	500 ^m –	1000 m ³)
Equipment					
Bulldozer D7G	8	HR	3,078.84	24,630.72	····, <u>·</u> ·····
Motor_Scraper 621B	16	HR.	4,530.08	72,481.28	
sub-total				97,112.00	
Labor					
Operator, bulldozer	8	МН	116.70	933.60	
Operator, scraper	16	MH	145.88	2,334.08	
Asst. operator	24	МН	72.94	1,750.56	
Foreman	8	мн	104.55	836.40	
Common Labor	24	мн	52.28	1,254.72	
sub-total				7,109.36	
Material					
Diesel	202.75	Gal	47.80	9,691.45	
Gasoline	3.96	Gal	47.80	189.29	
Motor Oil	4.58	Gal	283.63	1,299.02	
Transmission 011	1.14	Gal	260.00	296.40	
Hydraulic Oil	0.88	Gal	236.35	208.00	
Grease	3.96	Lb	32.50	128.70	
Lubricants, Filters				1,814.50	15% of F.O
sub-total				13,627.36	
Total Direct Cost For 10	00 m ³			117,848.72	
Unit Direct Cost Per m ³	······			117.84	

FEASIBILITY STUDY OF THE BOGOTA-BUENAVENTURA ROAD PROJECT STIMATER CHECKED BY Item No. C-5 Excavation Common (Hauling distance 500 ^m - 1000 ^{m3}) Equipment Bulldozer D7G 1000 m ³ + (200m ³ /HR x 0.8 x 0.8) = 8 HR Motor Scraper 621B 1000 m ³ (16 m ³ x 0.8 x 0.8 x 6 times) = 16 HR Labor Operator, bulldozer 8 MH Operator, scraper 16 MH Asst. operator 8 HR + 16 HR = 24 MH Foreman 8 MH Common Labor 3 ^{men} x 8 HR = 24 MH	COST ESTIMATE WORKSHEE	DATE PREPAR	ED		SHEET	OF
Item No. G-5 Excavation Common (Hauling distance $500^{m} - 1000^{m^{3}}$)Equipment Bulldozer D7G 1000 m^{3} + (200 m^{3}/HR x 0.8 x 0.8) = 8 HRMotor Scraper 621B 1000 m^{3} (16 m^{3} x 0.8 x 0.8 x 6 times) = 16 HRLabor Operator, bulldozer0perator, bulldozer8 MH Operator, scraper16 MH Asst. operator8 HR + 16 HR Foreman000 ma	FEASIBILITY STUDY	OF THE BOGOTA-BUENA	VENTURA	A ROAD 1	ROJECT	
EquipmentBulldozer D7G1000 m ³ \div (200m ³ /HR x 0.8 x 0.8) = 8 HRMotor Scraper 621B1000 m ³ (16 m ³ x 0.8 x 0.8 x 6 times) = 16 HRLaborOperator, bulldozer0perator, bulldozer8 MHOperator, scraper16 MHAsst. operator8 HR + 16 HR= 24 MHForeman8 MH	ESTIMATER	CHE	CKED BY	ζ		<u>_</u>
Bulldozer D7G 1000 m ³ ÷ (200 m ³ /HR x 0.8 x 0.8) = 8 HR Motor Scraper 621B 1000 m ³ (16 m ³ x 0.8 x 0.8 x 6 ^{times}) = 16 HR Labor Operator, bulldozer 8 MH Operator, scraper 16 MH Asst. operator 8 HR + 16 HR = 24 MH Foreman 8 MH	Item No. G-5 Excavation	Common (Hauling o	listanc	e 500 ^m	- 1000 ^{m3})	
1000 m ³ ÷ (200 m ³ /HR x 0.8 x 0.8) = 8 HR Motor Scraper 621B 1000 m ³ (16 m ³ x 0.8 x 0.8 x 6 times) = 16 HR Labor Operator, bulldozer 8 MH Operator, scraper 16 MH Asst. operator 8 HR + 16 HR = 24 MH Foreman 8 MH	Equipment		······································	····.		
Motor Scraper 621B 1000 m ³ (16 m ³ x 0.8 x 0.8 x 6 times) = 16 HR Labor Operator, bulldozer 8 MH Operator, scraper 16 MH Asst. operator 8 HR + 16 HR = 24 MH Foreman 8 MH	Bulldozer D7G					
$1000 \text{ m}^3 (16 \text{ m}^3 \times 0.8 \times 0.8 \times 6^{\text{times}}) = 16 \text{ HR}$ Labor Operator, bulldozer 0perator, scraper 16 MH Asst. operator 8 HR + 16 HR = 24 MH Foreman 8 MH	$1000 \text{ m}^3 \div (200 \text{ m}^3/\text{H})$	$R \ge 0.8 \ge 0.8$ = 8 H	R			
Labor Operator, bulldozer 8 MH Operator, scraper 16 MH Asst. operator 8 HR + 16 HR = 24 MH Foreman 8 MH	Motor Scraper 621B					
Operator, bulldozer 8 MH Operator, scraper 16 MH Asst. operator 8 HR + 16 HR = 24 MH Foreman 8 MH	1000 m ³ (16 m ³ x	0.8 x 0.8 x 6 times	³) = 16	HR		
Operator, scraper16 MHAsst. operator8 HR + 16 HR= 24 MHForeman8 MH	Labor		<u> </u>	<u>~</u>	·	
Asst. operator8 HR + 16 HR= 24 MHForeman8 MH	Operator, bulldozer	······································	8	MH		
Foreman 8 MH	Operator, scraper		16	мн	<u> </u>	
Mor	Asst. operator	8 HR + 16 HR	= 24	MH	· · · · · · · · · · · · · · · ·	
Common Labor 3 ^{men} x 8 HR = 24 MH	Foreman		8	МН		
	Common Labor	3 ^{men} x 8 HR	= 24	мн		
		······································				
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CONSTRUCTION COST ESTIMATE	DATE PI	LPARE	U	SHEET	OF
FEASIBILITY STUDY OF T	HE BOCOTA	- BUE	NAVENTIRA E		
ESTIMATER		CHECK	ED BY		
DESCRIPTION	QUANTITY	UNIT MEAS.	UNIT PRICE	TOTAL	REMARKS
Item No.G-7 Excavation Ha	rd Rock -	1000			
	<u></u>	·			
Equipment				71 000 00	
Air Compressor 17 m ³ /min			927.60	74,208.00	
Crawler Drill PCR200	160	HR	723.51	115,761.60	
Bulldozer D8K w/Ripper	27	HR	4,816.00	130,032.00	
Motor Generator 200 KVA	80	HR	703.85	56,308.00	
				376,309.60	
Labor				·	
Operator, compressor	80	MH	87.53	7,002.40	
Operator, drill	160	MH	116.70	18,672.00	
Operator, bulldozer	27	MH	116.70	3,150.90	
Operator, generator	80	MH	87.53	7,002.40	·
Asst. operator	27	MH	72.94	1,969.38	
Foreman	80	MH	104.55	8,364.00	
Common Labor	108	MH	52.28	5,646.24	
sub-total		· · · ·		51,807.32	······································
Material					*****
Diesel	1,218.23	Gal	47.80	58,231.94	
Gasoline	4.45	Gal	47.80	212.71	
Motor 0il	19,43	Gal	283.63	5,510.93	
Transmission 0il	1.12	Ga1	260.00	291.20	
Hydraulic 0il	2.65	Gal	236.35	626.27	
Grease	19.38	Lb	32.50	629,85	
Lubricants, Filters				10,060.38	15% of F
Explosive	300	Kg	110.00	33,000.00	
Cap electric	600	U	33.00	19,800.00	
Electric Cord	400	tu	30.00	12,000.00	
Wire, Lead	400	m	50.00	20,000.00	
sub-total				160,363.28	
Total Direct Cost For 1000	m ³			588,480.20	
Unit Direct Cost Per m ³			·	588.48	

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	ON COST ESTIMATE	SHEET	OF
FEASI	BILITY STUDY OF THE BOGOTA - BUENAVENTURA ROAD	PROJECT	
ESTIMATER	CHECKED BY		
DESCI	RIPTION QUANTITY UNIT UNIT T MEAS. PRICE	OTAL	REMARKS
Item No.G-7	Excavation Hard Rock - 1000 m ³		
Material	Explosive $1000^{m^{3}} \times 30^{kg}/100^{m^{3}} = 300 kg$		
	Cap electric $1000 \times 60^{9} / 100^{m^3} = 600 \text{ U}$		
	Cord $1000 \times 40^m / 100^{m^3} = 400 \text{ m}$		
	Wire, Lead $1000 \times 40^{m} / 100^{m3} = 400 m$		
Equipment	Air Compressor $1000^{\text{m}^3} \times 8^{\text{HR}} / 100^{\text{m}^3} = 80 \text{ HR}$	· <u></u> -	• ****
	Crawler Drill 80 ^{HR} x2 ^{unit} = 160 HR		
	D8K w/Ripper 1000 ^{m3} + (200 ^{m3} /HR _{x0.6x0.4}) HR		
	add. 30% = 27 HR	·	<u> </u>
	Motor Generator 80 HR	<u> </u>	
Labor	Operator, compressor 80 MH		
	Operator, drill 160 MH		—
	Operator, bulldozer 27 MH	<u> </u>	<u> </u>
	Operator, generator 80 MH		·
	Common Labor 4men _{x27} HR = 108 MH	<u> </u>	
······	Foreman 80 MH		
			— r
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	DATE	PREPARE	D		
CONSTRUCTION COST ESTIMATE				SHEET	OF
FEASIBILITY STUDY OF T	HE BOGOT	A – BUE		ROAD PROJEC	r
ESTIMATER		CHECK	ED BY		
DESCRIPTION	QUANTITY	UNIT MEAS.	UNIT PRICE	TOTAL	REMARKS
Item No. G-13 Concrete 3000) PSI (21				
Equipment					
Concrete Mixer	8	HR	468.54	3,748.32	
Tools	1	Lump	<u> </u>	2,160.00	1% of Materia
sub-total			_	5,908.32	
Labor	<u></u> ,				
Operator, mixer	16	MH	81.69	1,307.04	
Foreman	8	MH	104.55	836.40	
Common labor	96	MH	52.28	5,018.88	···
sub-total				7,162.32	
Material					
Portland Cement ,	36.75	t	4,000.00	147,000.00	
Aggregate	97.9	3	600.00	58,740.00	
Sand	49.5	m ³	500.00	24,750.00	
Gasoline	5.28	Gal	47.80	252.38	
Motor Oil	0.09	Gal	283.63	25.53	
Grease	1.32	Lb	32.50	42.90	_
Lubricants, Filters				49.28	15% of F.O.
sub-total				230,860.09	
Total Direct Cost For 100 m	3			243,930.73	·····
Unit Direct Cost Per m ³	····			2,439.31	··

COST ESTIMATE WORKSHEET DATE PREPARED	SHEET	OF
FEASIBILITY STUDY OF THE BOGOTA-BUENAVENTURA RO	DAD PROJECT	
STIMATER CHECKED BY		
Item No.G-13 Concrete 3000 PSI (210 kg/cm2) - 100 m3		
Equipment		
Concrete Mixer 0.7 m ³		
$0.7 \text{ m}^3 \times \frac{60}{3} \times 0.9 \times 8 \text{ HR} = 100 \text{ m}^3$		
Material		
Portland cement		
$100 \text{ m}^3 \text{ x } 350 \text{ kg/m}^3 \text{ x } 1.05 = 36.75 \text{ t}$		
Aggregate		
$100 \text{ m}^3 \ge 0.89 \text{ m}^3 \ge 1.10 = 97.9 \text{ m}^3$		
Sand	·	
$100 \text{ m}^3 \times 0.45 \text{ m}^3 \times 1.10 = 49.5 \text{ m}^3$		
Labor		
Operator, mixer 16 MH		
Foreman 8 MH		
Common Labor $12^{\text{men}} \times 8^{\text{HR}} = 96 \text{ MH}$		

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CONSTRUCTION COST ESTIMAT	ļ	PREPARE		ouppo	07
		·		SHEET	0F
FEASIBILITY STUDY OF	THE BOGO	TA – BUEI	NAVENTURA RO	AD PROJECT	<u> </u>
ESTIMATER		: CHECK	ED BY		
DESCRIPTION	QUANTIT	Y UNIT MEAS.	UNIT PRICE	TOTAL	REMARKS
Item No.G-23 Fabricated R	einforcing	; Steel	- 1000 kg		<u></u>
Equipment					
Flatbed Truck	55	HR	442.44	2,212.20	
Tools	1	Lump		500.00	
sub-total	·	. <u> </u>		2,712.20	
Labor		·			
Operator, driver	5	MH	72.94	364.70	
Foreman	5	MH	104.55	522.75	
Iron worker	40	MH	78.41	3,136.40	
Common Labor	40	мн	52.28	2,091.20	
sub-total		··		6,115.05	<u>,,,,,</u>
Material					
Reinforcing Steel (defo	rmed) 1,0)50 kg	45.00	47,250.00	
Binding wire		5 kg	50.00	250.00	
sub-total	<u> </u>	<u></u>		47,500.00	
Total Direct Cost For 1000	kg	····		56,327.25	
Unit Direct Cost Per kg				56.33	······
				<u> </u>	
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CONSTRUCTION COST ESTIMATE				SHEET	OF
FEASIBILITY STUDY OF T	HE BOGOTA	- BUEN	NAVENTURA R	OAD PROJECT	
ST IMATER		CHECKI	ED BY		
DESCRIPTION	QUANTITY	UNIT MEAS.	UNIT PRICE	TOTAL	REMARKS
tem No. P-4 Base Course -	1000 m ³				
Quipment					
Motor Grader 600R-1	16	HR	1,261.98	20,191.68	
Road Roller, Tire 20 t	25	HR	746.00	18,650.00	
Vibration Roller 10 t	25	HR	1,123.46	28,086.50	
Water Tanker	10	HR	434.52	4,345.20	
Ритр	10	HR	387.58	3,875.80	
sub-total				75,149.18	
Labor			·····		
Operator, grader	16	мн	116.70	1,867.20	· · ·
Operator, roller	50	MH	87.53	4,376.50	
Operator, driver	10	мн	72.94	729,40	
Operator, pump	10	мн	72.94	729.40	
Asst. Operator	16	мн	72.94	1,167.04	
Foreman	75	MH	104.55	7,841.25	
Common Labor	200	мн	52.28	10,456.00	
sub-total				27,166.79	· · · ·
laterial		i			
Coase Aggregate 3/4"-1/2"	585	<u>m</u> 3	640.96	374,961.60	
Fine Aggregate #4 - #200	715	<u>т</u> 3	640.96	458,286.40	·····
Diesel	236.50	Gal	47.80	11,304.70	•
Gasoline	99.32	Gal	47.80	4,747.50	
Motor 0il	6.18	Gal	283.63	1,752.83	
Transmission Oil	2.24	Gal	260.00	582.40	
Hydraulic Oil	1.18	Gal	236.35	278.89	
Grease	8.40	Lb	32.50	273.00	
Lubricants, Filters					15% of F.O
sub-total				855,096.42	
Fotal Direct Cost For 1000 r	n3			957,412.39	

COST ESTIMATE WORKSHEET	DATE	PREPARED	SHEET	OF
FEASIBILITY STUDY	OF THE BOGOT	A-BUENAVENTURA R	DAD PROJECT	
ESTIMATER		CHECKED BY	<u> </u>	
				
Item No. P-4 Base Course		_1000 m ³		
Material				
Coarse Aggregate 1000	$m^3 \times 0.45 \times 10^{-10}$	$1.30 = 585 \text{ m}^3$		
		$1.30 = 715 \text{ m}^3$,,,	···
				<u> </u>
Equipment	······································			
Motor Grador				
(585	<u>m³ + 715 m³)</u>	+ (100 m ³ /HR x	(0.8) = 16 HR	
R. Roller, Tyre and Vibra	ation			
	<u>m3 + 60 m³/</u>	HR x 1.15	= 25 HR	
Water Tanker and Pump				
<u>25 HR</u>	<u>x 40%</u>		= 10 HR	
			······································	
Labor			······································	
Operator, Grader		= 16 MH		<u> </u>
Operator, Roller 2	^{men} x`25 ^{HR}	= 50 MH		. <u> </u>
Operator, Driver		= 16 MH	· · · · · · · · · · · · · · · · · · ·	
Operator, Pump		= 10 MH	<u> </u>	
Foreman 3	^{men} x 25 ^{HR}	= 75 MH	— <u></u>	
Common Labor 8	men x 25 ^{HR}	= 200 MH		
			<u> </u>	
	- # <u>#</u>	······································		
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	DATE PI	REPAREI	0		
CONSTRUCTION COST ESTIMATE				SHEET	OF
FEASIBILITY STUDY OF THE	BOGOTA	- BUEN	AVENTURA RO	AD PROJECT	
STIMATER		CHECK	ID BY		
DESCRIPTION QUA	NTITY	UNIT MEAS.	UNIT PRICE	TOTAL	REMARKS
tem No.P-9 Asphalt Concrete	Pavemen	it -	1000 Ton		
Equipment					
Asphalt Plant Ba 1000	19	HR	4,394.62	83,497.78	
Wheel Loader 950	38	HR	2,478.72	94,191.36	
Bulldozer D7G	38	HR	3,078,84	116,995,92	
Asphalt Finisher SA35	28	HR	822.56	23,031.68	
Road Roller, Macadam 10 ^t	28	HR	513.85	14,387.80	
Road Roller, Tire 20 [€]	28	HR	746.00	20,888.00	
Dump Truck 7 ton	237	HR	467.06	110,693.22	
Generator EG300	19	HR	1,147.00	21,793.00	
Tools	1	Lump		2,915.00	
sub-total				488,393.76	
Labor					
Operator, plant	57	мн	145,88	8,315.16	
Operator, finisher	56	MH	145.88	8,169.28	
Operator, Loader	38	MH	116.70	4,434.60	
Operator, bulldozer	38	MH	116.70	4,434.60	
Operator, roller	56	МН	87.53	4,901.68	
Operator, generator	19	МН	87.53	1,663.07	
Operator, driver	237	MH	72.94	17,286.78	
Operator, raker	56	MH	91.48	5,122.88	
Asst. operator	76	MH	72.94	5,543.44	
Foreman	42	WH	104.55	4,391.10	
Mechanic	19	мн	104.55	1,986.45	
Common labor	228	МН	52.28	11,919.84	
sub-total				78,168.88	
Material					
Asphalt cement 80-100	61.8	t	8,400.00	519,120.00	
Aggregate Coarse					
1/2" - #8	272	m3	640.96	174,341.12	
3/8" - #16	77	<u>m</u> 3	640.96	49,352.92	
Aggregate Fine					
#4 - #200 crushed	310.8	<u>m</u> 3	500.00	155,400.00	
		m3	500.00	38,850.00	

	DATE I	REPAREI)		
CONSTRUCTION COST ESTIMA	TE '			SHEET	OF
FEASIBILITY STUDY O	F THE BOGOTA	- BUEN	AYENTURA	ROAD PROJECT	
ESTIMATER	<u>.</u>	CHECKI	ZD BY		
DESCRIPTION	QUANTITY	UNIT MEAS.	UNIT PRICE	TOTAL	REMARKS
Material	<u>_</u>				
Filler	52.5	t	800.00	42,000.00	···
Diesel	1,355.0	Ga1	47.80	64,769.00	
Kerosene	176.0	Gal	49.40	8,694.00	•
Grease	5.3	Lb	32.50	172.25	
Lubricants, Filters				1,364.00	15% of F.O.
sub-total		· · · · ·		1,054,064.29	
Total Direct Cost For 1000) Ton		<u></u>	1,620,626.93	
Unit Direct Cost Per Ton				1,620.63	
······					
	, <u></u>		<u></u>		···

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COST ESTIMATE WORKSHEET DATE PREPARED	SHEET	OF
FEASIBILITY STUDY OF THE BOGOTA-BUENAVENTURA	ROAD PROJECT	
ESTIMATER CHECKED BY		
Item No.P-9 Asphalt Concrete Pavement - 1000	Ton	
Material	· · · · · · · · · · · · · · · · · · ·	
Coarse Aggregate		
$1/2" - 48$ $1000^{t} \times 35\% \times 0.74 \text{ m}^{3}/t \times 1.05 =$	272 m ³	
	<u>77.7 m3</u>	
Fine Aggregate		
#4 - #200 crushed 1000 x 40% x 0.74 x 1.05 = 3		
#4 - #200 natural 1000 x 10% x 0.74 x 1.05 =	77.7 m ³	
Filler 1000 ^t x 5% x 1.05 = 52.5 ^t		
Asphalt $1000 \times 6\% \times 1.03 = 61.8^{t}$		
Equipment		· · · · · · · · · · · · · · · · · · ·
Plant 70 ^t /Hr		
$1000^{\text{t}} \times 1.03 + (70^{\text{t}}/\text{Hr} \times 0.8) = 19 \text{ HR}$		
Generator EG300 = 19 HR		
Wheel Loader 950 19 HR x 2 unit = 38 HR		
D7G = 38 HR		
Dump Truck		
$1000^{t} \times 1.03 + 7.0^{t} \times 1.61^{HR} = 237^{HR}$		
Required time		
Loading = 0.06		
Waiting = 0.05		
Hauling 15 km + 20 km/HR = 0.75	····	
Dump = 0.10	·····	
Waiting = 0.05		•
Return 15 km + 25 kg/HR = 0.60	· · · · · · · · · · · · · · · · · · ·	
Total 1.61	· · · · · · · · · · · · · · · · · · ·	
Finisher 1000 + 36 /HR = 28 HR		
Rollers = 28 HR		
Labor		
Operator, plant 19 ^{HR} x 3 ^{men} = 57 MH		
Operator, Finisher 28 ^{HR} × 2 ^{men} = 56 MH		
Operator, råker 56 MH		
Operator, loader 38 MH		
Operator, bulldozer 38 MH		
Operator, roller 56 MH	· · · · · · · · · · · · · · · · · · ·	
Operator, generator 19 MH		

(Cont'd)

COST ESTIMATE WORKSHEET	DATE PREPARED	SHEET	OF
FEASIBILITY STUDY OF TH	IE BOGOTA-BUENAVENTURA ROA	D PROJECT	·
ESTIMATER	CHECKED BY		
Operator, driven	237 мн		
Asst. operator		······	
2 ^{men} x 38 ^{HR}	76 MH		
Foreman 28 HR x 1.50 =	42 MH		
Mechanic	<u>19 мн</u>		
Common labor 38 HR x 6 ^{men}	= 228 MH		<u> </u>
			·
······································		·	

CONSTRUCTION COST ESTIMAT		PREPARE	D		
	· · · · · · · · · · · · · · · · · · ·			SHEET	OF
FEASIBILITY STUDY OF	THE BOGUI	A - BUE	NAVENTURA	ROAD PROJECT	
ESTIMATER		CHECK	ED BY		
DESCRIPTION	QUANTITY	UNIT MEAS.	UNIT PRICE	TOTAL	REMARKS
Item No. P-3 Setting of C	oncrete Pi			100 ^m	
Equipment				·····	
Excavator 215	11	HR	2,451.80	26 969 90	
Bulldozer D7G	6	HR	3,420.93	<u>26,969.80</u> 20,525.58	
Flatbed Truck 6 Ton	36	HR	398.19	14,334.84	
Tools		Lump		1,800.00	
sub-total				63,630.22	
Material			·····		
Reinforced Concrete Pipe	102	D	1,300.00	132,600.00	
Sand	33	<u>"</u> 3	500.00	16,500.00	
Plank	3	_m 3	5,860.00	17,580.00	
Cement Mortar	0.6	<u>3</u>	3,779.58	2,267.75	
Diesel	62.84	Gal	47.80	3,003.75	
Gasoline	289:51	Gal	47.80	13,838.58	
Motor Oil	5.75	Gal	283.63	1,630.87	
Transmission Oil	1.63	Gal	260.00	423.80	
Hydraulic Oil	0.25	Gal	236.35	59.09	
Grease	5.92	Lb	32.50	192.40	·····
Lubricants, Filters				2,941.05	
sub-total				191,037.29	·
Labor					
Operator, Excavator	11	МН	116.70	1,283.70	
Operator, Bulldozer	6	MH	116.70	700.20	
Operator, Driver	36	мн	72.94	2,625.84	
Asst. Operator	11	мн	72.94	802.34	····
Foreman	134	мн	104.55	14,009.70	
Common Labor	1720	мн	52.28	89,921.60	·
sub-total				109,343.38	
otal Direct Cost For 100 ^m				364,010.89	
nit Direct Cost Per m				3,640.10	

COST ESTIMATE WORKSHEET	DATE PREPARED	SHEET	OF
FEASIBILITY STUDY O	F THE BOGOTA-BUENAVENTURA ROA	D PROJECT	
ESTIMATER	CHECKED BY		
,,,,,,		. <u></u>	
Excavation			
Lower W. Uj	oper W. Height		
$1/2 \times (1.50 + 4.)$.26) x 2.30 x $100^{\text{m}} \approx 662 \text{ m}^3$	·····	
(back-fill)	$662 - 94 = 568 \text{ m}^3$		
Equipment		·	
Excavator 215			
662 m ³ + 61 m ³ /Η	R = 11 HR		
Bulldozer D7G	6 HR		
Labor	, · · · · · · · · · · · · · · · · ·		
Operator, Excavator	11 MH		
Operator, Bulldozer	6 МН		
Operator, driver	36 MH		
Common Labor 8 ^{HR} x 15 ^{me}	ⁿ = 120 MH		
Setting:-			
Foreman 100 ^m /6 ^m x 8	= 134 ^{MH}		
Common Labor			
100 ^m x 12 ^{mer}	$1/6^{m} \times 8 = 1600^{NH}$		•
Material			• · · · · · · · · ·
Reinforced Concrete Pipe	· · · · · · · · · · · · · · · · · · ·		
ø900 100 ^m x 1.02 = 1			
Sand 0.20 ^m x 1.50 ^m x 10	$10^{m} \times 1.10 = 33 m^{3}$		
Plank	3.0 m ³		
Cement Mortar	0.6 m ³		
Transportation of Pipe	·······	<u> </u>	
Flatbed Truck			
$1.5^{t}/2.43^{m} \times 102^{m} +$	$(6^{t} \times 0.9) \times 2.5^{HR}$		
	ing and Unloading) = 36 ^{HR}		

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Annex

Table 8-2 -1

Bulldozer	Caterpillar D6D 140 HP	7,586,930
Bulldozer	Caterpillar D7G 200 HP	10,339,870
Bulldozer	Caterpiller D8K 300 HP	14,416,180
Bulldozer	Caterpiller D8K w/Ripper 300 HP	16,173,880
Tractor Shovel	Caterpillar 955 L 1.8 ^{m3} 130 HP	6,990,730
Tractor Shovel	Caterpillar 977 L 2.1 ^{m3} 190 HP	11,229,990
Wheel Loader	Caterpillar 950 L 1.8 ^{m3} 130 HP	7,132,130
Excavator	Caterpillar 215 0.6 ^{m3} 85 HP	6,962,950
Motor Grader	Caterpillar 12 G 3.7 ^m 135 HP	7,656,470
Motor Grader	Komatsu GD 600R-1 3.7 ^m 145 PS	4,259,190
Motor Scraper	Caterpillar 621B 16 ^{m3} 330 HP	15,294,110
Road Roller, Macadam	Sakai KD7610 10 ton 87 PS	1,964,880
Road Roller, Tyre	Sakai TS7409 20 ton 95 PS	2,167,340
Vibration Roller	Sakai SV90 10 ton 133 PS	3,190,590
Asphalt Plant	Barber Green BA1000 70 T/H 190 HP	21,850,440
Asphalr Finisher	Barber Green SA35. 2.4 ^{m} -4.3 ^{m} 68 HP	2,835,120
Asphalt Finisher	Sakai PT280 1.8 ^m -2.8 ^m 22 PS	2,470,780
Asphalt Distributor	Hanta Kikai DS-50EA 26 PS	1,418,260
Concrete Batching Plan	Nikko BPU-150A 90 m ³ /H 110 KW	16,342,470
Concrete Mixer, portable	Nikko NCSTM28 0.7 ^{m3} 15 PS	1,058,320
Air Compressor, portable	Komatsu EC105V 10.5 ^{m3/min} 103 PS	1,982,450
Air Compressor, portable	Komatsu EC170V 17 ^{m3/min} 170 PS	3,115,260
Motor Generator	Komatsu EG200 200 KVA 246 PS	2,363,830
Motor Generator	Komatsu EG300 300 KVA 363 PS	3,852,090
Truck Crane	Kato NK110 10 ton 110 PS	4,377,440
Truck Grane	Hitachi Kenki FH70 20 con 140 PS	7,634,260
Crauler Crane	Hitachi Kenki KH70 23 ton 127 PS	8,019,470
File Driver	Isikawajima IDH25 2.5 ton 80 PS	2,626,390
Pile Driver	Isikawajima IDH35 3.5 ton 120 PS	3,326,810
Underwater Pump	Tsurumi TO-370 10 ^{m3/min} 37 KW	875,480
Crushing Plant	Daito Sangyo 60 T/H 130 KW	24,861,740
Blower	Mitsui MAF40 150 ^{m3} /min 11 KW	953,250
Crauler Drill	Furukawa PCR200 38 ^{mm} dia.	2,766,530
Concrete Pump car	Isikawajima IPF65T 60 ^{m3} /H 130 PS	6,828,770
Truck Mixer	Niigata Tekko NTO 350 3.5 ^{m3} 240 PS	2,529,080
Dump Truck	Dodge D600 7 ton 202 HP	1,478,800
Flatbed Truck	Dodge D600 6 ton 180 HP	1,247,500
Water Tapker	Dodge D600 2000 Gal. 200 HP	1,369,500
Drilling Machine	Yamato CH-1 66 ^{mm} dia. 5.5 KW	741,930
Leg Hammer	Furukawa 322D 22Hx108 ^{mm}	68,030
Grout Pump	Koken MG5A 65 1/min 3.7 KW	347,070

Table 8- 2-2 Hourly Costs Analysis

1980 Prices

	Factor of Conversion	on US\$1.00	= \$75.73	
BRAND:	Caterpillar Bulldoze: D6D Motor Diesel 14			
Ī	TEM	CALCULATION	NUMBER	UNIT
1. GENE	RAL DATA			
A. Ec	conomic Life in Hours		10,000	Hours
B. Ec	conomic Life in Years		5	Years
2. <u>ACQU</u>	ISITION COSTS			
C. To	tal Cost		7,586,930	\$
D. Co	st of Tyres		-	
E. To	tal Cost less Tyres	C - D	7,586,930	\$
3. <u>HOUR</u>	LY OWNERSHIP COSTS			
F. De	preciation	E/A	758.69	\$/Hr
G. Ho	urly Ownership Costs	$\frac{E}{1,000}$ x0.20710	<u>1,571.25</u>	\$/Hr
4. <u>HOUR</u>	LY OPERATING COSTS		~	
H. Re	pairs	F x 1.2375	938.87	\$/Hr
	st of Fuels and bricants			
	Diesel	47.80x3.75x1.1	197.18	
	Gasoline	47.80x0.15x1.1	7.89	
	Motor Oil Transmission Oil	283.63x0.08x1.1	24.96	
	Hydraulic 011	260.00x0.03x1.1	8.58	
	Grease (Lb)	236.35x0.02x1.1 32.50x0.04x1.1	5.20	
	Sub total	32.30.00.04%1.1	$\frac{1.43}{245.24}$	\$/Hr
	Lubricants and Filter	s 20%	49.05	\$/Hr \$/Hr
J. Co	st of Tyres		-	\$/Hr
К. Ор	erator and Asst.	(116.70+7294)	189.64	\$/Hr
L. Ho	urly Operating Costs	н + I + к	1,422.80	\$/Hr
5. <u>TOTA</u>	L DIRECT COST	G + L	2,994.05	\$/Hr
HOURI	LY COST G+H = 2,510.	12 — 188 —		

QUANTITIES AND COST: THE IMPROVEMENT PLANS SELECTED (1)

Section (01) P-2 KM 61.3 - KM62.8					(UN	IT: \$'000)
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	603	m ²	2	1	1	4
Excavation Common M	610	3	11	48	2	61
Excavation Soft Rock	737	<u>m</u> 3	89	\$5	21	165
Embankment	170	<u>_</u> 3	10	6	2	18
Removal of Old Pavement	2,874	3	214	145	55	414
Carriageway Pavement	3,895	m ²	1,017	704	202	1,923
Shoulder Pavement	728	m ²	111	73	19	203
Gravity Wall H=3 ^m	21	m.	84	117	12	213
Concrete Spraying	335	<u>m</u> ²	18	18	5	41
Guard Rail	364	ta	361	533	46	943
Total			1,917	1,700	365	3,982
w/Overhead and Profit			2,626	1,936	415	4,977
Supervision			189	47	12	248
Contingency			282	199	42	523
Detailed Eng. w/Cont.			208	52	13	273
Total			3,305	2,234	482	6,021
Economic Cost			3,305	2,234	-	5,539
Section (02) P-3 KM62.800 - KM63.855						
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	16,212	m ²	61	25	11	97
Excavation Common A	5,720	m ³	108	52	20	180
Excavation Common B	5,722	"3	431			
		_	451	164	79	674
Excavation Soft Rock	14,598	"3	1,777	164 1,101	79 425	674 3,303
Excavation Soft Rock Excavation Hard Rock	14,598 9,938	3 3				
		ກ ³ ກ ³ ກ ³	1,777	1,101	425	3,303
Excavation Hard Rock	9,938	ກ 3 ກ 3 ກ 2 ກ	1,777 3,027	1,101 2,018	425 803	3,303 5,848
Excavation Hard Rock Embankment	9,938 5,340	ກ ³ ສ ³ ສ ³ ກ ² ກ ²	1,777 3,027 308	1,101 2,018 183	425 803 67	3,303 5,848 558
Excavation Hard Rock Embankment Removal of Old Pavement	9,938 5,340 4,911	3 n 3 n 3 n 2 n 2 n 2 n 2 n 2	1,777 3,027 308 366	1,101 2,018 183 248	425 803 67 94	3,303 5,848 558 708
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement	9,938 5,340 4,911 7,000	3 13 13 13 13 14 15 15 15 15 15 15 15 15 15 15	1,777 3,027 308 366 1,563	1,101 2,018 183 248 1,028	425 803 67 94 275	3,303 5,848 558 708 2,866
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement	9,938 5,340 4,911 7,000 2,000	ກ ³ ສ ³ ສ ³ ກ ² ກ ²	1,777 3,027 308 366 1,563 395	1,101 2,018 183 248 1,028 261	425 803 67 94 275 71	3,303 5,848 558 708 2,866 727
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Concrete Spraying	9,938 5,340 4,911 7,000 2,000 2,402	3 13 13 13 13 14 15 16 16 16 16 16 16 16 16 16 16	1,777 3,027 308 366 1,563 395 130	1,101 2,018 183 248 1,028 261 129	425 803 67 94 275 71 35	3,303 5,848 558 708 2,866 727 294
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Concrete Spraying Seed Spraying	9,938 5,340 4,911 7,000 2,000 2,402 9,274	3 33 33 22 22 23 23 23 24 24 24 24 24 24 24 24 24 24 24 24 24	1,777 3,027 308 366 1,563 395 130 149	1,101 2,018 183 248 1,028 261 129 216	425 803 67 94 275 71 35 40	3,303 5,848 558 708 2,866 727 294 405
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Concrete Spraying Seed Spraying Setting Pipe 900 dia.	9,938 5,340 4,911 7,000 2,000 2,402 9,274 140	3 13 13 13 13 14 15 15 15 15 15 15 15 15 15 15	1,777 3,027 308 366 1,563 395 130 149 219	1,101 2,018 183 248 1,028 261 129 216 264	425 803 67 94 275 71 35 40 26	3,303 5,848 558 708 2,866 727 294 405 509
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Concrete Spraying Seed Spraying Setting Pipe 900 dia. Side Ditch	9,938 5,340 4,911 7,000 2,000 2,402 9,274 140 2,000	3 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	1,777 3,027 308 366 1,563 395 130 149 219 935	1,101 2,018 183 248 1,028 261 129 216 264 1,468	425 803 67 94 275 71 35 40 26 175	3,303 5,848 558 708 2,866 727 294 405 509 2,578
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Concrete Spraying Seed Spraying Setting Pipe 900 dia. Side Ditch Catch Basin	9,938 5,340 4,911 7,000 2,000 2,402 9,274 140 2,000 15	3 ສ.3 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2	1,777 3,027 308 366 1,563 395 130 149 219 935 30	1,101 2,018 183 248 1,028 261 129 216 264 1,468 94	425 803 67 94 275 71 35 40 26 175 4	3,303 5,848 558 708 2,866 727 294 405 509 2,578 128
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Concrete Spraying Seed Spraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail	9,938 5,340 4,911 7,000 2,000 2,402 9,274 140 2,000 15	3 ສ.3 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2	1,777 3,027 308 366 1,563 395 130 149 219 935 30 1,047	1,101 2,018 183 248 1,028 261 129 216 264 1,468 94 1,544	425 803 67 94 275 71 35 40 26 175 4 133	3,303 5,848 558 708 2,866 727 294 405 509 2,578 128 2,724
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Concrete Spraying Seed Spraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail Total	9,938 5,340 4,911 7,000 2,000 2,402 9,274 140 2,000 15	3 ສ.3 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2	1,777 3,027 308 366 1,563 395 130 149 219 935 30 1,047 10,546	1,101 2,018 183 248 1,028 261 129 216 264 1,468 94 1,544 8,795	425 803 67 94 275 71 35 40 26 175 4 133 2,258	3,303 5,848 558 708 2,866 727 294 405 509 2,578 128 2,724 21,599
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Concrete Spraying Seed Spraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail Total w/Overhead and Profit	9,938 5,340 4,911 7,000 2,000 2,402 9,274 140 2,000 15	3 ສ.3 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2	1,777 3,027 308 366 1,563 395 130 149 219 935 30 1,047 10,546 14,393	1,101 2,018 183 248 1,028 261 129 216 264 1,468 94 1,544 8,795 10,078	425 803 67 94 275 71 35 40 26 175 4 133 2,258 2,528	3,303 5,848 558 708 2,866 727 294 405 509 2,578 128 2,724 21,599 26,999
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Concrete Spraying Seed Spraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail Total w/Overhead and Profit Supervision	9,938 5,340 4,911 7,000 2,000 2,402 9,274 140 2,000 15	3 ສ.3 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2	1,777 3,027 308 366 1,563 395 130 149 219 935 30 1,047 10,546 14,393 1,026	1,101 2,018 183 248 1,028 261 129 216 264 1,468 94 1,544 8,795 10,078 257	425 803 67 94 275 71 35 40 26 175 4 133 2,258 2,528 2,528 67	3,303 5,848 558 708 2,866 727 294 405 509 2,578 128 2,724 21,599 26,999 1,350
Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Concrete Spraying Seed Spraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail Total w/Overhead and Profit Supervision Contingency	9,938 5,340 4,911 7,000 2,000 2,402 9,274 140 2,000 15	3 ສ.3 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2 ສ.2	1,777 3,027 308 366 1,563 395 130 149 219 935 30 1,047 10,546 14,393 1,026 1,542	1,101 2,018 183 248 1,028 261 129 216 264 1,468 94 1,544 8,795 10,078 257 1,034	425 803 67 94 275 71 35 40 26 175 4 133 2,258 2,528 2,528 67 259	3,303 5,848 558 708 2,866 727 294 405 509 2,578 128 2,724 21,599 26,999 1,350 2,835

Section (03) P-2

KM65.6 - KM68.1						
MI03.0 - MI00.1						
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	10,103	m ²	38	15	7	60
Excavation Common M	6,904	_3 3	122	544	20	686
Excavation Common B	6,414	m ³	483	184	89	756
Excavation Soft Rock	17,140	m ³	2,086	1,293	499	3,878
Excavation Hard Rock	49,115	m 3	14,958	9,976	3,969	28,903
Embankment	217	3	13	7	3	23
Removal of Old Pavement	4,282	m ²	319	216	82	617
Carriageway Pavement	6,633	m ²	1,732	1,198	343	3,273
Shoulder Pavement	1,628	²	247	164	44	455
Gravity Wall H=3 ^m	60	m	240	333	35	608
Slope Protection A	1,434	<u></u> 2	885	1,544	78	2,507
Concrete Spraying	4,236	2	229	228	62	519
Seed Spraying	2,613	m ²	42	61	11	114
Guard Rail	762	EL.	756	1,115	96	1,967
Total			22,150	16,878	5,338	44,366
w/Overhead and Profit			30,053	19,512	5,893	55,458
Supervision			2,107	527	139	2,773
Contingency			3,216	2,004	603	5,823
Detailed Eng. w/Cont.			2,318	580	152	3,050
Total			37,694	22,623	6,787	67,104
Economic Cost			37,694	22,623	-	60,317
Section (04) P-3						
KM68,384 - KM69,228						
KM68,384 - KM69,228 Item	Quantity	Unit	FC	. TC	TAX	TOTAL
	Quantity 17,833	2	FC 67	- LC 27	TAX 12	TOTAL 106
Item		ա ² ա ³				
Item Clearing, Stripping	17,833	2 3 3	67	27	12	106
Item Clearing, Stripping Excavation Common A	17,833 19,500	2 3 3 3	67 369	27 176	12 67	106 612
Item Clearing, Stripping Excavation Common A Excavation Common B	17,833 19,500 19,558	2 3 3 3 3 3	67 369 1,472	27 176 562	12 67 271	106 612 2,305
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock	17,833 19,500 19,558 3,550	2 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2	67 369 1,472 432	27 176 562 268	12 67 271 103	106 612 2,305 803
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock	17,833 19,500 19,558 3,550 29,768	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	67 369 1,472 432 9,066	27 176 562 268 6,046	12 67 271 103 2,405	106 612 2,305 803 17,517
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment	17,833 19,500 19,558 3,550 29,768 6,467	2 2 2 2 2 2 2 2 2 2	67 369 1,472 432 9,066 372	27 176 562 268 6,046 221	12 67 271 103 2,405 81	106 612 2,305 803 17,517 674
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement	17,833 19,500 19,558 3,550 29,768 6,467 2,592	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	67 369 1,472 432 9,066 372 193	27 176 562 268 6,046 221 131	12 67 271 103 2,405 81 49	106 612 2,305 803 17,517 674 373
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403	2 2 2 2 2 2 2 2 2 2	67 369 1,472 432 9,066 372 193 983	27 176 562 268 6,046 221 131 647	12 67 271 103 2,405 81 49 173	106 612 2,305 803 17,517 674 373 1,803
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258	2 2 3 2 3 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2	67 369 1,472 432 9,066 372 193 983 249	27 176 562 268 6,046 221 131 647 164	12 67 271 103 2,405 81 49 173 44	106 612 2,305 803 17,517 674 373 1,803 457
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1	ມີ ເຊິ່ງ ເຊີ່ງ ເຊີ່ມ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເຊີ່ງ ເລີ່ງ ເລີ່ງ ເລີ ເຊີ່ງ ເ ເ ເ ເ ເ ເ ເ ເ ເ ເ ເ ເ ເ ເ ເ ເ ເ ເ	67 369 1,472 432 9,066 372 193 983 249 2,394	27 176 562 268 6,046 221 131 647 164 2,940	12 67 271 103 2,405 81 49 173 44 573	106 612 2,305 803 17,517 674 373 1,803 457 5,907
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64	ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ	67 369 1,472 432 9,066 372 193 983 249 2,394 527	27 176 562 268 6,046 221 131 647 164 2,940 702	12 67 271 103 2,405 81 49 173 44 573 75	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30	ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575	27 176 562 268 6,046 221 131 647 164 2,940 702 941	12 67 271 103 2,405 81 49 173 44 573 75 89	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m Concrete Spraying	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30 3,240	ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ ສິ	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575 176	27 176 562 268 6,046 221 131 647 164 2,940 702 941 174	12 67 271 103 2,405 81 49 173 44 573 75 89 47	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605 397
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m Concrete Spraying Seed Paraying	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30 3,240 13,633	2 2 3 3 3 3 2 2 2 2 5 pan 2 2 2 2 2 2 2 2 2 2 2 2 2	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575 176 219	27 176 562 268 6,046 221 131 647 164 2,940 702 941 174 318	12 67 271 103 2,405 81 49 173 44 573 75 89 47 58	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605 397 595
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m Concrete Spraying Seed Paraying Setting Pipe 900 dia.	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30 3,240 13,633 80	2 ສີ3 ສີ3 ສີ2 ສີ2 ສີ2 ສີ2 ສີ2 ສີ2 ສີ2 ສີ2 ສີ2 ສີ2	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575 176 219 125	27 176 562 268 6,046 221 131 647 164 2,940 702 941 174 318 151	12 67 271 103 2,405 81 49 173 44 573 75 89 47 58 15	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605 397 595 291
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m Concrete Spraying Seed Paraying Setting Pipe 900 dia. Side Ditch	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30 3,240 13,633 80 1,290	ສີ ສີ ສີ ສີ ສີ ສີ ສີ ສີ ສີ ສີ ສີ ສີ ສີ	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575 176 219 125 603	27 176 562 268 6,046 221 131 647 164 2,940 702 941 174 318 151 947	12 67 271 103 2,405 81 49 173 44 573 75 89 47 58 15 113	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605 397 595 291 1,663
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m Concrete Spraying Seed Paraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail Total	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30 3,240 13,633 80 1,290 8	ມີ ເຊິ່ງ ເຊີ່ງ ເລີ່ງ ເລີ່ງ ເລີ ເລີ່ງ ເລີາ ເລີ່ງ ເລີ່ມ ເລີ່ມ ເລີ່ມ ເລີອ ເລີອ ເລີ ເລີອ ເລີອ ເລີອ ເລີອ ເລີອ	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575 176 219 125 603 16 624 18,462	27 176 562 268 6,046 221 131 647 164 2,940 702 941 174 318 151 947 50 920 15,385	12 67 271 103 2,405 81 49 173 44 573 75 89 47 58 15 113 2 80 4,257	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605 397 595 291 1,663 68 1,624 38,104
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m Concrete Spraying Seed Paraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail Total	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30 3,240 13,633 80 1,290 8	ມີ ເຊິ່ງ ເຊີ່ງ ເລີ່ງ ເລີ່ງ ເລີ ເລີ່ງ ເລີາ ເລີ່ງ ເລີ່ມ ເລີ່ມ ເລີ່ມ ເລີອ ເລີອ ເລີ ເລີອ ເລີອ ເລີອ ເລີອ ເລີອ	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575 176 219 125 603 16 624 18,462 25,249	27 176 562 268 6,046 221 131 647 164 2,940 702 941 174 318 151 947 50 920 15,385 17,648	12 67 271 103 2,405 81 49 173 44 573 75 89 47 58 15 113 2 80 4,257 4,733	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605 397 595 291 1,663 68 1,624 38,104 47,630
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m Concrete Spraying Seed Paraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail Total W/Overhead and Profit Supervision	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30 3,240 13,633 80 1,290 8	ມີ ເຊິ່ງ ເຊີ່ງ ເລີ່ງ ເລີ່ງ ເລີ ເລີ່ງ ເລີາ ເລີ່ງ ເລີ່ມ ເລີ່ມ ເລີ່ມ ເລີອ ເລີອ ເລີ ເລີອ ເລີອ ເລີອ ເລີອ ເລີອ	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575 176 219 125 603 16 624 18,462 25,249 1,810	27 176 562 268 6,046 221 131 647 164 2,940 702 941 174 318 151 947 50 920 15,385 17,648 453	12 67 271 103 2,405 81 49 173 44 573 75 89 47 58 15 113 2 80 4,257 4,733 119	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605 397 595 291 1,663 68 1,624 38,104 47,630 2,382
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m Concrete Spraying Seed Paraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail Total W/Overhead and Profit Supervision Contingency	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30 3,240 13,633 80 1,290 8	ມີ ເຊິ່ງ ເຊີ່ງ ເລີ່ງ ເລີ່ງ ເລີ ເລີ່ງ ເລີາ ເລີ່ງ ເລີ່ມ ເລີ່ມ ເລີ່ມ ເລີອ ເລີອ ເລີ ເລີອ ເລີອ ເລີອ ເລີອ ເລີອ	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575 176 219 125 603 16 624 18,462 25,249 1,810 2,706	27 176 562 268 6,046 221 131 647 164 2,940 702 941 174 318 151 947 50 920 15,385 17,648 453 1,810	12 67 271 103 2,405 81 49 173 44 573 75 89 47 58 15 113 2 80 4,257 4,733 119 485	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605 397 595 291 1,663 68 1,624 38,104 47,630 2,382 5,001
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m Concrete Spraying Seed Paraying Seed Paraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail Total W/Overhead and Profit Supervision Contingency Detailed Eng. w/Cont.	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30 3,240 13,633 80 1,290 8	ມີ ເຊິ່ງ ເຊີ່ງ ເລີ່ງ ເລີ່ງ ເລີ ເລີ່ງ ເລີາ ເລີ່ງ ເລີ່ມ ເລີ່ມ ເລີ່ມ ເລີອ ເລີອ ເລີ ເລີອ ເລີອ ເລີອ ເລີອ ເລີອ	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575 176 219 125 603 16 624 18,462 25,249 1,810 2,706 1,991	27 176 562 268 6,046 221 131 647 164 2,940 702 941 174 318 151 947 50 920 15,385 17,648 453 1,810 498	12 67 271 103 2,405 81 49 173 44 573 75 89 47 58 15 113 2 80 4,257 4,733 119 485 131	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605 397 595 291 1,663 68 1,624 38,104 47,630 2,382 5,001 2,620
Item Clearing, Stripping Excavation Common A Excavation Common B Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement P.C.T. Bridge L=20 ^m Gravity Wall h=4 ^m Retaining Wall h=7 ^m Concrete Spraying Seed Paraying Setting Pipe 900 dia. Side Ditch Catch Basin Guard Rail Total W/Overhead and Profit Supervision Contingency	17,833 19,500 19,558 3,550 29,768 6,467 2,592 4,403 1,258 1 64 30 3,240 13,633 80 1,290 8	ມີ ເຊິ່ງ ເຊີ່ງ ເລີ່ງ ເລີ່ງ ເລີ ເລີ່ງ ເຊີ່ງ ເລີາ ເລີ່ງ ເລີ່ມ ເລີ່ມ ເລີ່ມ ເລີອ ເລີອ ເລີອ ເລີອ ເລີອ ເລີອ ເລີອ ເລີອ	67 369 1,472 432 9,066 372 193 983 249 2,394 527 575 176 219 125 603 16 624 18,462 25,249 1,810 2,706	27 176 562 268 6,046 221 131 647 164 2,940 702 941 174 318 151 947 50 920 15,385 17,648 453 1,810	12 67 271 103 2,405 81 49 173 44 573 75 89 47 58 15 113 2 80 4,257 4,733 119 485	106 612 2,305 803 17,517 674 373 1,803 457 5,907 1,304 1,605 397 595 291 1,663 68 1,624 38,104 47,630 2,382 5,001

Table 8-3-1 Annex

QUANTITIES AND COST: THE IMPROVEMENT PLANS SELECTED (3)

Section (05) P-2 KM69.2 - KM70.1

Item	Quantity		FC	LC	TAX	TOTAL
Clearing, Stripping	1,329	m ²	5	2	1	8
Excavation Common M	760	3	13	60	2	75
Excavation Common B	777	щ ³	59	22	11	92
Excavation Soft Rock	1,059	3	129	80	31	240
Excavation Hard Rock	4,007	3	1,220	814	324	2,358
Removal of Old Paveme	nt 1,480	m ²	110	75	28	213
Carriageway Pavement	2,464	m ²	643	445	128	1,216
Shoulder Pavement	644	<u>m</u> 2	98	65	17	180
Gravity Wall h=3 ^m	20	m	80	111	12	203
Slope Protection A	616	2	380	663	34	1,077
Concrete Spraying	378	2	21	20	5	46
Embankment	78	3	4	3	1	8
Guard Rail	382	щ	379	559	48	986
Total			3,141	2,919	642	6,702
w/Overhead and Profit			4,335	3,317	726	8,378
Supervision			318	80	21	419
Contingency			465	340	75	880
Detailed Eng. w/Cont.			349	88	23	460
Total			5,467	3,825	845	10,137
Economic Cost			5,467	3,825	-	9,292
Section (06) P-2 KM70.1 - KM72.9						
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Excavation Common M	58	3	1	5	0	6
Embankment	800	m ³	46	27	10	83
Removal of Old Paveme	Ŧ	m	123	84	31	238
Carriageway Pavement	1,764	²	461	319	91	871
Shoulder Pavement	430	m ²	65	43	12	120
Gravity Wall H=3 ^m Guard Rail	64 215	n	256	355	37	648
Total	410	π	213 1,165	315 1,148	27 208	555
w/Overhead and Profit			1,105	1,297	200	2,521 3,151
Supervision			120	30	240	158
Contingency			173	133	25	331
Detailed Eng. w/Cont.			132	33	9	174
Total			2,039	1,493	282	3,814
Economic Cost			2,039	1,493		3,532

Annex Table 8-3-1						
QUANTITIES AND	COST:	THE IMP	ROVEMENT	PLANS	SELECTED	(4)
Section (08) P-2 Km 73.4 - KM 75.2						
Item Qu	antity	Unit	FC	LC	TAX	TOTAL
Excavation Common M	52	<u></u> 3	1	4	0	5
Embankment	508	<u></u> 3	29	17	7	53
Removal of Old Pavement	774	m	57	39	15	111
Carriageway Pavement	718	m ²	187	130	37	354
Shoulder Pavement	172	m ²	26	17	5	48
Guard Rail	145	m	144	212	18	374
Total			444	419	82	945
w/Overhead and Profit			612	475	94	1,181
Supervision			45	11	3	59
Contingency			66	49	9	124
Detailed Eng. w/Cont.			50	12	3	65
Total			773	547	109	1,429
Economic Cost			773	547	-	1,320
Section (09) P-2 Km 75.2 -KM 75.7						
Km 75.2 -KM 75.7	ntity	Unit	FC	LC	TAX	TOTAL
Km 75.2 -KM 75.7	ntity 53	3	FC 1	LC 4	TAX 0	TOTAL 5
Km 75.2 -KM 75.7 Item Qua	_	_m 3 3	-			
Km 75.2 -KM 75.7 Item Qua Excavation Common M	53	m ³ m ³ m ²	1	4	0	5
Km 75.2 -KM 75.7 Item Qua Excavation Common M Embankment	53 23	m ³ m ³ m ² m ²	1 1	4 1	0	5 2
Km 75.2 -KM 75.7 Item Qua Excavation Common M Embankment Removal of Old Pavement	53 23 684	m ³ m ³ m ²	1 1 51	4 1 35	0 0 13	5 2 99
Km 75.2 -KM 75.7 Item Quar Excavation Common M Embankment Removal of Old Pavement Carriageway Pavement	53 23 684 635	m ³ m ³ m ² m ²	1 1 51 166	4 1 35 115	0 0 13 33	5 2 99 314
Km 75.2 -KM 75.7 Item Quar Excavation Common M Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement	53 23 684 635 152	n ³ n ³ n ² n ² n ²	1 1 51 166 23	4 1 35 115 15	0 0 13 33 4	5 2 99 314 42
Km 75.2 -KM 75.7 Item Qua Excavation Common M Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement R.C.Bridge L=10 ^m	53 23 684 635 152 1	n ³ m ² n ² m ² m ² Span	1 51 166 23 580	4 1 35 115 15 931	0 0 13 33 4 91	5 2 99 314 42 1,602
Km 75.2 -KM 75.7 Item Quar Excavation Common M Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement R.C.Bridge L=10 ^m Guard Rail	53 23 684 635 152 1	n ³ m ² n ² m ² m ² Span	1 51 166 23 580 76	4 35 115 15 931 111	0 0 13 33 4 91 10	5 2 99 314 42 1,602 197
Km 75.2 -KM 75.7 Item Quar Excavation Common M Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement R.C.Bridge L=10 ^m Guard Rail Total	53 23 684 635 152 1	n ³ m ² n ² m ² m ² Span	1 51 166 23 580 76 898	4 1 35 115 15 931 111 1,212	0 13 33 4 91 10 151	5 2 99 314 42 1,602 197 2,261
Km 75.2 -KM 75.7 Item Quar Excavation Common M Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement R.C.Bridge L=10 ^m Guard Rail Total w/Overhead and Profit	53 23 684 635 152 1	n ³ m ² n ² m ² m ² Span	1 51 166 23 580 76 898 1,301	4 1 35 115 15 931 111 1,212 1,346	0 13 33 4 91 10 151 179	5 2 99 314 42 1,602 197 2,261 2,826
Km 75.2 -KM 75.7 Item Quar Excavation Common M Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement R.C.Bridge L=10 ^m Guard Rail Total w/Overhead and Profit Supervision	53 23 684 635 152 1	n ³ m ² n ² m ² m ² Span	1 51 166 23 580 76 898 1,301 107	4 1 35 115 931 111 1,212 1,346 27	0 13 33 4 91 10 151 179 7	5 2 99 314 42 1,602 197 2,261 2,826 141
Km 75.2 -KM 75.7 Item Quar Excavation Common M Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement R.C.Bridge L=10 ^m Guard Rail Total w/Overhead and Profit Supervision Contingency	53 23 684 635 152 1	n ³ m ² n ² m ² m ² Span	1 51 166 23 580 76 898 1,301 107 141	4 1 35 115 931 111 1,212 1,346 27 137	0 13 33 4 91 10 151 179 7 19	5 2 99 314 42 1,602 197 2,261 2,826 141 297
Km 75.2 -KM 75.7 Item Quar Excavation Common M Embankment Removal of Old Pavement Carriageway Pavement Carriageway Pavement Shoulder Pavement R.C.Bridge L=10 ^m Guard Rail Total w/Overhead and Profit Supervision Contingency Detailed Eng. w/Cont.	53 23 684 635 152 1	n ³ m ² n ² m ² m ² Span	1 51 166 23 580 76 898 1,301 107 141 118	4 1 35 115 931 111 1,212 1,346 27 137 30	0 13 33 4 91 10 151 179 7 19 7	5 2 99 314 42 1,602 197 2,261 2,826 141 297 155

Annex

Section (10) P-2 Km 75.7 - KM 81.1

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	480	_m 2	2	1	0	3
Excavation Common M	254	_3 m	4	20	1	25
Excavation Soft Rock	2,727	3	332	206	79	617
Excavation Hard Rock	947	3	288	192	77	557
Embankment	872	3	50	30	11	91
Removal of Old Pavement	4,090	m ²	304	207	78	589
Removal of Old Masonry	667	m.	36	25	8	69
Carriageway Pavement	4,821	m ²	1,259	871	249	2,379
Shoulder Pavement	1,394	_m ²	212	1.40	38	390
R.C.¤ridge ^T =5 ^m	1	Snan	293	460	43	796
P.C.T.Bridge L=30 ^m	1	Span	3,862	4,467	937	9,266
Gravity Wall H=3 ^m	127	m	508	705	73	1,286
Slope Protection A	237	<u></u> 2	146	255	13	414
Seed Spraying	544	_m 2	9	13	2	24
Guard Rail	553	tn.	549	809	70	1,428
Total			7,854	8,401	1,679	17,934
w/Overhead and Profit			11,049	9,466	1,903	22,418
Supervision			852	213	56	1,121
Contingency			1,190	968	195	2,353
Detailed Eng. w/Cont.			937	234	62	1,233
Total			14,028	10,881	2,216	27,125
Economic Cost			14,028	10,881	-	24,909

QUANTITITES AND COST: THE IMPROVEMENT PLANS SELECTED (6)

Section (11) P-3 KM 81.1 - KM81.6

	Item	Quantity	Unit	FC	LC	TAX	TOTAL
	Clearing Stripping	1,081	m ²	4	2	0	6
	Excavation Common A	1,460	m ³	28	13	5	46
	Excavation Common B	1,475	3	111	42	21	174
		533	2	65	40	16	121
	Excavation Soft Rock		2	44	30	11	85
	Removal of Old Paveme	1,330	2	347	240	69	656
	Carriageway Pavement	•	2	58	38	10	106
	Shoulder Pavement	380		_	9,796	2,053	20,324
	P.C.T.Bridge (2030 ^{m})	1		8,475	-	2,000	37
	Seed Spraying	842	m ²	14	20	-	69
	Setting Pipe 900 dia	. 19	m	30	36	3	
	Side Ditch	380	m	178	279	33	490
	Catch Basin	2	U	4	12	1	17
	Guard Rail	215	m	213	315	27	555
	Total			9,571	10,863	2,252	22,686
	w/Overhead and Profit	Ł		13,612	12,210	2,536	28,358
	Supervision			1,077	270	71	1,418
	Contingency			1,469	1,248	261	2,978
-				1,185	297	78	1,560
	Detailed Eng. w/Cont	•		17,343	14,025	2,946	34,314
	Total			17,343	÷	_	31,368
	Economic Cost			1,040	14,023		,

Addex 19016 9-2-1						
QUANTITIES AND	COST: 1	HE IMPI	ROVEMENT	PLANS SEI	LECTED (7)	
Section (12) P-2 KM 81.6 - KM 83.5						
Item 0	uantity	Unit	FC	LC	TAX	TOTAL
Embankment	616	³	35	21	8	64
Removal of Old Pavement	495	_m 2	37	25	9	71
Carriageway Pavement	718	_m 2	187	130	37	354
Shoulder Pavement	172	m ²	26	17	5	48
Gravity Wall H=3 ^m	4	m	16	22	2	40
R.C. Half Bridge	46	m	1,218	2,198	187	3,603
Guard Rail	86	m	85	126	11	222
Total			1,604	2,539	259	4,402
w/Overhead and Profit			2,388	2,801	314	5,503
Supervision			20 9	52	14	275
Contingency			260	285	33	578
Detailed Eng. w/Cont.			230	57	15	302
Total			3,087	3,195	376	6,658
Economic Cost			3,087	3,195	_	6,282
Section (13) P-2 KM 83.5 - KM 88.7						
Item (uantity	Unit	FC	LC	TAX	TOTAL
		-				
Clearing, Stripping	1,617	ա ²	6	3	1	10
Clearing, Stripping Excavation Common M	1,617 1,836	ա ² 3	6 32	3 145	1 5	10 182
	•					
Excavation Common M	1,836	<u></u> 3	32	145	5	182
Excavation Common M Excavation Soft Rock	1,836 1,630	_m 3 m3	32 198	145 123	5 47	182 368
Excavation Common M Excavation Soft Rock Excavation Hard Rock	1,836 1,630 352	m ³ m ³ m ³	32 198 107	145 123 72	5 47 28	182 368 207
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment	1,836 1,630 352 1,184	^{m3} m3 m3 m3	32 198 107 68	145 123 72 40	5 47 28 15	182 368 207 123
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement	1,836 1,630 352 1,184 3,561	m ³ m ³ m ³ m ³ m ²	32 198 107 68 265	145 123 72 40 180	5 47 28 15 68	182 368 207 123 513
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Gravity Wall H=3 ^m	1,836 1,630 352 1,184 3,561 4,203	m ³ m ³ m ³ m ³ m ² m ² m ² m ² m ² m ²	32 198 107 68 265 1,098	145 123 72 40 180 759	5 47 28 15 68 217	182 368 207 123 513 2,074
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement	1,836 1,630 352 1,184 3,561 4,203 1,010	n3 n3 n3 n3 n2 n2 n2 n2 n2	32 198 107 68 265 1,098 154	145 123 72 40 180 759 102	5 47 28 15 68 217 27	182 368 207 123 513 2,074 283
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Gravity Wall H=3 ^m	1,836 1,630 352 1,184 3,561 4,203 1,010 83	m ³ m ³ m ³ m ³ m ² m ² m ² m ² m ² m ²	32 198 107 68 265 1,098 154 332	145 123 72 40 180 759 102 461	5 47 28 15 68 217 27 48	182 368 207 123 513 2,074 283 841
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Gravity Wall H=3 ^m Concrete Spraying Guard Rail Total	1,836 1,630 352 1,184 3,561 4,203 1,010 83 484	m ³ m ³ m ³ m ² m ² m ² m ² m ² m ²	32 198 107 68 265 1,098 154 332 26	145 123 72 40 180 759 102 461 26 739 2,650	5 47 28 15 68 217 27 48 7	182 368 207 123 513 2,074 283 841 59
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Gravity Wall H=3 ^m Concrete Spraying Guard Rail Total w/Overhead and Profit	1,836 1,630 352 1,184 3,561 4,203 1,010 83 484	m ³ m ³ m ³ m ² m ² m ² m ² m ² m ²	32 198 107 68 265 1,098 154 332 26 501	145 123 72 40 180 759 102 461 26 739	5 47 28 15 68 217 27 48 7 64 527 602	182 368 207 123 513 2,074 283 841 59 1,304
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Gravity Wall H=3 ^m Concrete Spraying Guard Rail Total W/Overhead and Profit Supervision	1,836 1,630 352 1,184 3,561 4,203 1,010 83 484	m ³ m ³ m ³ m ² m ² m ² m ² m ² m ²	32 198 107 68 265 1,098 154 332 26 501 2,787 3,849 283	145 123 72 40 180 759 102 461 26 739 2,650 3,004 71	5 47 28 15 68 217 27 48 7 64 527 602 19	182 368 207 123 513 2,074 283 841 59 1,304 5,964 7,455 373
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Gravity Wall H=3 ^m Concrete Spraying Guard Rail Total w/Overhead and Profit Supervision Contingency	1,836 1,630 352 1,184 3,561 4,203 1,010 83 484	m ³ m ³ m ³ m ² m ² m ² m ² m ² m ²	32 198 107 68 265 1,098 154 332 26 501 2,787 3,849 283 413	145 123 72 40 180 759 102 461 26 739 2,650 3,004 71 308	5 47 28 15 68 217 27 48 7 64 527 602 19 62	182 368 207 123 513 2,074 283 841 59 1,304 5,964 7,455 373 783
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Carriageway Pavement Shoulder Pavement Gravity Wall H=3 ^m Concrete Spraying Guard Rail Total W/Overhead and Profit Supervision Contingency Detailed Eng. w/Cont.	1,836 1,630 352 1,184 3,561 4,203 1,010 83 484	m ³ m ³ m ³ m ² m ² m ² m ² m ² m ²	32 198 107 68 265 1,098 154 332 26 501 2,787 3,849 283 413 311	145 123 72 40 180 759 102 461 26 739 2,650 3,004 71 308 78	5 47 28 15 68 217 27 48 7 64 527 602 19 62 21	182 368 207 123 513 2,074 283 841 59 1,304 5,964 7,455 373 783 410
Excavation Common M Excavation Soft Rock Excavation Hard Rock Embankment Removal of Old Pavement Carriageway Pavement Shoulder Pavement Gravity Wall H=3 ^m Concrete Spraying Guard Rail Total w/Overhead and Profit Supervision Contingency	1,836 1,630 352 1,184 3,561 4,203 1,010 83 484	m ³ m ³ m ³ m ² m ² m ² m ² m ² m ²	32 198 107 68 265 1,098 154 332 26 501 2,787 3,849 283 413	145 123 72 40 180 759 102 461 26 739 2,650 3,004 71 308	5 47 28 15 68 217 27 48 7 64 527 602 19 62	182 368 207 123 513 2,074 283 841 59 1,304 5,964 7,455 373 783

Almex lable 8-3-1						
QUANTITIES AN	D COST: TH	E IMPRO	VEMENT	PLANS SE	LECTED (8)	
Section (14) P-2 KM 94.3 - KM 97.6						
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	1,623	" ²	6	3	1	10
Excavation Common M	1,529	<mark>т</mark> 3	27	120	5	152
Excavation Common B	1,096	<u>т</u> 3	82	32	15	129
Excavation Soft Rock	1,234	m3	150	93	36	279
Embankment	4,956	"3	286	169	62	517
Removal of Old Pavemen	t 3,634	m ²	271	183	69	523
Carriageway Pavement	4,348	m2	1,135	786	228	2,146
Shoulder Pavement	1,092	m ²	166	110	29	305
Gravity Wall H=3 ^m	55	n	270	305	32	557
R.C.Bridge L=10 ^m	1	Span	580	931	91	1,602
Concrete Spraying	128	m ²	7	7	2	16
Seed Spraying	452	m ²	7	11	2	20
Guard Rail	373	m	370	546	47	963
Total			3,307	3,296	616	7,219
w/Overhead and Profit			4,593	3,725	706	9,024
Supervision			343	85	23	451
Contingency			494	381	73	948
Detailed Eng. w/Cont.			377	94	25	496
Total			5,807	4,285	827	10,919
Economic Cost			5,807	4,285	-	10,092
Section (15) P-2 KM 97.6 - KM 98.2						
	Quantity	Unit	FC	LC	TAX	TOTAL
Excavation Common M	58	^m 3	1	5	0	6
Embankment	58	<u>س</u> 3	3	2	1	6
Removal of Old Pavement		²	64	44	16	124
Carriageway Pavement	802	m ²	209	145	42	396
Shoulder Pavement	192	ш ²	29	19	5	53
Guard Rail	96	m	95	140	12	247
Total			401	355	76	832
w/Overhead and Profit			549	405	86	1,040
Supervision			39	10	3	52
Contingency			59	42	9	109
Detailed Eng. w/Cont.			43	11	3	58
Total			690	468	101	1,259
Economic Cost			690	468	-	1,158

QUANTITIES AND COST: THE IMPROVEMENT PLANS SELECTED (9)

Section (16) P-2 KM 98.2 - KM 100.7

KM 98.2 - KM 100.7						
Item	Quantit		FC	LC	TAX	TOTAL
Embankment	113	" ³	6	5	1	12
Removal of Old Pavement	758	m ²	57	38	14	109
Carriageway Pavement	563	n ²	147	102	29	278
Shoulder Pavement	150	m ²	23	15	4	42
Seed Spraying	248	m ²	4	6	1	11
Guard Rail	75	m	75	110	9	194
Total			312	276	58	646
w/Overhead and Profit			427	315	66	808
Supervision			31	8	2	41
Contingency			46	32	7	85
Detailed Eng. w/Cont.			34	9	2	45
Total			538	364	77	979
Economic Cost			538	364	-	902
Section (17) P-3 KM 101.2						
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	3,590	m ²	13	6	3	22
Excavation Common A	2,100	" ³	40	19	7	66
Excavation Common B	2,105	.3 m	158	61	29	248
Excavation Soft Rock	1,450	" ³	176	109	42	327
Embankment	8,570	n 3	494	293	107	894
Carriageway Pavement	2,930	"2	765	529	152	1,466
Shoulder Pavement	680	m ²	104	68	18	190
P.C.T.Bridge L=170 ^m	1	Place	48,720	44,574	10,366	103,660
R.C.Bridge L=5 ^m	1	Span	293	460	43	796
Gravity Wall H=3 ^m	80	æ	320	444	46	810
Retaining Wall H=5 ^m	100	m	1,019	1,726	159	2,904
Retaining Wall H=7 ^m	170	D.	3,258	5,335	507	9,100
Recaining Wall H=10 ⁰⁰	80	12	2,333	2,900	226	5,459
Slope Protection A	484	²	299	521	26	846
Seed Spraying	909	m ²	15	21	4	40
Setting Pipe 900 dia.	13	p1	20	25	2	47
Side Ditch	620	w	290	455	54	799
Catch Basin	6	U	12	37	2	51
Guard Rail	290	m	288	424	37	749
Total			58,617	58,007	11,830	128,454
w/Overhead and Profit			81,498	65,634	13,436	160,568
Supervision			6,101	1,525	402	8,028
Contingency			8,760	6,716	1,384	16,860
Detailed Eng. w/Cont.			6,711	1,678	442	8,831
Total			103,070	75,553	15,664	194,287
Economic Cost			103,070	75,553	-	178,623

Annex Table 8-3-1						
QUANTITIES AND	COST: THE	IMPRO	VEMENT PI	LANS SEL	ECTED (10))
Section (18) P-2 KM102.1 - KM135.6						(UNIT: \$'000)
Item	Quantity	Uni	t FC	LC	TAX	TOTAL
Clearing, Stripping	62,354	m ²	235	95	43	373
Excavation Common M	34,434	_m 3	607	2,713	100	3,420
Excavation Common B	25,201	m3	1,896	724	349	2,969
Excavation Soft Rock	136,413	_m 3	16,603	10,290	3,969	30,862
Excavation Hard Rock	1,125	_m 3	343	229	91	663
Embankment	19,153	m ³	1,103	655	240	1,998
Removal of Old Pavemen	± 53,026	m ²	3,949	2,679	1,012	7,640
Removal of Old Masonry	370	m	20	14	4	38
Carriageway Pavement	70,427	m ²	18,391	12,722	3,643	34,756
Shoulder Pavement	13,172	_m 2	2,003	1,325	354	3,682
Gravity Wall H=3 ^m	150	m	600	833	86	1,519
Gravity Wall H=4 ^m	50	m	411	549	59	1,019
Retaining Wall H=7 ^m	50	m	958	1,569	149	2,676
Slope Protection A	16,442	m ²	10,146	17,703	894	28,743
Concrete Spraying	795	m2	38	37	10	85
Seed Spraying	22,523	_m 2	362	526	97	985
Setting Pipe 900 dia.	117	m	183	221	22	426
Setting Pipe 600 dia.	15	m	16	19	2	37
Side Ditch	13,562	m	6,343	9,957	1,185	17,485
Catch Basin	2	U	4	13	0	17
Guard Rail	6,606	m	6,557	9,666	834	17,057
Total			70,768	72,539	13,143	156,450
w/Overhead and Profit			98,636	81,828		195,563
Supervision			7,431	1,858	489	9,778
Contingency			10,607	8,369	1,558	20,534
Detailed Eng. w/Cont.			8,174	2,044	538	10,756
Total			124,848			236,631
Economic Cost			124,848	•	/	218,947

MINIMUM SCALE IMPROVEMENT (1)

Section (01) KM 61.3 ~ KM 62.8					(US\$	'000)
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	603	<u></u> п2	2	1	1	4
Excavation Common M	610	m ³	11	48	2	61
Excavation Soft Rock	737	3	89	55	21	165
Embankment	170	m ³	10	6	2	18
Removal of Old Paveme	ent 2,874	m ²	214	1.45	55	414
Carriageway Pavement	3,895	m ²	1,017	704	202	1,923
Shoulder Pavement	728	_m 2	111	73	19	203
Gravity Wall H=3 ^m	21	m	84	117	12	213
Concrete Spraying	335	m ²	18	18	5	41
Guard Rail	364	m	361	533	46	940
Total			1,917	1,700	365	3,982
Section (02) KM 62.8 - KM 63.9						
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	1,838	2	7	3	1	11
Excavation Common M	4,066	3	72	320	12	404
Excavation Soft Rock	11,456	"3	1,394	864	334	2,592
Excavation Hard Rock	4,115	3	1,253	836	. 332	2,421
Removal of Old Paveme	nt 1,052	m ²	78	53	20	151
Carriageway Pavement	1,774	<u></u> м2	463	320	92	875
Shoulder Pavement	428	m ²	65	43	12	120
Gravity Wall H=3 ^m	7	m	28	39	4	71
Slope Protection A	168	m ²	104	181	9	294
Concrete Spraying	815	² ۳	44	44	12	100
Seed Spraying	924	ա ²	15	21	4	40
Guard Rail	214	m	212	313	27	552
Total			3,735	3,037	859	7,631

MINIMUM SCALE IMPROVEMENT (2)

•

(UNIT: \$'000)

Section (03) KM 65.6 - KM 68.1

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	10,103	m ²	38	15	7	60
Excavation Commom M	6,904	m ³	122	544	20	686
Excavation Common B	6,414	m ³	483	184	89	756
Excavation Soft Rock	17,140	m ³	2,086	1,293	499	3,878
Excavation Hard Rock	49,115	m ³	14,958	9,976	3,969	28,903
Embankment	217	3	13	7	3	23
Removal of Old Pavemen	t 4,282	m ²	319	216	82	617
Carriageway Pavement	6,633	m ²	1,732	1,198	343	3,273
Shoulder Pavement	1,628	m ²	247	164	44	455
Gravity Wall H=3 ^m	60	m	240	333	35	608
Slope Protection A	1,434	m ²	885	1,544	78	2,507
Concrete Spraying	4,236	m ²	229	228	62	519
Seed Spraying	2,613	m ²	42	61	11	114
Guard Rail	762	m	756	1,115	96	1,967
Total			22,150	16,878	5,338	44,366
Section (04) KM 68.4 - KM 69.2						
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	4,974	<mark>ي</mark> 2	19	8	3	30
Excavation Commom M	5,893	m ³	104	464	17	585
Excavation Commom B	5,200	3 	391	150	72	613
Excavation Soft Rock	10,721	3	1,305	809	312	2,426
Excavation Hard Rock	28,123	3	8,565	5,713	2,272	16,550
Removal of Old Payment	1,208	m ²	90	61	23	174
Carriageway Pavement	2,205	m ²	576	398	114	1,088
Shoulder Pavement	560	m ²	85	56	15	156
Gravity Wall H=3 ^m	8	m	32	44	5	81
Slope Protection A	1,268	2	783	1,365	69	2,217
Concrete Spraying	769	m ²	42	41	11	94
Seed Spraying	2,443	²	39	57	11	107
Guard Rail	220	İN	218	322	28	568
Total						
			12,249	9,488	2,952	24,689

(UNIT: \$'000)

MINIMUM SCALE IMPROVEMENT (3)

Section (05) KM 69.2 - KM 70.1

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	1,329	m ²	5	2	1	8
Excavation Commom M	760	m ³	13	60	2	75
Excavation Commom B	777	m ³	59	22	11	92
Excavation Soft Rock	1,059	3	129	80	31	240
Excavation Hard Rock	4,007	_3	1,220	814	324	2,358
Removal of Old Pavement	1,480	2	110	75	28	213
Carriageway Pavement	2,464	2	643	445	128	1,216
Shoulder Pavement	644	m ²	98	65	17	180
Gravity Wall H=3 ^m	20	m	80	111	12	203
Slope Protection A	616	m ²	380	663	34	1,077
Concrete Spraying	378	m ²	21	20	5	46
Embankment	78	3	4	3	1	8
Guard Rail	382	m	379	559	48	986
Total			3,141	2,919	642	6,702

Section (06) KM 70-1 - KM 72.9

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Excavation Commom M	58	m ³	1	5	0	6
Embankment	800	<u>"</u> З	46	27	10	83
Removal of Old Pavement	1,654	m	123	84	31	238
Carriageway Pavement	1,764	ш ²	461	319	91	871
Shoulder Pavement	430	<mark>2</mark>	65	43	12	120
Gravity Wall H=3 ^m	64	m	256	355	37	648
Guard Rail			213	315	27	555
Total			1,165	1,148	208	2,521

MINIMUM SCALE IMPROVEMENT (4)

(UNIT: \$'000)

Section (08) KM 73.4 - KM 75.2

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Excavation Commom M	52	m ³	1	4	0	5
Embankment	508	m ³	29	17	7	53
Removal of Old Pavemen	t 774	m	57	39	15	111
Carriageway Pavement	718	m ²	187	130	37	354
Shoulder Pavement	172	m ²	26	17	5	48
Guard Rail	145	m	144	212	18	374
Total			444	419	82	945

Section (09) KM 75.2 - KM 75.7

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Excavation Commom M	53	m 3	1	4	0	5
Embankment	23	m ³	1	1	0	2
Removal of Old Pavement	nt 684	m ²	51	35	13	99
Carriageway Pavement	635	²	166	115	33	314
Shoulder Pavement	152	m ²	23	15	4	42
R.C.Bridge L=10 ^m	1	Span	580	931	9 1	1,602
Guard Rail	76	m	76	111	10	197
Total			898	1,212	151	2,261

MINIMUM SCALE IMPROVEMENT (5)

Section (10) KM 75.7 - KM 81.1						
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	480	m ²	2	1	0	3
Excavation Commom M	254	m ³	4	20	1.	25
Excavation Soft Rock	2,727		332	206	79	617
Excavation Hard Rock	947	<u>_</u> 3	288	192	77	557
Embankment	872	m ³	50	30	11	91
Removal of Old Pavement	: 4,090	m ²	304	207	78	589
Removal of Old Masonry	667		36	25	8	69
Carriageway Pavement	4,821	<mark>2</mark>	1,259	871	249	2,379
Shoulder Pavement	1,394	m ²	212	140	38	390
R.C.Bridge L=5 ^m	1	Span	293	460	43	796
F.C.T. Bridge L=30 ^m	1	Span	3,862	4,467	937	9,266
Gravity Wall H=3 ^m	127	m	508	705	73	1,286
Slope Protection A	237	²	146	255	13	414
Seed Spraying	544	ա ²	9	13	2	24
Guard Rail	553	m	549	8 09	70	1,428
Total			7,854	8,401	1,679	17,934
Section (11) KM 81.1 ~ KM 81.6						
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Excavation Commom M	31	m 3	1	2	0	3
Embankment	347	m_	20	12	4	36
Removal of Old Pavement	: 113	m ²	8	6	2	16
Carriageway Pavement	439	m 2	115	79	23	217
Shoulder Pavement	110	m ²	17	11	3	31
P.C.T.Bridge L=40 ^m	1	Span	5,208	5,757	1,268	12,233
Half Bridge	35	m	927	1,673	142	2,742
Gravity Wall H=3 ^m	5	ш	20	28	3	51
Guard Rail	110	n	109	161	14	284
Total			6,425	7,729	1,459	15,613

MINIMUM SCALE IMPROVEMENT (6)

(UNIT:\$'000)

Section (12) KM 81.6 - KM 83.5

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Embankment	616	"3 "	35	21	8	64
Removal of Old Pavement	± 495	m ²	37	25	9	71
Carriageway Pavement	718	m ²	187	130	37	354
Shoulder Pavement	172	_m 2	26	17	5	48
Gravity Wall H=3 ^m	4	n	16	22	2	40
R.C. Half Bridge	46	m	1,218	2,198	187	3,603
Guard Rail	86	m	85	126	11	222
Total			1,604	2,539	259	4,402

Section (13) KM 83.5 - KM 88.7

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	1,617	<mark>2</mark>	6	3	1	10
Excavation Commom M	1,836	3	32	145	5	182
Excavation Soft Rock	1,630	"3	198	123	47	368
Excavation Hard Rock	352	3	107	72	28	207
Embankment	1,184	m ³	68	40	15	123
Removal of Old Pavement	: 3,561	m ²	265	180	68	513
Carriageway Pavement	4,203	m ²	1,098	759	217	2,074
Shoulder Pavement	1,010	_m 2	154	102	27	283
Gravity Wall H=3 ^m	83	m	332	461	48	841
Concrete Spraying	484	m ²	26	26	7	59
Guard Rail	505	m	501	739	64	1,304
Total			2,787	2,650	527	5,964

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MINIMUM SCALE IMPROVEMENT (7)

(UNIT:\$'000)

Section (14) KM 94.3 - KM 97.6

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	Item	Quantity	Unit	FC	LC	TAX	TOTAL
	Clearing, Stripping	1,623	m ²	6	3	1	10
	Excavation Commom M	1,529	m ³	27	120	5	152
	Excavation Commom B	1,096	3	82	32	15	129
	Excavation Soft Rock	1,234	<u></u> 3	150	93	36	279
	Embankment	4,956	m ³	286	169	62	517
	Removal of Old Pavement	3,634	m ²	271	183	69	523
	Carriageway Pavement	4,348	m ²	1,135	786	228	2,146
	Shoulder Pavement	1,092	m ²	166	110	29	305
	Gravity Wall H=3 ^m	55	m	270	305	32	557
	R.C.Bridge L=10 ^m	1	Span	580	931	91	1,602
	Concrete Spraying	128	m ²	7	7	2	16
	Seed Spraying	452	m ²	7	11	2	20
	Guard Rail	373	m	370	546	47	963
	Total			3,307	3,296	616	7,219
*1	Section (15) KM 96.6 - KM 98.2						
	Item	Quantity	Unit	FC	LC	TAX	TOTAL
	Excavation Commom M	58	m ³	1	5	0	6
	Embankment	58	3	3	2	1	6
	Removal of Old Pavement	. 864	m ²	64	44	16	124
	Carriageway Pavement	802	m ²	209	145	42	396
	Shoulder Pavement	192	<u>m</u> 2	29	19	5	53
	Guard Rail	96	m	95	140	12	247
	Total			401	355	76	832

MINIMUM SCALE IMPROVEMENT (8)

(UNIT:\$'000)

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Section (16) KM 98.2 - KM 100.7

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Embankment	113	m ³	6	5	1	12
Removal of Old Pavemen	t 758	m ²	57	38	14	109
Carriageway Pavement	563	m ²	147	102	29	278
Shoulder Pavement	150	²	23	15	4	42
Seed Spraying	248	²	4	6	1	11
Guard Rail	75	ш	75	110	9	194
Total			312	276	58	646

Section (17) KM 100.7 - KM 102.1

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	850	_m ²	3	1	1	5
Excavation Commom M	252		4	20	1	25
Excavation Soft Rock	316	<u>_</u> 3	38	24	9	71
Embankment	379	3	22	13	5	40
Removal of Old Pavement	: 375	_m ²	28	19	7	54
Carriageway Pavement	1,404	<u></u> ∎2	367	253	73	693
Shoulder Pavement	320	2	49	32	9	90
Retaining Wall H≓7 ^m	150	m	2,874	4,708	447	8,029
Slope Protection A	496	m ²	306	534	27	867
Seed Spraying	918	\mathfrak{m}^2	15	21	4	40
Side Ditch	320	m	150	235	28	413
Guard Rail	160	m	159	234	20	413
Total			4,015	6,094	631	10,704

MINIMUM SCALE IMPROVEMENT (9)

(UNIT: \$'000)

Section (18) KM 102.1 - KM 135.6

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	62,354	m ²	235	95	43	373
Excavation Commom M	34,434	m ³	607	2,713	100	3,420
Excavation Common B	25,201	m ³	1,896	724	349	2,969
Excavation Soft Rock	136,413	3	16,603	10,290	3,969	30,862
Excavation Hard Rock	1,125	3	343	229	91	663
Embankment	19,153	m ³	1,103	655	240	1,998
Removal of Old Pavemen	t 53,026	m ²	3,949	2,679	1,012	7,640
Removal of Old Masonry	370	m	20	14	4	38
Carriageway Pavement	70,427	^m 2	18,391	12,722	3,643	34,756
Shoulder Pavement	13,172	<u></u> 2	2,003	1,325	354	3,682
Gravity Wall H=3 ^m	150	m	600	833	86	1,519
Gravity Wall H=4 ^m	50	m	411	549	59	1,019
Retaining Wall H=7 ^m	50	m	958	1,569	149	2,676
Slope Protection A	16,442	m ²	10,146	17,703	894	28,743
Concrete Spraying	695	m ²	38	37	10	85
Seed Spraying	22,523	2	362	526	97	985
Setting Pipe 900 dia.	117	m	183	221	22	426
Setting Pipe 600 dia.	15	m	16	1.9	2	37
Side Ditch	13,562	m	6,343	9,957	1,185	17,485
Catch Basin	2	U	4	13	0	17
Guard Rail	6,060	m	6,557	9,666	834	17,057
Total			70,768	72,539	13,143	156,450

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MEDIUM SCALE IMPROVEMENT (1)

(UNIT: \$'000)

Section (02) KM 62.800 - KM63.855

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	16,212	_m 2	61	25	11	97
Excavation Commom A	5,720	m ³	108	52	20	180
Excavation Commom B	5,722	m ³	431	164	79	674
Excavation Soft Rock	14,598	3	1,777	1,101	425	3,303
Excavation Hard Rock	9,938	m ³	3,027	2,018	803	5,848
Embankment	5,340	m ³	308	183	67	558
Removal of Old Pavement	t 4,911	m ²	366	248	94	708
Carriageway Pavement	7,000	m ²	1,563	1,028	275	2,866
Shoulder Pavement	2,000	m ²	395	261	71	727
Concrete Spraying	2,402	m ²	130	129	35	294
Seed Spraying	9,274	m ²	149	216	40	405
Setting Pipe 900 dia.	140	m	219	264	26	509
Side Ditch	2,000	m	935	1,468	175	2,578
Catch Basin	15	U	30	94	4	128
Guard Rail	1,055	m	1,047	1,544	133	2,724
Total			10,546	8,795	2,258	21,559

MEDIUM SCALE IMPROVEMENT (2)

(UNIT: \$'000)

Section (03) KM 65.600 - KM 68.130

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	35,486	"2	134	53	24	211
Excavation Commom A	16,640	3	315	150	57	522
Excavation Common B	16,677	3	1,255	479	231	1,965
Excavation Soft Rock	11,351	3	1,382	856	330	2,568
Excavation Hard Rick	151,544	3	46,153	30,781	12,245	89,179
Embankment	51,813	3	2,984	1,772	648	5,404
Removal of Old Pavemen	t 7,403	²	551	374	141	1,066
Carriageway Pavement	16,394	m ²	3,660	2,409	644	6,713
Shoulder Pavement	4,684	m ²	926	612	166	1,704
R.C.Bridge L=10 ^m	1	Span	580	931	91	1,602
P.C.T.Bridge L=20 ^m	1	Span	2,394	2,940	573	5,907
P.C.T.Bridge L=30 ^m	1	Span	3,863	4,466	937	9,266
P.C.T.Bridge L=40 ^m	2	Span	10,417	11,514	2,535	24,466
P.C.T.Bridge (30 ^m +20 ^m)	1	Place	7,479	8,267	1,820	17,566
P.C.T.Bridge (2040 ^m)	1	Place	11,118	12,288	2,706	26,112
Gravity Wall H=4 ^m	460	m	3,786	5,051	538	9,375
Retaining Wall H=10 ^m	580	m	16,914	21,019	1,642	39,575
Concrete Spraying	29,526	m ²	1,600	1,588	429	3,617
Seed Spraying	13,212	m ²	212	308	57	577
Setting Pipe 900 dia.	230	Ш	359	435	43	837
Side Ditch	4,746	m	2,220	3,484	414	6.118
Catch Basin	25	U	50	156	7	213
Guard Rail	2,342	ш	2,342	3,427	296	6,047
Total			120,676	13,360	26,574	260,610

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MEDIUM SCALE IMPROVEMENT (3)

Section (04) KM 68.384 - KM 69.228

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing,Stripping	17,833	m ²	67	27	12	106
Excavation Common A	19,500	3	369	176	67	612
Excavation Common B	19,558	3	1,472	562	271	2,305
Excavation Soft Rock	3,550	3	432	268	103	803
Excavation Hard Rock	29,768	3	9,066	6,046	2,405	17,517
Embankment	6,467	m ³	372	221	81	674
Removal of Old Paveme	nt 2,592	m ²	193	1 31	49	373
Carriageway Pavement	4,403	2	983	647	173	1,803
Shoulder Pavement	1,258	m ²	249	164	44	457
P.C.T.Bridge L=20 ^m	1	Span	2,394	2,940	573	5,907
Gravity Wall H=4 ^m	64	m	527	702	75	1,304
Retaining Wall H=7 ^m	30	m	575	941	89	1,605
Concrete Spraying	3,240	m ²	176	174	47	397
Seed Spraying	13,633	"2	219	318	58	595
Setting Pipe 900 dia	. 80	m	125	151	15	291
Side Ditch	1,290	m	603	947	113	1,663
Catch Basin	8	U	16	50	2	68
Guard Rail	629	m.	624	920	80	1,624
Total			18,462	15,385	4,257	38,104

MEDIUM SCALE IMPROVEMENT (4)

Section (06) K70.1 - K71.3

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	8,324	m ²	31	13	6	50
Excavation Common A	1,500	³	28	14	5	47
Excavation Common B	1,670	m ³	126	48	23	197
Excavation Soft Rock	5,105	3	621	385	149	1,155
Excavation Hard Rock	5,008	m ³	1,525	1,108	404	2,947
Embankment	14,316	3	824	490	179	1,493
Removal of Old Pavement	2,780	_m 2	207	141	53	401
Carriageway Pavement	7,700	m ²	2,011	1,391	398	3,800
Shoulder Pavement	2,200	m ²	335	221	59	615
P.C.T.Bridge L=40 ^m	1	Span	5,208	5,757	1,268	12,233
P.C.T.Bridge (2040 ^{III})	1	Span	11,118	12,288	2,706	26,112
Gravity Wall H=4 ^m	240	ш	1,975	2,635	281	4,891
Retaining Wall H=10 ^m	130	m	3,791	4,711	368	8,870
Seed Spraying	4,678	m ²	75	109	20	204
Setting Pipe 900 dia.	70	m	109	133	13	255
Side Ditch	1,230	m	576	903	107	1,586
Catch Basin	7	U	14	44	2	60
Guard Rail	910	m	903	1,332	115	2,350
Total			29,477	31,633	6,156	67,266

MEDIUM SCALE IMPROVEMENT (5)

Section (07) K71.3 - K72.9

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	15,053	m ²	57	23	10	90
Excavation Common A	3,000	3	57	27	10	94
Excavation Common B	2,998	m ³	226	86	41	353
Excavation Soft Rock	6,938	m ³	844	523	202	1,569
Excavation Hard Rock	25,805	<u></u> 3	7,859	5,242	2,085	15,186
Embankment	5,254	3	303	180	65	548
Removal of Old Pavement	3,609	m ²	269	1.82	69	520
Carriageway Pavement	8,260	m ²	2,157	1,492	427	4,076
Shoulder Pavement	2,360	2	359	237	64	660
R.C.Bridge L=10 ^m	1	Span	580	931	91	1,602
Gravity Wall H=4 ^m	115	m	947	1,263	134	2,344
Retaining Wall H=10 ^m	60	m	1,750	2,174	170	4,094
Seed Spraying	2,497	m ²	40	58	11	109
Setting Pipe 900 dia.	100	m	156	189	19	364
Side Ditch	2,130	m	996	1,564	186	2,746
Catch Basin	11	U	22	69	3	94
Guard Rail	1,370	m	1,360	2,005	173	3,538
Sub-Total			17,982	16,245	3,760	37,987
K72 Tunnel	790	m	87,604	94,433	26,099	208,136
Corrugate Pipe 4.5 ^m dia	. 25	m	1,404	207	281	1,892
Sub-Total			89,008	94,640	26,380	210,028
Total			106,990	110,885	30,140	248,015

MEDIUM SCALE IMPROVEMENT (6)

Section (08) K73.4 - K75.2

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	20.148	_m 2	76	30	14	120
Excavation Common A	13,540	3 3	256	123	46	425
Excavation Common B	13,541	3	1,109	389	188	1,596
Excavation Soft Rock	2,976	_m3	362	224	87	673
Excavation Hard Rock	766	3	233	156	62	451
Embankment	14,503	" ³	835	497	181	1,513
Removal of Old Pavement	: 3,743	2	279	188	71	538
Carriageway Pavement	11,060	2	2,888	1,998	572	5,458
Shoulder Pavement	3,160	m ²	481	317	85	883
P.C.T.Bridge L=20 ^m	1	Span	2,394	2,940	573	5,907
P.C.T.Bridge L=40 ^m	2	Span	10,417	11,514	2,535	24,466
P.C.T.Bridge (2030 ^m)	1	Place	7,885	8,716	1,919	18,520
Gravity Wall H=3 ^m	460	n	1,839	2,555	265	4,659
Retaining Wall H=10 ^m	300	п	8,749	10,872	849	20,470
Seed Spraying	15,531	m ²	250	362	67	679
Setting Pipe 900 dia.	118	m	183	223	22	428
Side Ditch	3,145	n	1,471	2,309	275	4,055
Catch Basin	12	U	24	75	3	102
Guard Rail	1,359	m	1,349	1,988	172	3,509
Total			40,990	45,476	7,986	94,452

MEDIUM SCALE IMPROVEMENT (7)

Section (09) K75.2 ← K75.7

Item	Quantity		FC	LC	TAX	TOTAL
Clearing, Stripping	462	m ²	2	1	0	3
Excavation Common A	605	m ³	11	6	2	19
Excavation Soft Rock	31	m ³	4	2	1	7
Embankment	2,172	m ³	125	74	28	227
Removal of Old Pavement	655	m ²	49	33	13	95
Carriageway Pavement	910	m ²	238	164	47	449
Shoulder Pavement	260	m^2	40	26	7	73
Gravity Wall H=3 ^m	65	m	260	361	37	658
Retaining Wall H=10 ^m	20	m	583	724	57	1,364
Seed Spraying	467	m ²	8	10	2	20
Setring Pipe 900 dia.	20	m	31	38	4	73
Side Ditch	215	m	100	158	19	277
Catch Basin	2	U	4	13	l	1.8
Guard Rail	238	ш	236	348	30	614
Sub-Total			1,691	1,958	248	3,897
K75 Bridge L=170 ^m	1	Place	45,197	34,965	8,808	88,970
Approach of Bridge	1	Lump	1,168	1,462	292	2,922
Sub-Total			46,365	36,427	9,100	91,892
Total			48,056	38,385	9,348	95,789

MEDIUM SCALE IMPROVEMENT (8)

Section (10) K75.7 - K81.1

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	39,348	m ²	148	60	27	235
Excavation Common A	34,360	"3	650	310	119	1,079
Excavation Common B	34,371	3	2,586	987	477	4,050
Excavation Soft Rock	20,778	3	2,529	1,567	605	4,701
Excavation Hard Rock	33,195	3	10,110	6,742	2,682	19,534
Embankment	45,338	m ³	2,611	1,550	568	4,729
Removal of Old Pavement	10,606	m ²	790	537	202	1,529
Carriageway Pavement	26,334	m ²	6,876	4,757	1,363	12,996
Shoulder Pavement	7,524	m ²	1,144	757	202	2,103
P.C.T. Bridge L=20 ^m	2	Span	4,787	5,881	1,146	11,814
P.C.T. Bridge L=30 ^m	1	Span	3,863	4,466	937	9,266
P.C.T. Bridge L=40 ^m	1	Span	5,208	5,757	1,268	12,233
P.C.T. Bridge (2040 ^m)	2	Place	22,236	24,577	5,411	52,224
P.C.T. Bridge (2030 ^m)	4	Place	34,614	38,258	8,424	81,296
P.C.T. Bridge (30m + 20)m) 2	Place	14,958	16,533	3,641	35,132
P.C.T. Bridge (30m + 40)m) 1	Place	9,886	10,926	2,406	23,218
P.C.T. Bridge (3030m +	40m) 1	Place	20,616	22,786	5,018	48,420
P.C.T. Bridge (2040m +	30m) 1	Place	16,483	18,218	4,012	38,713
P.C.T. Bridge (3@30m)	1	Place	14,019	15,495	3,411	32,925
Gravity Wall H=3 ^m	865	ш	3,459	4,804	499	8,762
Retaining Wall H=10 ^m	660	m	19,247	23,918	1,868	45,033
Seed Spraying	30,046	² ش	482	702	129	1,313
Setting Pipe 900 dia.	3,339	m	5,220	6,311	623	12,154
Side Ditch	5,950	m	2,783	4,368	520	7,671
Catch Basin	34	ប	67	212	10	289
Guard Rail	3,850	Ψ	3,821	5,634	486	9,941
Sub-Total			209,193	226,113	46,054	481,360
K76 Tunnel	790	m	89,627	96,961	26,605	213,193
Corrugate Pipe 4.5 ^m d	ia. 25	ш	1,404	207	281	1,892
Sub-Total			91,031	97,168	26,886	215,085
Total			300,224	323,281	72,940	696,445

MEDIUM SCALE IMPROVEMENT (9)

Section (11) P-3 KM81.1 - KM81.6

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	1,081	2	4	2	0	6
Excavation Common A	1,460	_3	28	13	5	46
Excavation Common B	1,475	щ ³	111	42	21	174
Excavation Soft Rock	533	2	65	40	16	121
Removal of Old Pavement	5 9 3	2	44	30	11	85
Carriageway Pavement	1,330	m ²	347	240	69	656
Shoulder Pavement	380	m ²	58	38	10	106
P.C.T.Bridge (2030 ^m)	1	Place	8,475	9,796	2,053	20,324
Seed Spraying	842	m ²	14	20	3	31
Setting Pipe 900 dia.	19	m	30	36	3	69
Side Ditch	380	m	178	279	33	490
Catch Basin	2	U	4	12	1	17
Guard Rail	215	m	213	315	27	555
Total			9,571	10,863	2,252	22,686

(UNIT:\$'000)

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ME	DIUM SCALE	IMPROVE	MENT (10)			
Section (13) K83.475 - K88.650						
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Stripping	51,456	m ²	194	78	35	307
Excavation Common A	63,800	3	1,208	575	220	2,003
Excavation Common B	65,006	m ³	4,891	1,867	902	7,660
Excavation Soft Rock	27,424	ш ³	3,338	2,068	798	6,204
Excavation Hard Rock	61,235	3	18,649	12,438	4,948	36,035
Embankment	62,424	m ³	3,595	2,135	781	6,511
Removal of Old Pavement	4,525	m ²	337	229	96	662
Carriageway Pavement	22,155	m ²	5,785	4,002	1,146	10,933
Shoulder Pavement	6,330	m ²	1,090	719	190	1,999
P.C.T. Bridge L=20 [™]	1	Span	2,394	2,940	573	5,907
P.C.T. Bridge L=40 ^m	2	Span	10,417	11,514	2,535	24,466
P.C.T. Bridge (3@40 ^m +2()m) 1	Place	21,905	24,211	5,332	51,448
P.C.T. Bridge (2030 ^m)	1	Place	8,653	9,565	2,106	20,324
P.C.T. Bridge (20 ^m +30 ^m)	2	Place	14,958	16,533	3,641	35,132
P.C.T. Bridge (3@30 ^m)	1	Place	14,019	15,494	3,412	32,925
P.C.T. Bridge (30 ^m +40 ^m)	1	Place	9,886	10,926	2,406	23,218
Gravity Wall H=3 [™]	50	m	200	278	29	507
Gravity Wall H=4 [™]	610	m	5,020	6,698	714	12,432
Retaining Wall H=5 ^m	25	Ш	255	432	39	726
Retaining Wall H=10 ^m	450	m	13,123	16,307	1,274	30,704
Seed Spraying	43,349	2	697	1,012	186	1,895
Setting Pipe 900 dia.	50	m	78	9 5	9	182
Side Ditch	6,560	ш	3,068	4,817	573	8,458
Catch Basin	6	U	12	37	2	51
Guard Rail	3,165	m	3,141	4,631	400	8,172
(Sub-Total)			(146,913)	(149,601)	(32,347)	(328,861)
K Tunnel	250	m	28,556	30,925	8,469	67,950
Corrugate Pipe 4.5 ^{m} dia.	25	m	1,404	207	281	1,892
(Sub-Total)			(29,960)	(31,132)	(8,750)	(69,842)
Total			176,873	180,733	41,097	398,703

MEDIUM SCALE IMPROVEMENT (11)

Section (15) K97.500-

Item	Quantity	Unti	FC	LC	TAX	TOTAL
Clearing, Stripping	484	_m ²	2	1	0	3
Embankment	3,400	m ³	250	148	54	452
Carriageway Pavement	770	m ²	201	139	40	380
Shoulder Pavement	220	m ²	38	25	7	70
P.C.T. Bridge L=170 ^m	1	Span	37,864	29,292	7,379	74,535
Retaining Wall H=5 ^m	80	m	815	1,381	127	2,323
Retaining Wall H=7 ^m	70	m	1,341	2,197	20 9	3,747
Retaining Wall H=10 ^m	20	m	583	724	57	1,364
Setting Pipe 900 dia.	15	m	24	28	3	55
Side Ditch	220	m	103	162	19	284
Guard Rail	220	m	218	322	28	568
Total			41,439	34,419	7,923	83,781

MEDIUM SCALE IMPROVEMENT (12)

Section (17) P-3 KM101.2

Item	Quantity		FC	LC	TAX	TOTAL
Clearing, Stripping	3,590	<u></u> _2	13	6	3	22
Excavation Common A	2,100	<u></u> 3	40	19	7	66
Excavation Common B	2,105	ш ³	158	61	29	248
Excavation Soft Rock	1,450	m ³	176	109	42	327
Embankment	8,570	m 3	494	293	107	894
Carriageway Pavement	2,930	²	765	529	152	1,466
Shoulder Pavement	680	m ²	104	68	1.8	190
P.C.T. Bridge L=170 ^m	1	Place	48,720	44,574	10,366	103,660
R.C.Bridge L=5 ^m	1	Span	293	460	43	796
Gravity Wall H=3 ^m	80	m	320	444	46	810
Retaining Wall H=5 ^m	100	m	1,019	1,726	159	2,904
Retaining Wall H=7 ^m	170	m	3,258	5,335	507	9,100
Retaining Wall H=10 ^m	80	m	2,333	2,900	226	5,459
Slope Protection A	484	<mark>_</mark> 2	299	521	26	846
Seed Spraying	909	m ²	15	21	4	40
Setting Pipe 900 dia.	13	ш	20	25	2	47
Side Ditch	620	m	290	455	54	799
Catch Basin	6	ប	12	37	2	51
Guard Rail	290	m	288	424	37	749
Total			58,617	58,007	11,830	128,454

LARGE SCALE IMPROVEMENT (1)

Priced Bill of Quantity: Girardot Bypass Al-Bl Route

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Grubbing	813,000	2	992	447	179	1,618
Stripping	813,000	m ²	2,073	789	374	3,236
Excavation Common A	266,660	m ³	5,048	2,405	920	8,373
Embankment	266,660	m ³	6,381	3,093	1,053	10,527
(Sub-Total)			(14,494)	(6,734)	(2,526)	(23,754)
Subbase Course	156,100	m ³	51,849	41,220	14,475	107,544
Base Course	53,660	m ³	27,320	18,230	5,827	51,377
Carriageway Pavement	189,700	m ²	34,281	22,172	4,885	61,338
Shoulder Pavement	54,200	m ²	3,527	2,319	489	6,335
(Sub-Total)		((116,977)	(83,941)	(25,676)	(226,594)
R.C.Bridge L=5 ^m	6	Span	1,758	2,759	261	4,778
R.C.Bridge L=10 ^m	2	Span	1,161	1,861	183	3,205
P.C.T.Bridge L=40 ^m	1	Span	5,208	5,757	1,268	12,233
P.C.T.Bridge L=110 ^m	1	Place	27,000	20,866	5,235	53,104
P.C.T.Bridge L=260 ^m	1	Place	102,745	66,360	13,840	182,945
(Sub-Total)		•	(137,875)	(97,603)	(20,787)	(256,265)
Box Culvert 1.2m x 1.	Om 2,448	m	14,020	21,719	2,026	37,765
Side Ditch	2,710	m	1,267	1,990	237	3,494
Catch Basin	54	U	107	337	16	460
Setting of Guard Rail	800	m	794	1,171	101	2,066
(Sub-Total)			(16,188)	(25,217)	(2,380)	(43,785)
Total			285,534	213,495	51,369	550,398
w/Overhead and Profit			383,574	246,175	58,249	687,998
Supervision			26,144	6,536	1,720	34,400
Contingency			40,972	25,271	5,997	72,240
Detailed Eng. w/Cont.			28,758	7,190	1,892	37,840
Total			479,448	285,172	67,858	832,478
Economic Cost			479,448	285,172	-	764,620

LARGE SCALE IMPROVEMENT (2)

Priced, Bill of Quantity: Ibague Bypass A Route

Priced, Bill of Quanti	ty: <u>Ibague</u>	Bypass A	Route		(UNI	T: \$'000)
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Clearing, Grubbing	98,000	_m ²	120	54	21	195
Stripping	98,000	m ²	250	95	45	390
Excavation Common M	46,020	_ш 3	811	3,626	134	4,571
Excavation Common B	92,040	3	6,925	2,644	1,277	10,846
Excavation Soft Rock	73,520	3	8,948	5,546	2,139	16,633
Embankment	205,330	3	11,825	7,022	2,571	21,418
(Sub-Total)		-	(28,879)	(18,987)	(6,187)	(54,053)
Carriageway Pavement	45,850	m ²	14,833	10,117	2,778	27,728
Shoulder Pavement	13,100	2	1,993	1,317	352	3,662
(Sub-Total)			(16,826)	(11,434)	(3,130)	(31,390)
R.C.Bridge L=10 ^m	1	Span	580	931	91	1,602
P.C.T.Bridge L=20 ^m	2	Span	4,787	5,881	1,146	11,814
P.C.T.Bridge L=80 ^m	2	Place	22,235	24,575	5,412	52,222
P.C.T.Bridge L=110 ^m	1	Place	27,003	20,866	5,235	53,104
(Sub-Total)			(54,605)	(52,253)	(11,884)	(118,742)
Retaining Wall H=7 ^m	200	m	3,832	6,276	597	10,705
Retaining Wall H=10 ¹¹	¹ 200	n v	5,832	7,248	566	13,646
Box Culvert 4.5m x 4.	0m <u>1</u> 50	n	5,226	7,702	771	13,699
Slope Protection A	12,120	² 1	7,479	13,049	659	21,187
Seed Spraying	60,320	m ²	969	1,408	25 9	2,636
Setting Pipe 600mm	660	ŵ	695	836	79	1,610
Setting Pipe 900mm	120	m	188	227	22	437
Side Ditch	5,500	m	2,572	4,038	480	7,090
Catch Basin	37	ប	74	231	10	315
Guard Rail	4,200	m	4,169	6,146	530	10,845
(Sub-Total)			(31,036)	(47,161)	(3,973)	(82,170)
Total			131,346	129,835	25,174	286,355
w/Overhead and Profit	t i		182,353	146,837	28,754	357,944
Supervision	,		13,602	3,400	895	17,897
Contingency			19,595	15,024	2,965	37,584
Detailed Eng. w/Cont.			14,962	3,740	985	19,687
Total			230,512	169,001	33,599	433,112
Economic Cost			230,512	169,001	-	399,513

LARGE SCALE IMPROVEMENT (3)

Priced Bill of Quantity: Coello Bypass

Item	Quantity	Unit	FC	LC	TAX	TOTAL
Earthwork						
Clearing, Stripping	110,400	m ²	416	5 168	75	659
Excavation Common A	349,000	3	6,607	7 3,148		10,959
Excavation Common B	351,975	3	26,483		4,882	41,477
Excavation Soft Rock	675,520	3	82,218		19,658	152,830
Excavation Hard Rock	187,930	3	57,236			110,593
Embankment	33,555	3	1,932	,	420	3,500
(Sub-Total)		(-	• • •		(320,018)
Pavementwork		·		/	~~~,~~~,	(320,018)
Carriageway Pavement	184,000	m ²	48,048	33,238	9,518	00.90/
Shoulder Pavement	69,000	2	11,884		•	90,804
(Sub-Total)				•	•	21,796 (112,600)
Bridgework			(/(+1;0/3/	(11, 193)	(112,600)
R.C. Half Bridge	1,900	R	50,309	90,791	7,724	140 000
P.C.T.Bridge L=20 ^m	3	Span	7,181		•	148,830
P.C.T.Bridge L=30 ^m	1	Span	3,863	•	1,719 936	17,722
(Sub-Total)		-		•	(10,379)	9,266
Drainage and Structure			(),	(2043000)	(10,579)	(175,818)
Box Culvert 4.5m x 4.0m	1 30	m	1,045	1,540	154	0 700
Gravity Wall H=3 ^m	4,070	m	16,275		2,348	2,739
Concrete Spraying	239,180	_m 2	12,964	• • •	-	41,228
Seed Spraying	45,960	m ²	739	,	3,473 197	29,298
Slope Protection A	117,150	2		126,131	6,371	2,009
Setting Pipe 900 dia.	2,238	m	3,499	4,230	•	204,793
Setting Pipe 600 dia.	9,500		10,006	12,033	418	8,147
Side Ditch	23,300				1,130 2,035	23,169
Catch Basin	380	 U		2,372		30,039
Guard Rail	4,300	m		2,372 6,292	109	3,237
(Sub-Total)	,					11,103
Tunnel		(.	LJ,/4L)¥	200,243) (16,778) ((355,762)
Coello Tunnel	950	n 1(10 020 1	16 100		
Total Direct Cost				16,199		256,271
	-222		0,940 5	71,305 I.	12,218 1,	220,469

Priced Bill of Quantity: La-Linea Bypass

(UNIT: \$'000)

TITCE DITT OF Generey.			•		•	•
Item	Quantity	Unit	FC	LC	TAX	TOTAL
Earthwork						
Clearing, Stripping	139,470	m ²	526	212	95	833
Excavation Common A	640,000	3	12,115	5,773	2,208	20,096
Excavation Common B	641,286	3	48,250	18,424	8,895	75,569
Excavation Soft Rock	149,530	щ ³	18,199	11,279	4,351	33,829
Excavation Hard Rock	228,665	m ³	69,642	46,447	18,476	134,565
Embankment	806,361	3	46,438	27,578	10,096	84,112
(Sub-Total)		(195,170)	Q09,713)	(44,121)	(349,004)
Pavementwork						
Carriageway Pavement	210,495	m ²	54,966	38,024	10,889	103,879
Shoulder Pavement	57,160	m ²	9,845	6,492	1,719	18,056
(Sub-Total)			(64,811)	(44,516)	(12,608)	(121,935)
Bridgework						
P.C.T. Bridge L=20 ^m	2	Span	4,787	5,881	1,146	11,814
P.C.T. Bridge L=30 ^m	2	Span	7,725	8,934	1,874	18,533
P.C.T. Bridge L=40 ^m	7	Span	36,460	40,298	8,874	85,632
P.C.T. Bridge (40m + 30m	m) 1	Place	9,886	10,926	2,406	23,218
P.C.T. Bridge (2040m +	30m) 1	Place	16,483	18,218	4,012	38,713
P.C.T. Bridge (2040m +	20m) 2	Place	30,617	33,840	7,451	71,908
(Sub-Total)		((105,958)	Q18,097)	(25,763)	(249,818)
Drainage and Structure						
Retaining Wall H=5m	3,720	m	37,896	64,204	5,931	108,031
Retaining Wall H=7m	1,590	m	30,467	49,898	4,743	85,108
Retaining Wall H=10m	790	щ	23,038	28,629	2,236	53,903
Gravity Wall H=3m	550	m	2,199	3,055	317	5,571
Seed Spraying	409,000	m ²	6,573	9,550	1,755	17,878
Slope Protection A	21,232	m ²	13,102	22,860	1,154	37,116
Setting Pipe 900 dia.	2,860	m	4,471	5,406	534	10,411
Setting Pipe 600 dia.	14,300	m	15,062	18,113	1,700	34,875
Side Ditch	57,160	'n	26,735	41,964	4,992	73,691
Catch Basin	572	ប	1,137	3,571	164	4,872
Guard Rail	24,230	m	24,049	35,455	3,061	62,565
(Sub-Total)		((184,729)	¢ 82,705	(26,587)	(494,021)
Tunnel						

La-Linea Tunnel Total Direct Cost

890 m 101,216 108,875 30,023 240,114 651,884 663,906 139,102 1,454,892

	, <u>=</u>		<u> </u>		<u> </u>
		Improvement Plan	Girardot Bypass	Ibague Bypass	Total
1)	Portland Cement	6,000 ^t	5,000 ^t	3,700 ^t	14,700 ^t
2)	Asphalt	1,100 ^t	1,700 ^t	600 [±]	3,400 [±]
3)	Asphalt Liquid	160 ^t	450 ^t	110 ^t	720 ^t
4)	Reinforcing Steel	550 ^t	500 ^t	340 ^t	1,390 ^t
5)	P.C. Steel Cable	130 ^t	310 ^t	90^t	530 [±]
6)	Diese1	120,000 ^{gal.}	155,000 ^{gal.}	70,000 ^{gal.}	345,000 ^{gal.}
7)	Gasoline	14,000 ^{gal.}	8,000 ^{gal.}	4,000 ^{gal.}	26,000 ^{gal.}
8)	Motor 011	2,100 ^{gal.}	2,200 ^{gal.}	•	5,600 ^{gal.}
9)	Transmission 011	470 ^{gal.}	670 ^{gal.}	330 ^{gal.}	1,470 ^{gal.}
10)	Hydraulic 0il	320 ^{gal.}	430 ^{gal.}	230 ^{gal.}	980 ^{gal.}
11)	Grease	1,000 ^{kg}	2,100 ^{kg}	820 ^{kg}	3,920 ^{kg}
12)	Plank	1,700 ^{m3}	500 ^{m3}	900 ^{m3}	3,100 ^{m3}
13)	Explosive	50 ^t	0	6 ^t	56 [±]

Quantities of Materials to be Procured

			Improvement Plan	Girardot Bypass	Ibague Bypass	Total
			-	1		
T)	Bulldozer	D6D	1	1	1	3
2)	Bulldozer	D7G	2	4	2	8
3)	Bulldozer	D8K w/r	2	0	1	3
4)	Wheel Loader	1.8 m3	0	1	0	1
5)	Motor Scraper	16 m3	1	0	0	1
6)	Motor Grader	3.7 m	0	2	0	2
7)	Asphalt Plant	70 T/H	1	1	1	3
8)	Asphalt Finisher	2.4m-4.3m	1	1	1	3
9)	Concrete Mixer, Porta	ble 0.7 m3	5	4	3	12
10)	Road Roller, Tire	20 ton	1	4	1	6
L1)	Road Roller, Macadam	10 ton	1	2	1	4
L2)	Vibration Roller	10 ton	0	3	1	4

Required Quantity of Principal Equipment