APPENDICES

APPENDICES

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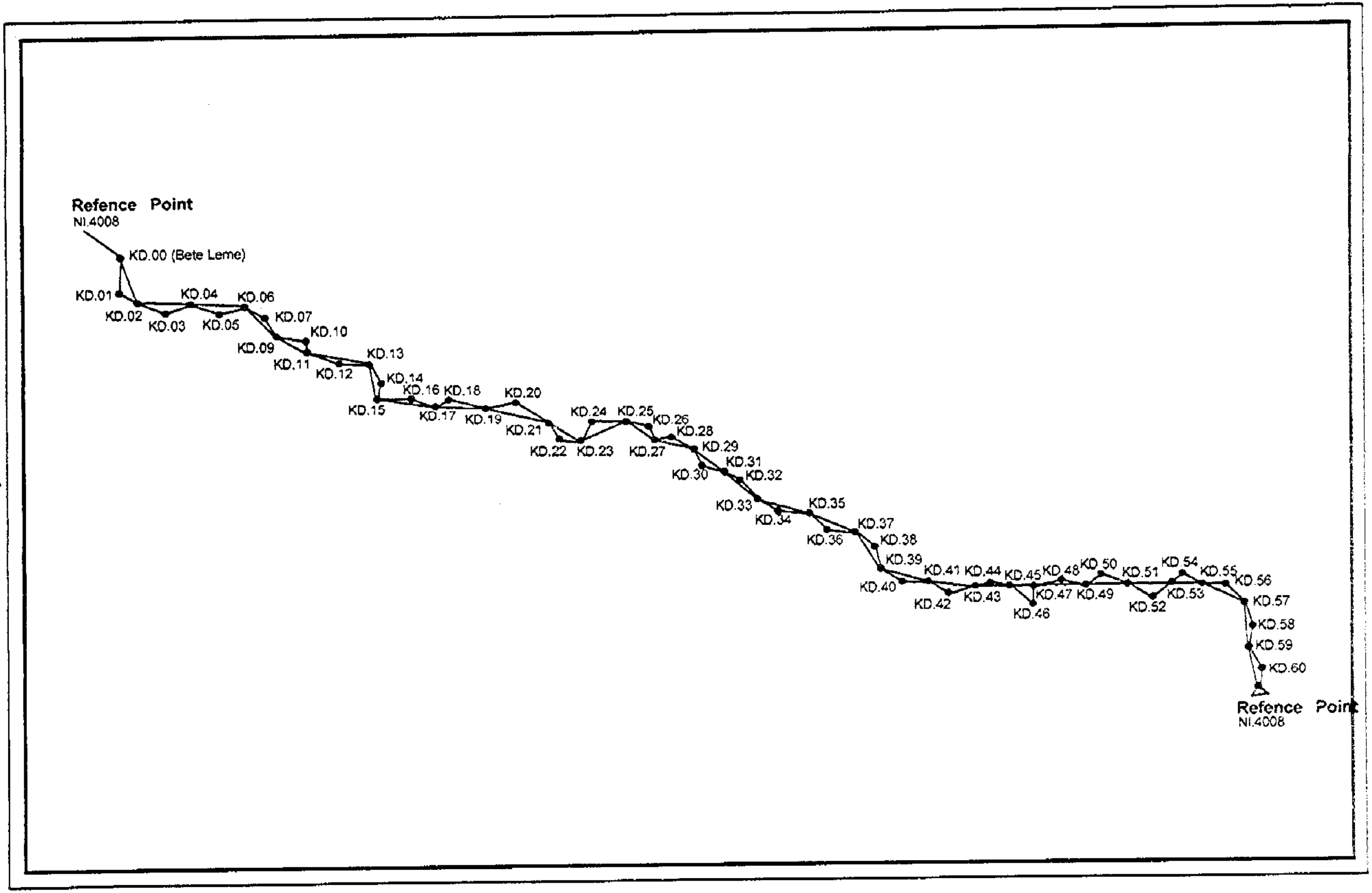


Figure A3-1-1 Network Configuration

Table A3-2-1 Coordinates Results (1 of 3)

COORDINATES RESULT

GROUND SURVEY FOR THE ROAD NETWORK STUDY
IN CETRAL AND SOUTHEAST SULAWESI

	UTM Coordinates		Geographic Coordinates		
Point	East	North (m)	Latitude	Longitude	Height
4006	434,238.6830	9,548,155.6900	4° 05'15.678100"	122° 24'27.118900"	
4008	242,414.8220	9,770,827.4560	2° 04'18.061100"	120° 41'03.395300"	
00KD	308,920.7904	9,762,887.2556	2° 08' 39.311886"	121° 16' 54.777974"	
01KD	365,559.6244	9,747,442.7886	2° 17' 03.986036"	121° 47' 27.433730"	1.709
02KD	369,293.1564	9,745,910.7020	2° 17' 53.976083"	121° 49' 28.250440"	2.487
03KD	370,763.2171	9,741,716.6785	2° 20' 10.585443"	121° 50' 15.726958"	2.413
04KD	373,614.2612	9,737,455.9673	2° 22' 29.404302"	121° 51' 47.909801"	2.735
05KD	374,738.6691	9,734,567.0509	2° 24' 03.507277"	121° 52' 24.234254"	2.718
06KD	377, 645.3475	9, 310.15.8466	2° 25' 59.224704"	121° 53' 58.243000"	5.322
07KD	381,300.9430	9,726,374.2130	2° 28' 30.470662"	121° 55' 56.474648"	1.930
09KD	383,425.4012	9,722,342.0659	2° 30' 41.829566"	121° 57' 05.153732"	2.994
10KD	386,028.2054	9,718,062.0309	2° 33' 01.273747"	121° 58' 29.317435"	1.369
11KD	384,592.8259	9,716,913.5471	2° 33' 38.635861"	121° 57' 42.811428"	11.629
12KD	388,415.7115	9,711,053.6632	2° 6' 49.559938"	121° 59' 46.443483"	2.104
13KD	392,142.6934	9,706,549.4211	2° 39' 16.335656"	122° 01' 47.013062"	1.570
14KD	389,781.7393	9,703,962.8090	2° 40' 40.506967"	122° 00' 30.493135"	3.366
15KD	386,696.7614	9,703,515.9442	2° 40' 54.976492"	122° 58' 50.582100"	13.685
16KD	390,750.6167	9,697,748.9109	2° 44' 02.886569"	121° 01'01.704906"	11.996
17KD	391,513.8243	9,693,389.4659	2° 46' 24.871369"	122° 01'26.305181"	37.642
18KD	396,457.8563	9,694,275.8205	2° 45' 56.136729"	122° 04'06.442497"	17.786
19KD	404,576.9871	9,691,471.6538	2° 47' 27.656191"	122° 08'29.320947"	1.647
20KD	409,346.4836	9,687,840.1581	2° 49' 26.030791"	122° 11'03.708504"	6.810
21KD	409,601.0203	9,684,799.1479	2° 51' 05.070815"	122° 11'11.883230"	3.018

Table A3-2-2 Coordinates Results (2 of 3)

22KD	409,361.1512	9,682,350.7057	2°	52' 24.801733"	122°	11'04.057779"	2.143
23KD	410,437.4956	9,679,847.0216	2°	53' 46.362219"	122°	11'38.862610"	9.870
24KD	413,795.7656	9,680,560.3673	2°	53' 23.207323"	122°	13'27.653718"	10.756
25KD	422,202.7432	9,679,195.4759	2°	54' 07.835567"	122°	17'59.932658"	1.230
26KD	424,015.5048	9,675,930.6084	2°	55' 54.199086"	122°	18'58.585929"	2.772
27KD	416,118.9152	9,675,479.2348	2°	56' 08.733679"	122°	14'42.791055"	383.402
28KD	421,132.3593	9,673,717.2968	2°	57' 06.221503"	122°	17'25.149518"	176.238
29KD	419,394.5746	9,669,364.8122	2°	59' 27.931602"	122°	16'28.765929"	11.880
30KD	413,812.1456	9,665,129.5046	3°	01' 45.736161"	122°	13'27.834922"	147.044
31KD	412,718.3819	9,659,035.1514	3°	05' 04.181161"	122°	12'52.258941"	708.529
32KD	408,887.5388	9,656,256.7265	3°	06' 34.569342"	122°	10'48.086446"	305.355
33KD	404,167.6692	9,653,081.3643	3°	08' 17.854629"	122°	08'15.096394"	259.919
34KD	402,265.0565	9,648,845.9383	3°	10' 35.731709"	122°	07'13.341819"	112.027
35KD	405,586.8357	9,641,623.2144	3°	14' 31.035227"	122°	09'00.766610"	41.465
36KD	405,336.0208	9,636,934.5889	3°	17' 03.716476"	122°	08'52.511546"	10.292
37KD	408,588.3094	9,636,687.2534	3°	17' 11.859871"	122°	10'37.884556"	66.331
38KD	403,619.2682	9,628,845.3390	3°	21' 27.098659"	122°	07'56.656278"	9.381
39KD	394,841.8460	9,627,832.8271	3°	21' 59.805783"	122°	03'12.205687"	32.884
40KD	395,475.5548	9,625,294.2642	3°	23'22.493470"	122°	03'32.660413"	15.202
41KD	397,160.5051	9,621,718.0112	3°	25' 19.006627"	122°	04'27.148765"	12.043
42KD	396,505.7900	9,615,792.5430	3°	28' 31.947749"	122°	04'05.744600"	11.629
43KD	399,647.3710	9,614,023.5085	3°	29' 29.655772"	122°	05'47.499890"	11.336
44KD	403,860.8979	9,609,815.6658	3°	31' 46.814709"	122°	08'03.926410"	8.513
45KD	404,222.9107	9,605,259.8606	3°	34' 15.187098"	122°	08'15.521496"	39.697
46KD	408,767.9185	9,600,282.7102	3°	36' 57.406827"	122°	10'42.686049"	21.928
47KD	410,124.4005	9,600,870.0230	3°	36'38.320182"	122°	11'26.670770"	14.234
48KD	414,516.7921	9,595,302.4777	3°	39' 39.757312"	122°	13'48.888079"	7.393
49KD	417,099.3604	9,592,299.8124	3°	41' 17.613784"	122°	15'12.521143"	21.086
50KD	422,220.5073	9,590,879.1655	3°	42' 04.014782"	122°	17'58.493825"	22.916
51KD	425,134.3738	9,585,845.8804	3°	44' 48.005652"	122°	19'32.828342"	14.745

Table A3-2-3 Coordinates Results (3 of 3)

52KD	427,443.0722	9,583,690.2050	3°	45' 58.265981"	122°	20'47.621556"	4.977
53KD	429,963.7479	9,584,855.6131	3°	45' 20.372672"	122°	22'09.368722"	35.231
54KD	431,776.1585	9,586,396.9186	3°	44' 30.218916"	122°	23'08.161251"	1.268
55KD	435,846.7472	9,585,334.9503	3°	45'04.894327"	122°	25'20.103688"	1.341
56KD	438,376.8408	9,582,629.0096	3°	46'33.073024"	122°	26'42.072783"	2.405
57KD	439,707.2389	9,580,680.8695	3°	47'36.546283"	122°	27'25.165712"	1.649
58KD	436,814.0378	9,577,719.3924	3°	49'12.933010"	122°	25'51.300999"	22.433
59KD	433,088.1815	9,576,079.8021	3°	50'06.246974"	122°	23'50.463402"	13.206
60KD	430,697.6468	9,568,978.1194	3°	53'57.470984"	122°	22'32.786993"	10.310

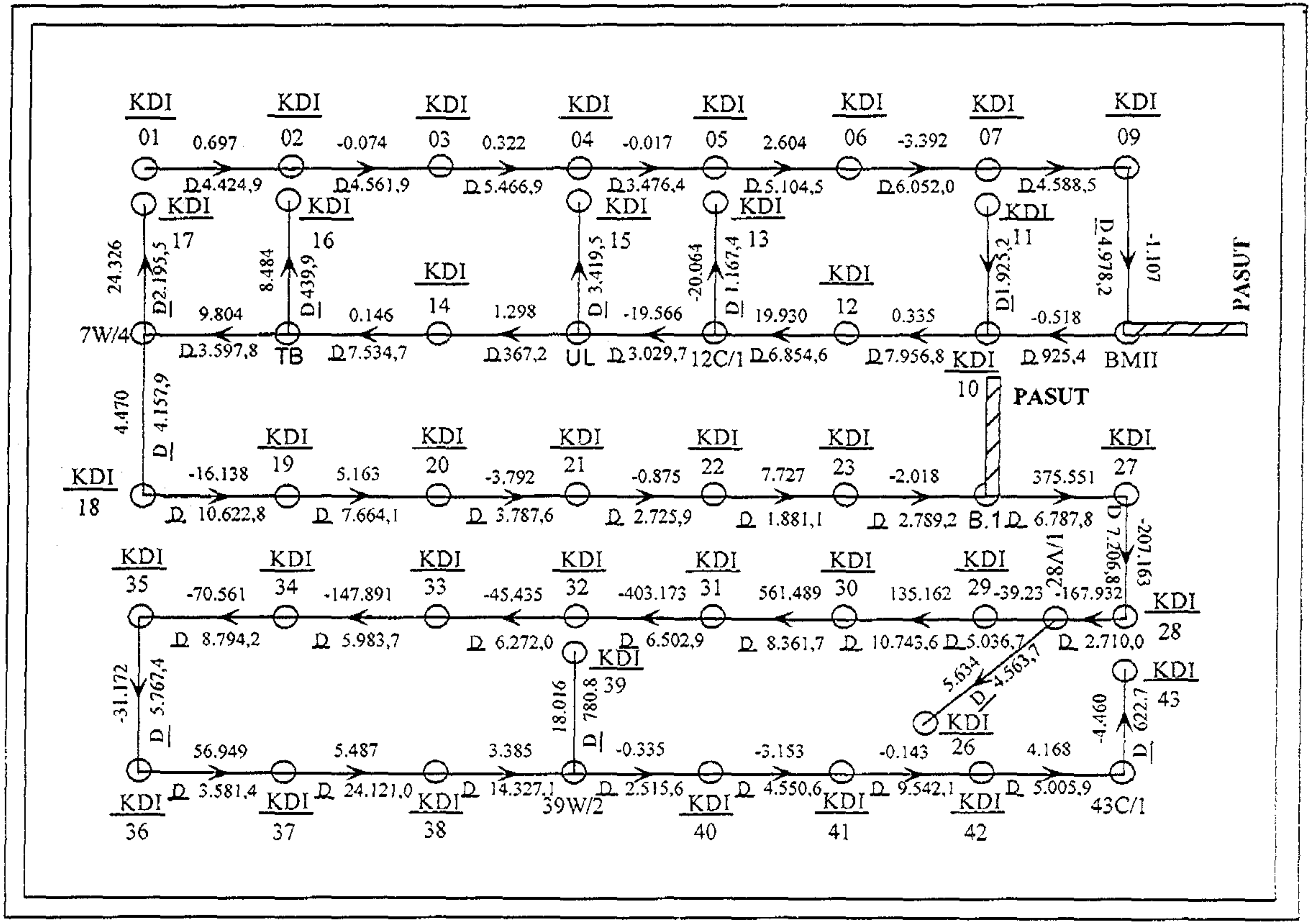


Figure A3-3-1 Leveling results (1 of 2)

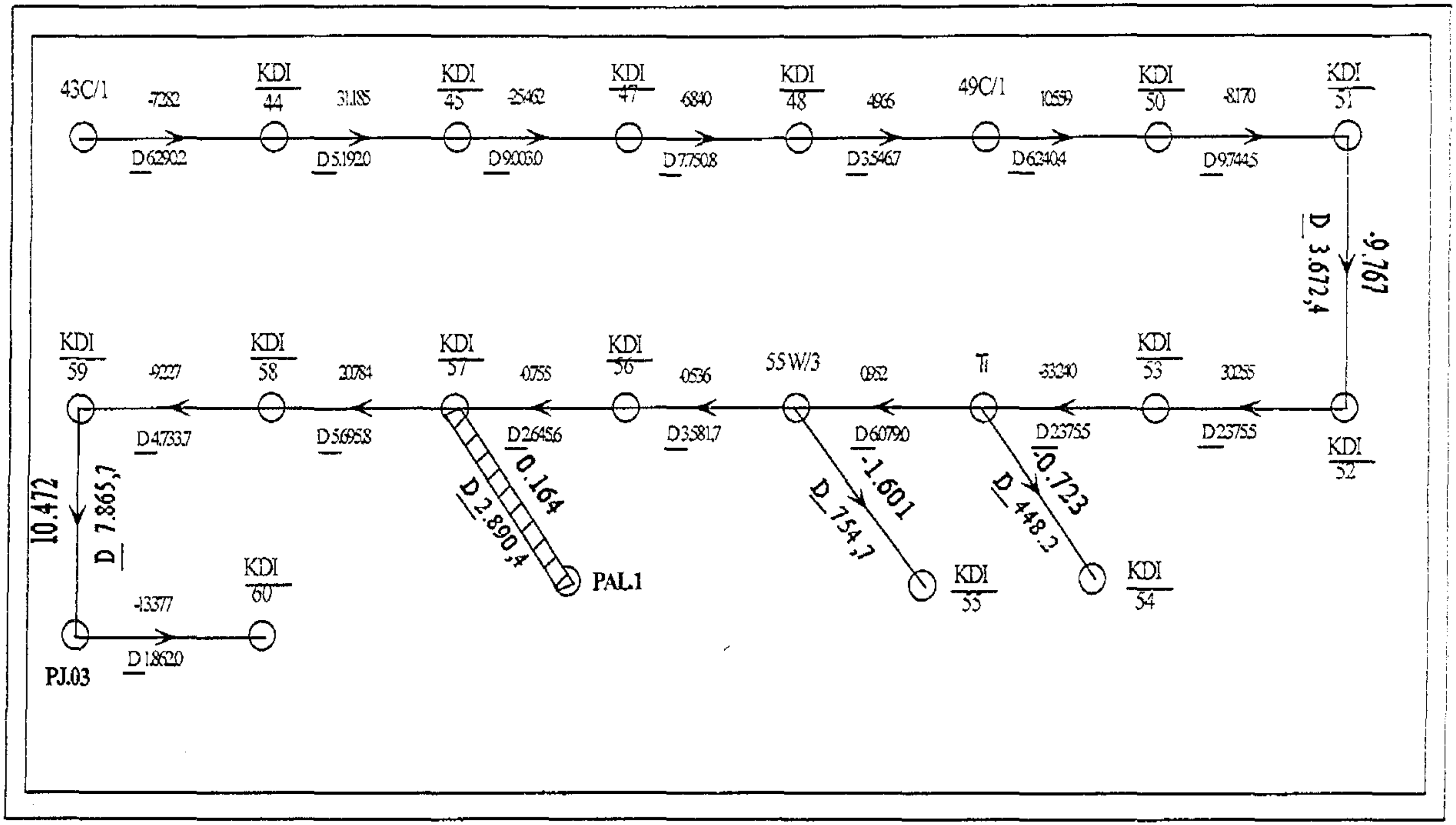


Figure A3-3-2 Leveling results (2 of 2)

Appendix A-4.1 Result of Boring

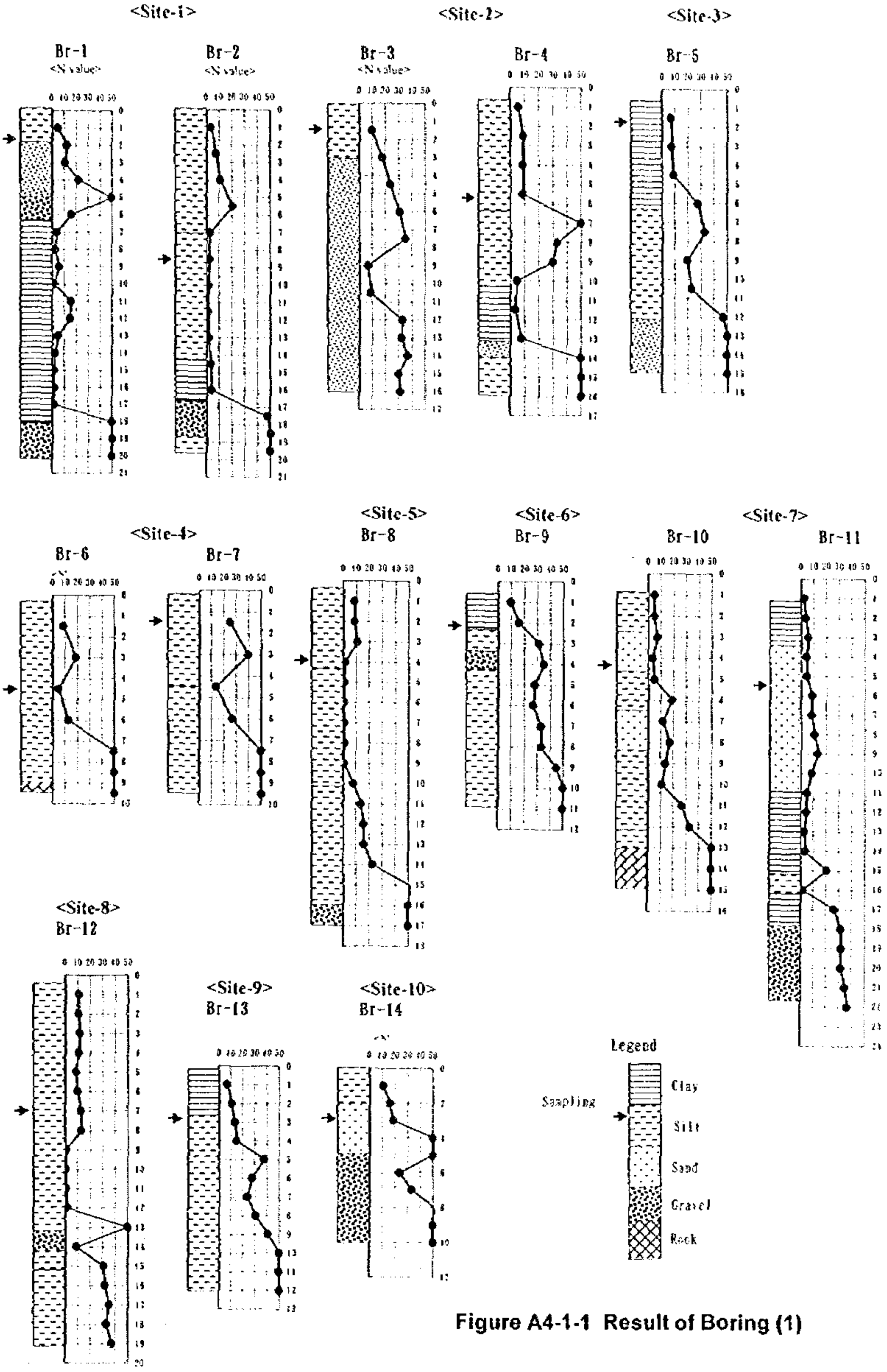


Figure A4-1-1 Result of Boring (1)

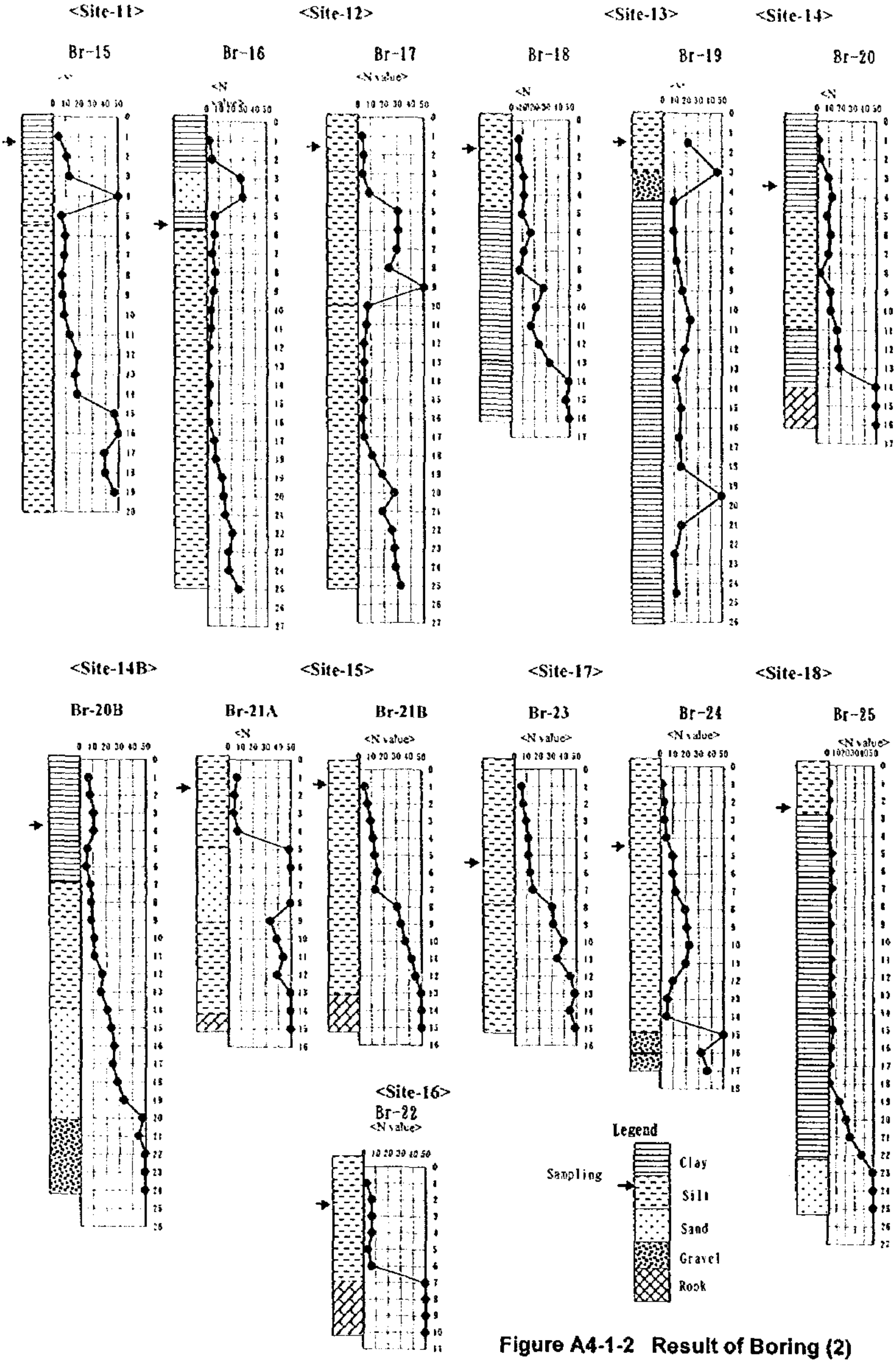


Figure A4-1-2 Result of Boring (2)

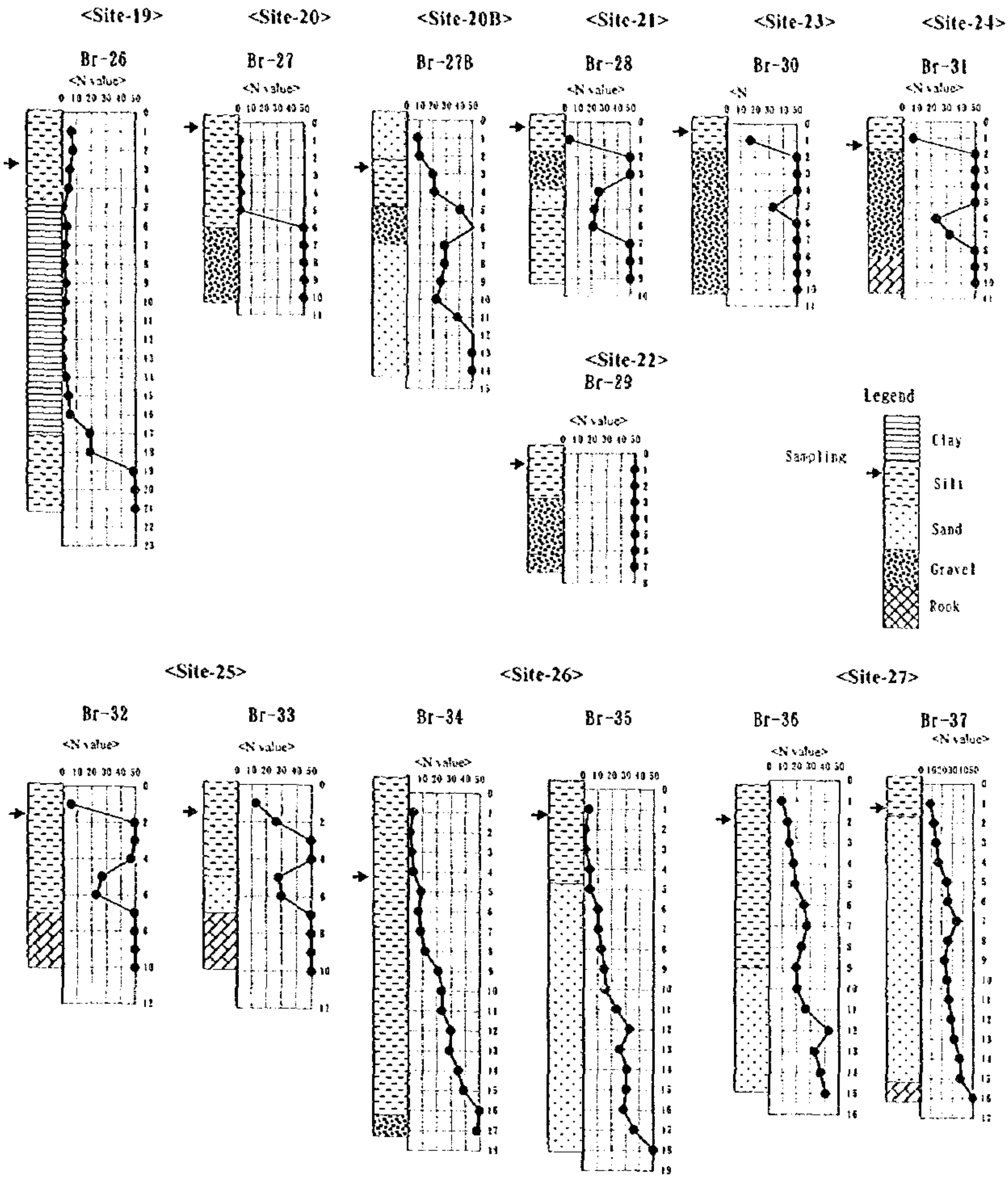


Figure A4-1-3 Result of Boring (3)

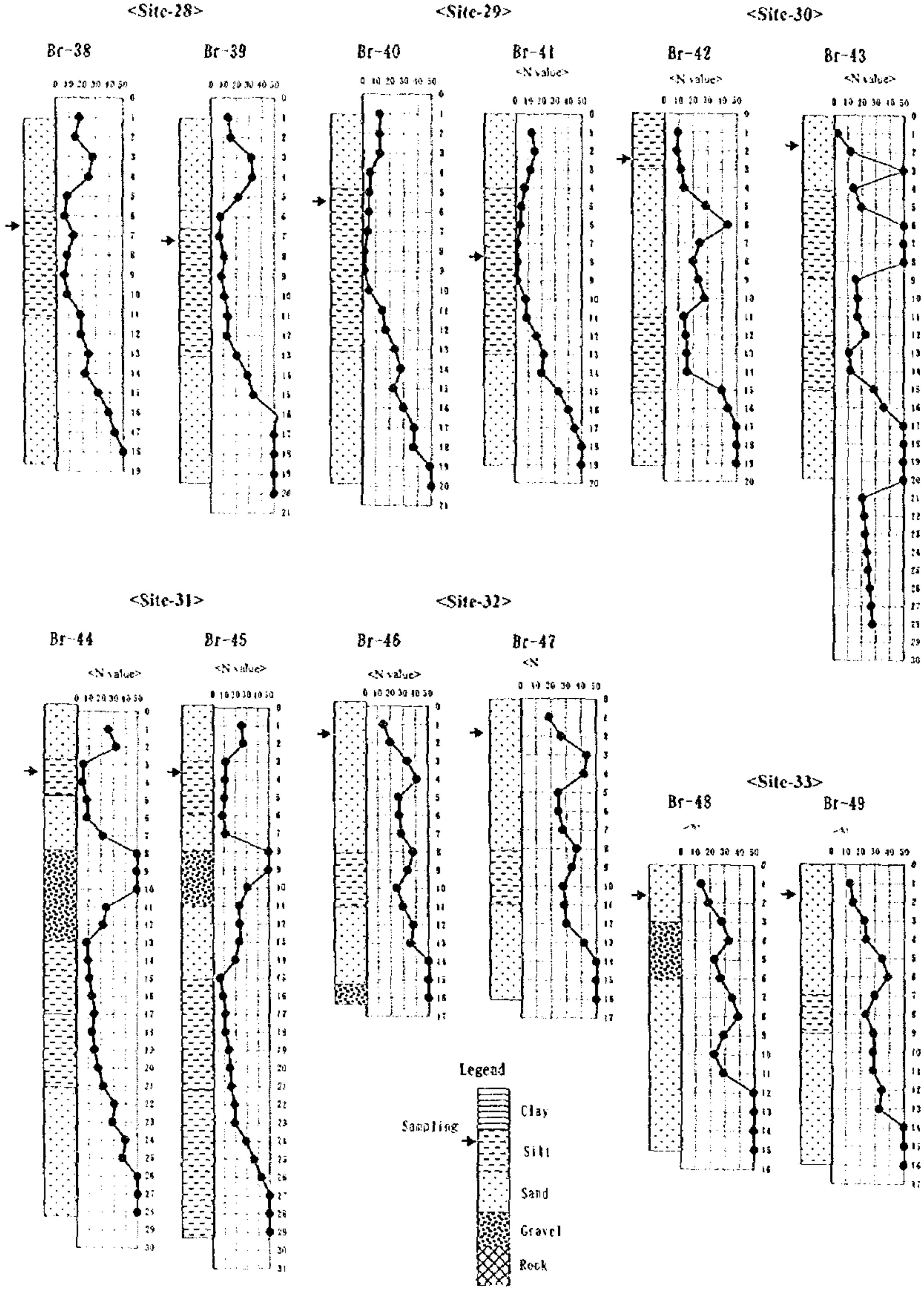
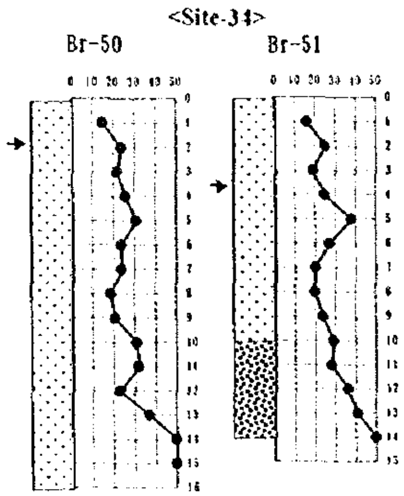
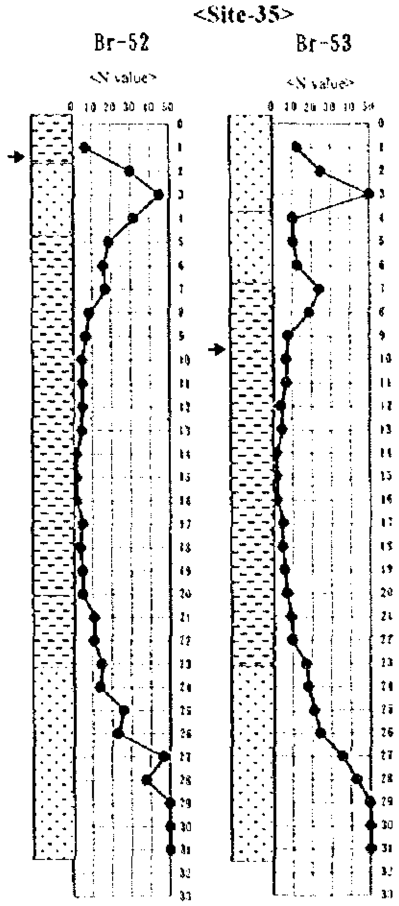
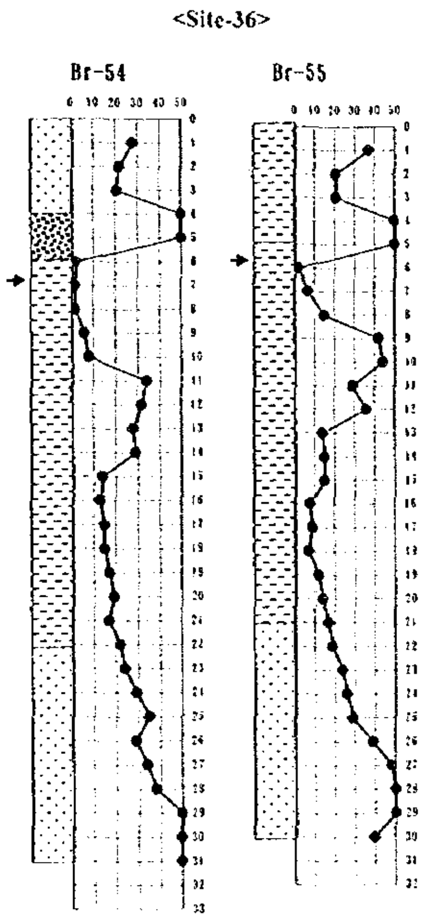


Figure A4-1-4 Result of Boring (4)







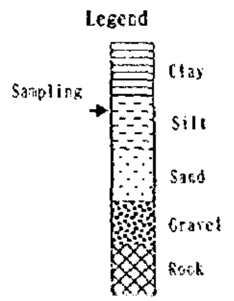


Figure A4-1-5 Result of Boring (5)

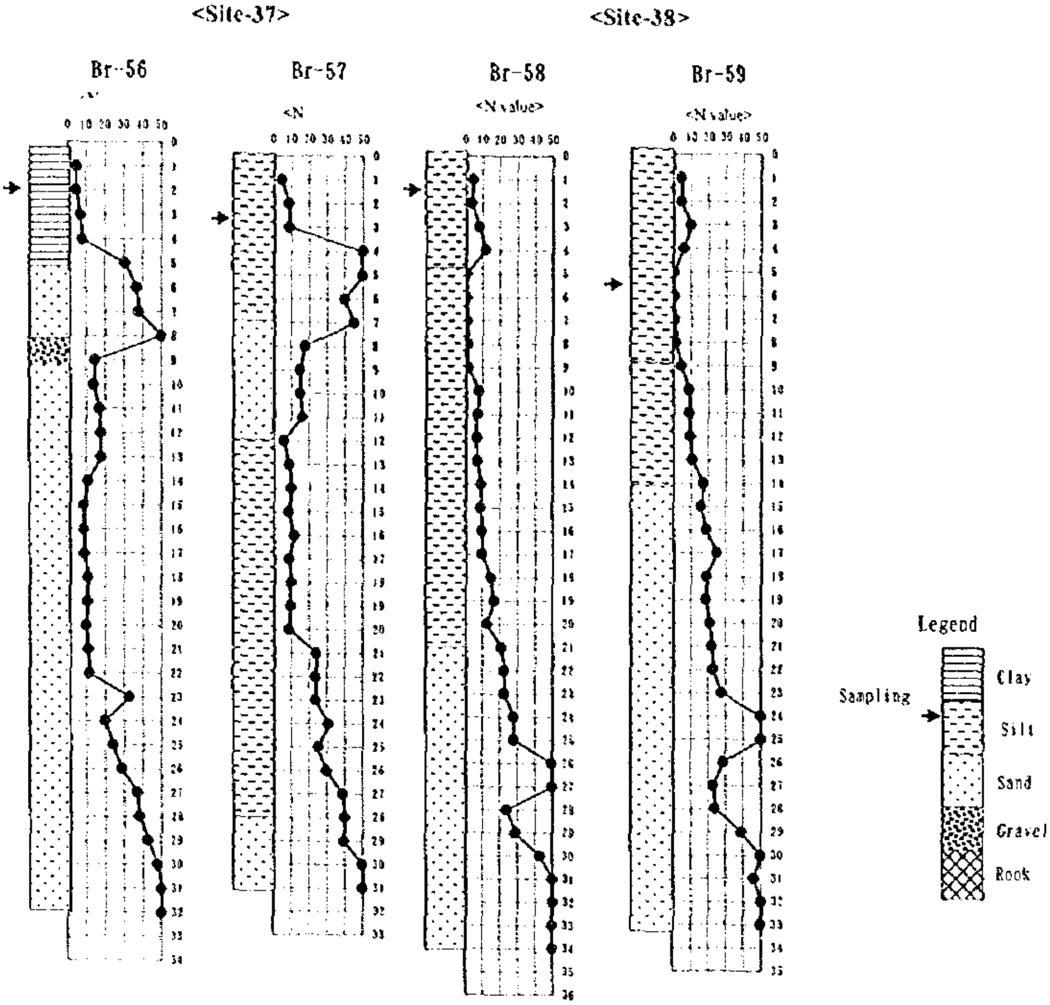
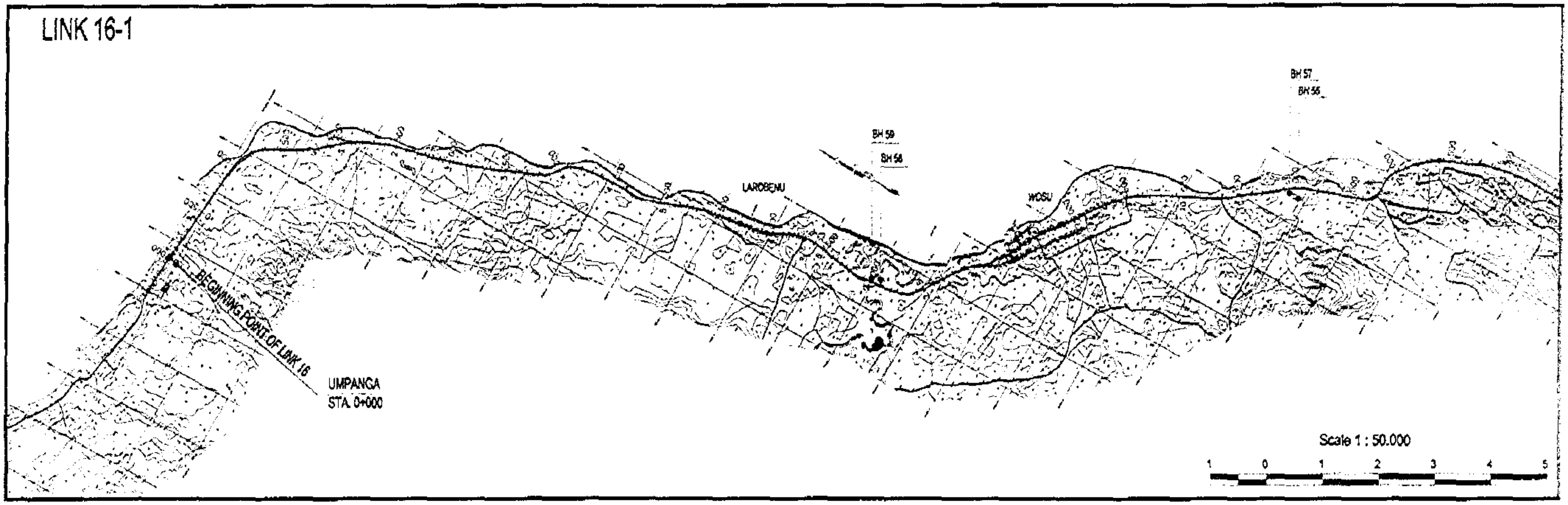


Figure A4-1-6 Result of Boring (6)

Table A4-2-1 Result of Laboratory Test

Link	Site No.	Br No.	Depth	Water Content	Unit Weight		Sepecific Gravity	Void Ratio	Saturation	Consistency (%)			Grain size distribution (%)				Consolidation Test		Triaxial Compession (UU)		Unconfined Test
			(GL-m)	Wn (%)	wet (t/m2)	dry (t/m2)	Gs	e	Sr (%)	Wp	WL	PI	Clay	Silt	Sand	Gravel	Cc (kg/cm2)	Pv (kg/cm2)	Φ	Cuu (kg/cm2)	qu (kg/cm2)
Link-16	32	Br-46	1.5-2.0	39.0	1.74	1.25	2.72	1.17	90.7	-	-	-	6.5	15.2	78.3	.0	.35	4	32.0	.05	-
		Br-47	1.5-2.0	40.0	1.68	1.20	2.75	1.29	85.3	-	-	-	13.0	17.2	69.8	0	25	4	36.0	.06	-
	33	Br-48	1.5-2.0	42.0	1.75	1.23	2.74	1.22	94.2	-	-	-	8.0	22.0	70.0	.0	.28	4	35.0	.07	-
		Br-49	1.5-2.0	44.0	1.70	1.18	2.75	1.33	91.0	-	-	-	13.4	21.4	65.2	0	32	4	28.5	10	-
	34	Br-50	1.5-2.0	46.0	1.62	1.11	2.68	1.42	86.8	-	-	-	11.3	30.7	58.0	.0	35	4	36.5	.17	-
		Br-51	3.5-4.0	36.0	1.70	1.25	2.68	1.14	84.6	-	-	-	17.8	41.5	40.7	0	25	4	26.5	28	-
	35	Br-52	1.5-2.0	38.0	1.71	1.24	2.64	1.13	88.8	37.2	70.4	33.2	41.3	50.3	8.4	.0	.38	4	20.0	34	1.08
		Br-53	9.5-10.0	39.0	1.66	1.19	2.50	1.09	89.4	32.4	92.6	60.2	38.5	46.5	10.0	5.0	40	4	22.5	48	1.84
	36	Br-54	6.5-7.0	64.0	1.48	.90	2.46	1.73	91.0	38.2	87.3	49.1	52.8	42.4	4.8	.0	.93	4	10.0	.15	0.66
		Br-55	5.5-6.0	66.0	1.46	.88	2.44	1.77	91.0	32.4	98.3	65.9	42.1	52.2	5.7	0	93	4	7.5	18	0.61
	37	Br-56	1.5-2.0	43.0	1.68	1.17	2.56	1.16	92.7	34.7	86.6	51.9	52.4	43.1	4.5	.0	.50	4	20.0	32	0.98
		Br-57	2.5-3.0	44.0	1.70	1.18	2.66	1.25	93.6	30.7	70.6	39.9	50.8	41.5	7.7	0	35	4	18.0	42	1.04
	38	Br-58	1.5-2.0	48.0	1.63	1.10	2.48	1.25	95.2	31.6	78.8	47.2	52.4	43.4	4.2	.0	.42	4	15.5	.22	0.88
		Br-59	5.5-6.0	60.0	1.59	.99	2.60	1.62	96.3	34.2	74.6	40.4	39.0	38.2	22.8	0	83	4	26.0	25	1.26
Link-22	26	Br-34	4.5-5.0	46.0	1.54	1.05	2.50	1.37	83.9	39.2	65.4	26.2	42.8	53.0	4.2	.0	.62	4	12.0	12	0.48
		Br-35	1.5-2.0	48.0	1.56	1.05	2.55	1.41	86.1	40.4	63.8	23.4	40.8	56.0	3.2	0	68	4	14.5	14	0.5
	27	Br-36	1.5-2.0	40.0	1.70	1.21	2.68	1.21	88.6	32.4	58.2	25.8	18.0	52.8	29.2	.0	.28	4	22.0	.34	0.96
		Br-37	1.5-2.0	42.0	1.72	1.21	2.70	1.23	92.2	30.7	55.7	25.0	11.4	56.2	32.4	0	27	4	23.5	28	0.86
	28	Br-38	5.5-6.0	46.0	1.50	1.03	2.46	1.39	81.4	32.4	88.7	56.3	56.2	35.6	8.2	.0	.42	4	20.5	25	0.9
		Br-39	6.5-7.0	44.0	1.52	1.03	2.46	1.33	81.4	33.8	86.2	52.4	51.1	41.9	7.0	0	45	4	18.5	36	0.84
	29	Br-40	4.5-5.0	48.0	1.56	1.03	2.44	1.31	89.4	35.4	89.8	54.4	32.4	60.2	7.4	.0	.50	4	17.5	26	0.64
		Br-41	7.5-8.0	62.0	1.48	.91	2.46	1.69	90.2	34.2	90.7	56.5	38.2	56.0	5.8	0	83	4	5.5	18	0.45
	30	Br-42	2.5-3.0	38.0	1.75	1.27	2.64	1.08	92.9	30.4	70.5	40.1	31.4	47.9	20.7	.0	.30	3	18.0	26	0.83
		Br-43	1.5-2.0	42.0	1.65	1.16	2.70	1.32	85.9	-	-	-	19.3	38.2	42.5	0	58	4	12.0	10	-
	31	Br-44	3.5-4.0	47.0	1.54	1.05	2.56	1.44	83.6	34.7	90.2	55.5	42.5	52.7	4.8	0	.63	4	20.0	17	0.78
		Br-45	3.5-4.0	46.0	1.69	1.16	2.66	1.30	94.1	36.2	67.4	31.2	28.7	53.5	17.8	0	33	4	28.0	38	1.42
Link-32	1	Br-1	1.5-2.0	46.4	1.65	1.13	2.62	1.32	92.1	42.1	67.8	25.7	22.0	58.0	20.0	.0	.42	5	15.0	32	0.92
		Br-2	8.0-8.5	80.5	1.50	.83	2.60	2.13	98.3	40.8	85.4	44.6	36.0	62.0	2.0	0	1.39	3	4.0	15	0.44
	2	Br-3	1.0-1.5	45.1	1.72	1.18	2.60	1.19	98.5	37.8	68.4	30.6	33.0	56.0	11.0	.0	.35	4	24.0	.56	1.28
		Br-4	5.0-5.5	48.1	1.54	1.04	2.59	1.49	83.6	38.9	72.6	33.7	50.2	48.0	1.8	0	37	4	22.0	38	1.08
	3	Br-5	1.0-1.5	40.1	1.60	1.14	2.60	1.28	81.5	35.2	84.1	48.9	64.6	27.7	7.7	0	43	3	16.0	33	0.88
	4	Br-6	4.0-4.5	46.7	1.72	1.17	2.60	1.22	99.5	39.1	78.4	39.3	23.4	66.6	10.0	.0	.27	4	30.0	.32	1.84
		Br-7	1.0-1.5	45.6	1.68	1.15	2.59	1.24	95.2	40.2	72.3	32.1	42.1	50.3	7.6	0	32	3	28.0	48	1.2
	5	Br-8	3.5-4.0	42.3	1.61	1.13	2.61	1.31	84.3	33.3	65.4	32.1	38.4	56.0	5.6	0	.32	3	26.0	.40	1.76
	6	Br-9	1.5-2.0	44.0	1.66	1.15	2.58	1.24	91.5	34.5	75.8	41.3	64.5	33.1	2.4	0	30	4	20.0	42	1.64
	7	Br-10	3.5-4.0	54.0	1.65	1.07	2.68	1.50	96.0	-	-	-	11.1	40.7	48.2	.0	.55	3	24.0	.20	-
		Br-11	4.5-5.0	56.0	1.66	1.06	2.70	1.54	98.0	-	-	-	21.0	38.8	40.2	0	61	3	22.0	14	-
	8	Br-12	6.5-7.0	42.6	1.70	1.19	2.59	1.17	94.3	39.9	67.8	27.6	44.0	50.8	5.2	0	.30	3	26.0	.30	1.32
	9	Br-13	2.5-3.0	50.4	1.67	1.11	2.60	1.34	97.8	42.5	69.2	26.7	36.6	55.6	7.8	0	33	4	28.0	46	1.49
Link-33	10	Br-14	2.0-3.0	42.0	1.78	1.25	2.70	1.15	98.6	-	-	-	15.8	33.4	50.8	0	.35	3	36.0	.20	-
	11	Br-15	1.0-1.5	64.0	1.57	.96	2.59	1.71	96.9	32.8	92.5	59.7	68.4	26.4	5.2	0	55	4	12.0	40	0.82
	12	Br-16	5.5-6.0	35.4	1.50	.96	2.60	1.69	85.2	38.4	87.1	48.7	70.8	23.8	5.4	.0	.55	3	14.0	.44	0.96
		Br-17	1.5-2.0	53.0	1.62	1.06	2.64	1.49	93.9	44.3	70.1	25.8	55.8	34.6	9.6	0	78	4	7.5	08	0.46
	13	Br-18	1.5-2.0	44.0	1.58	1.10	2.68	1.44	81.9	28.7	51.4	22.7	48.8	28.4	22.8	0	43	3	18.5	12	0.8
	14	Br-19	1.0-1.5	48.0	1.72	1.16	2.72	1.34	97.4	40.7	69.3	28.6	27.2	47.9	15.0	10.0	30	3	28.0	56	1.56
		Br-20	3.5-4.0	43.4	1.74	1.21	2.58	1.13	99.1	34.5	79.4	44.9	51.4	38.4	10.2	0	30	4	18.0	34	0.96
	14B	Br-20B	3.5-4.0	30.2	1.86	1.43	2.58	.81	96.1	-	-	-	48.1	46.1	5.8	0	30	4	22.0	45	1.88
	15	Br-21A	1.5-2.0	33.4	1.56	1.02	2.59	1.55	89.2	40.3	68.9	28.6	30.2	55.8	14.0	0	45	4	20.0	28	0.84
		Br-21B	1.0-1.5	48.5	1.65	1.11	2.58	1.32	94.8	42.4	72.4	30.0	28.8	60.2	11.0	0	33	4	24.0	32	0.92
	16	Br-22	2.5-3.0	45.0	1.66	1.14	2.59	1.26	92.5	37.6	83.4	45.8	54.2	37.0	8.8	0	37	4	28.0	18	0.9
	17	Br-23	5.5-6.0	42.0	1.75	1.23	2.59	1.10	98.9	40.1	72.9	32.8	21.6	68.1	10.3	0	27	3	30.0	48	1.69
	18	Br-24	4.5-5.0	46.5	1.57	1.07	2.60	1.43	84.5	35.5	83.7	48.2	-	-	-	.0	47	3	20.0	36	1.08
	19	Br-25	2.5-3.0	62.0	1.42	.88	2.46	1.81	84.3	34.7	102.1	67.4	78.2	39.9	1.9	0	83	3	5.0	.05	0.36
	20	Br-26	2.5-3.0	54.0	1.55	1.01	2.46	1.44	92.3	38.3	94.2	55.9	64.3	26.2	9.5	0	55	4	14.0	18	0.77
	20B	Br-26B	2.5-3.0	28.2	1.80	1.40	2.66	.89	84.3	-	-	-	40.5	52.5	7.0	0	27	4	24.0	46	2.01
	21	Br-27	3.5-4.0	54.4	1.56	1.01	2.58	1.55	90.5	30.3	67.2	36.9	23.2	55.3	21.5	0	80	4	6.0	12	0.6
	22	Br-28	0.5-1.0	61.2	1.49	.92	2.63	1.85	87.1	40.4	62.3	21.9	37.2	58.3	4.5	.0	58	4	10.0	18	0.52
	23	Br-29	0.5-1.0	36.0	1.82	1.34	2.76	1.06	93.7	34.3	65.0	30.7	27.0	48.0	10.0	15.0	20	4	35.0	62	3.4
	24	Br-30	0.5-1.0	38.0	1.71	1.24	2.64	1.13	88.8	34.8	67.2	32.4	40.3	52.7	7.0	.0	23	4	24.0	34	1.55
		Br-31	1.5-2.0	39.0	1.70	1.22	2.64	1.16	88.8	40.4	68.2	27.8	37.5	58.3	4.2	0	32	4	26.0	38	1.68
	25	Br-32	1.5-2.0	42.0	1.67	1.18	2.65	1.25	89.0	39.8	65.8	26.0	54.1	43.5	2.4	.0	48	4	24.0	26	0.88
		Br-33	1.5-2.0	39.0	1.72	1.24	2.64	1.13	91.1	37.2	70.1	32.9	45.8	50.7	3.5	0	37	4	28.0	48	1.48



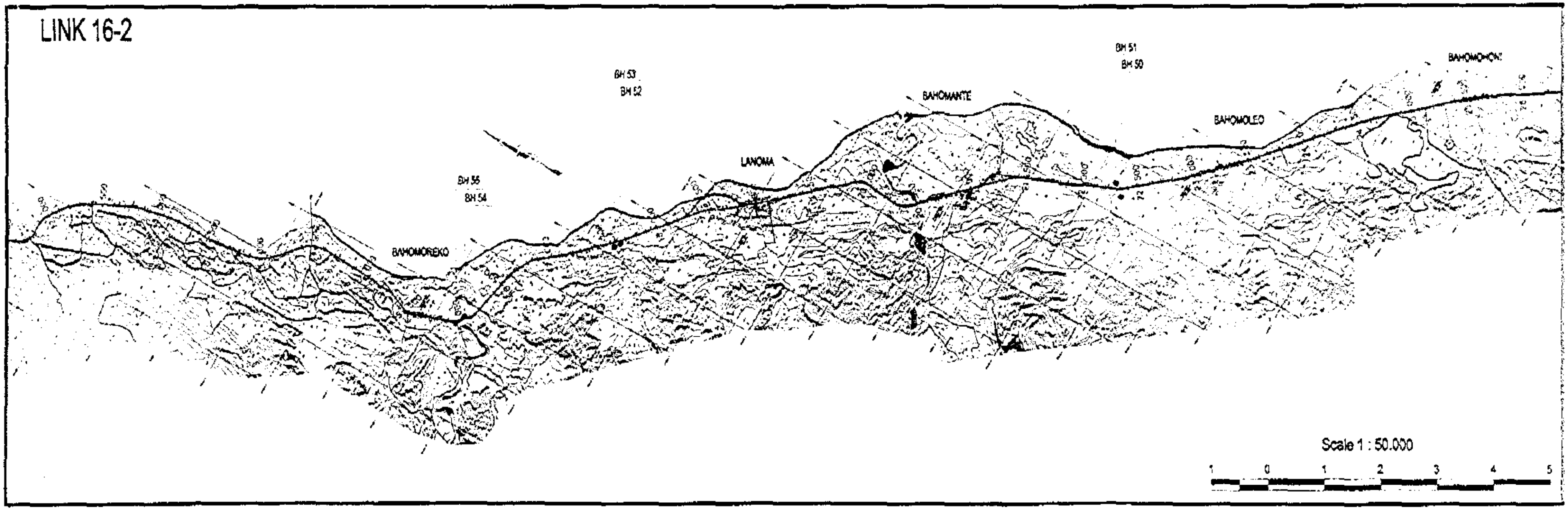
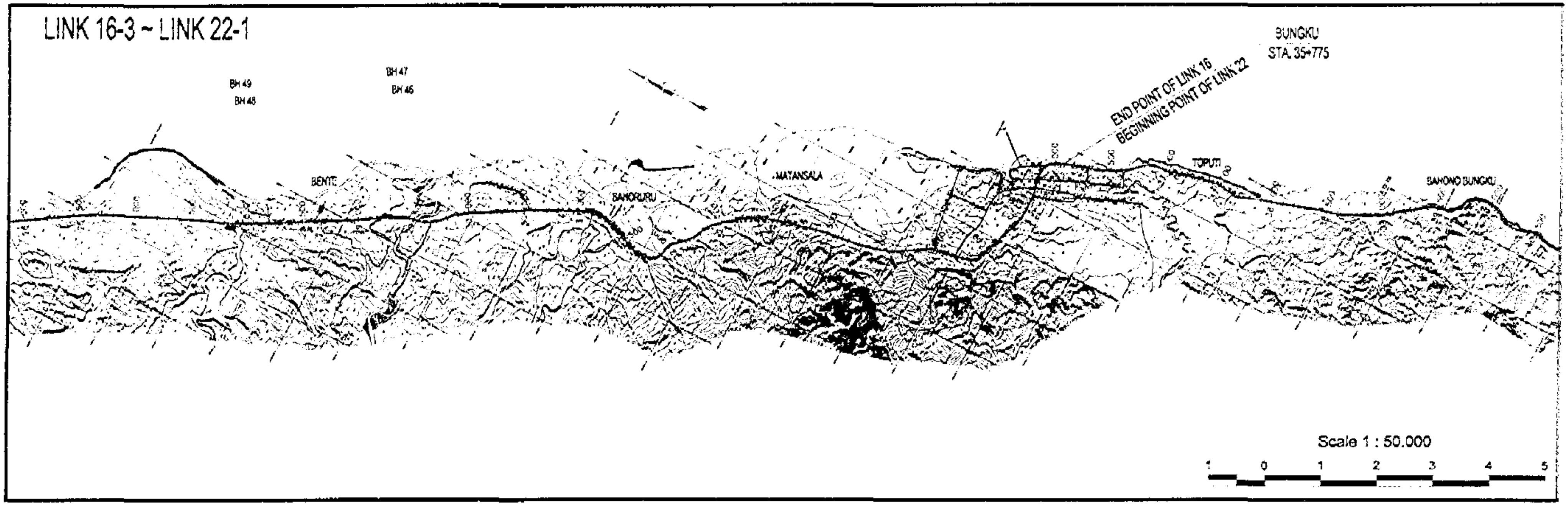


Figure A6-1-1 Road Alignment of Umpanga to Sandangpangan (1 of 11)



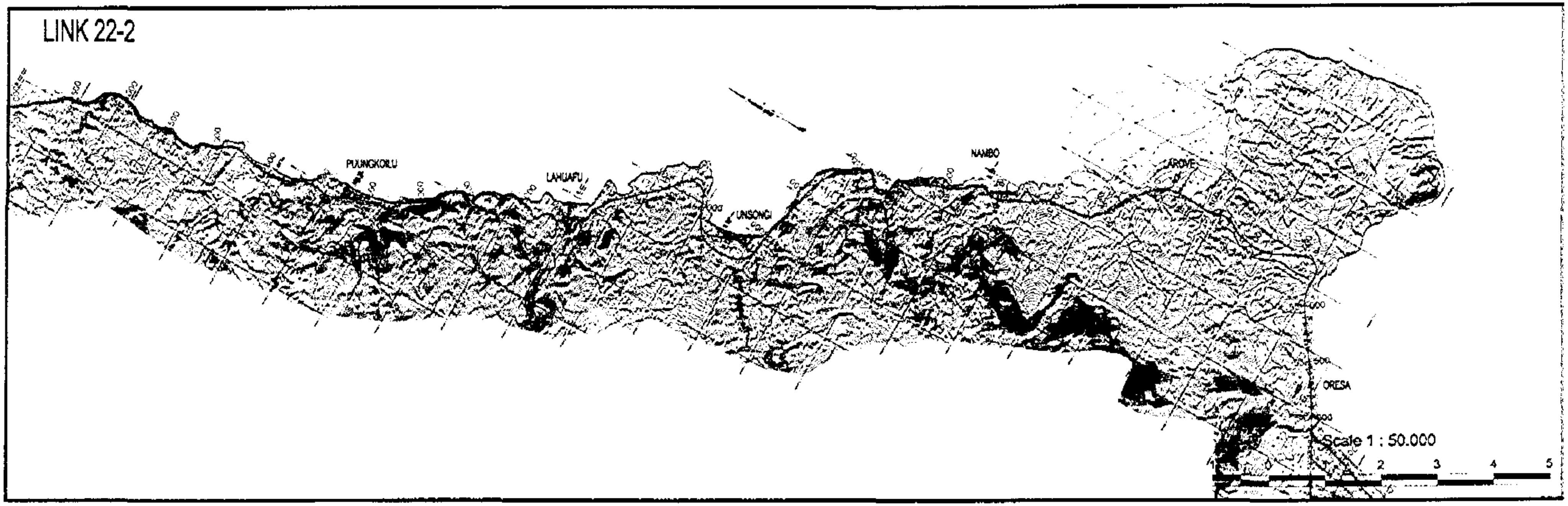
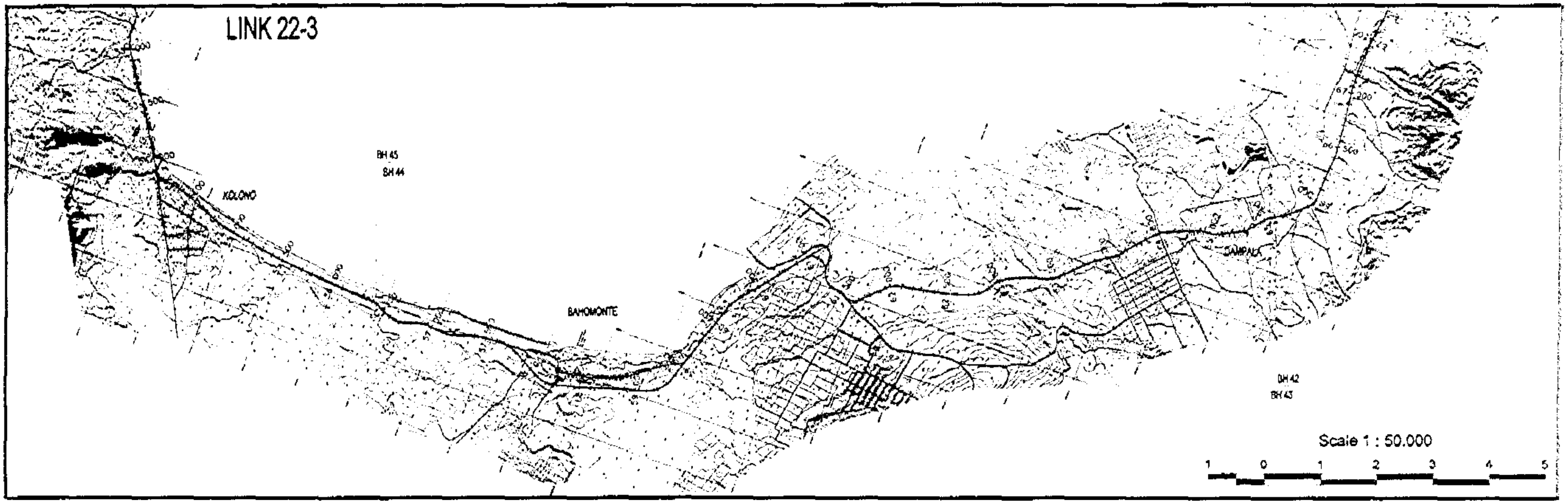


Figure A6-1-2 Road Alignment of Umpanga to Sandangpangan (2 of 11)



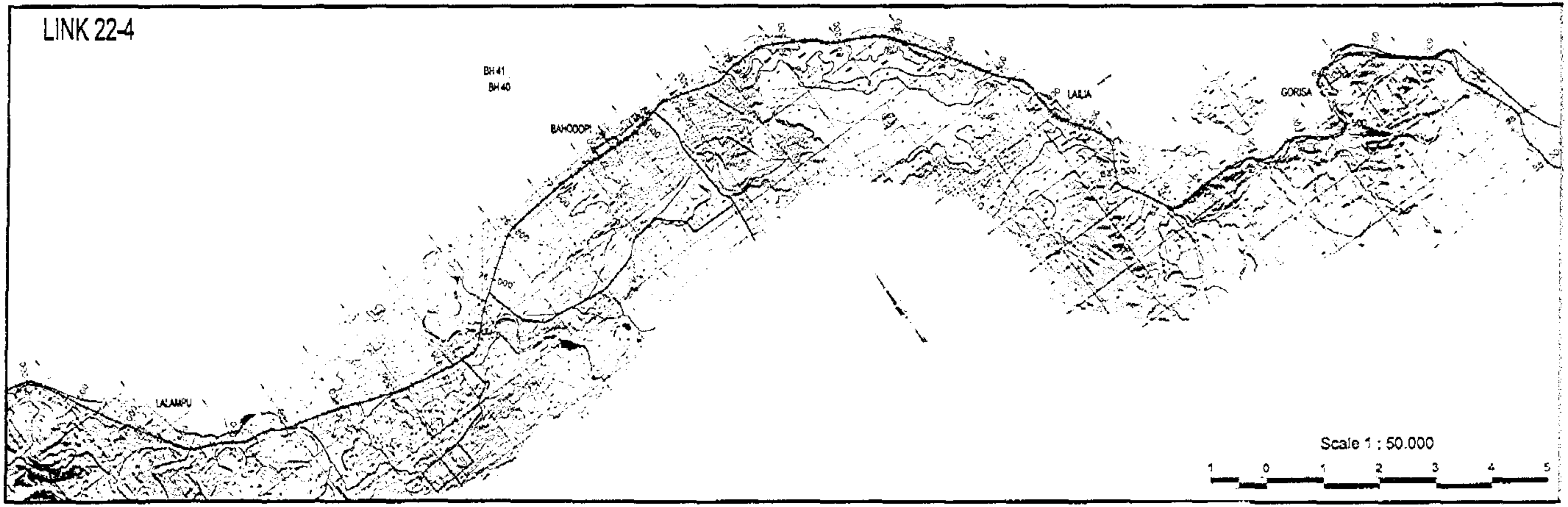


Figure A6-1-3 Road Alignment of Umpanga to Sandangpangan (3 of 11)

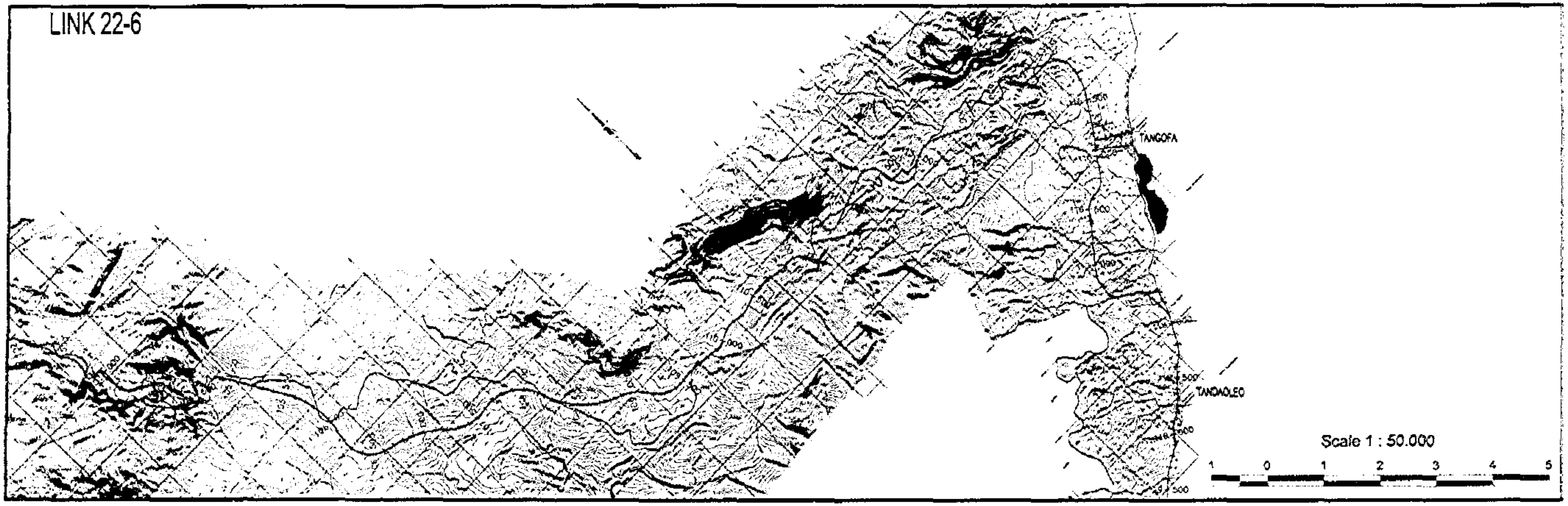


Figure A6-1-4 Road Alignment of Umpanga to Sandangpangan (4 of 11)

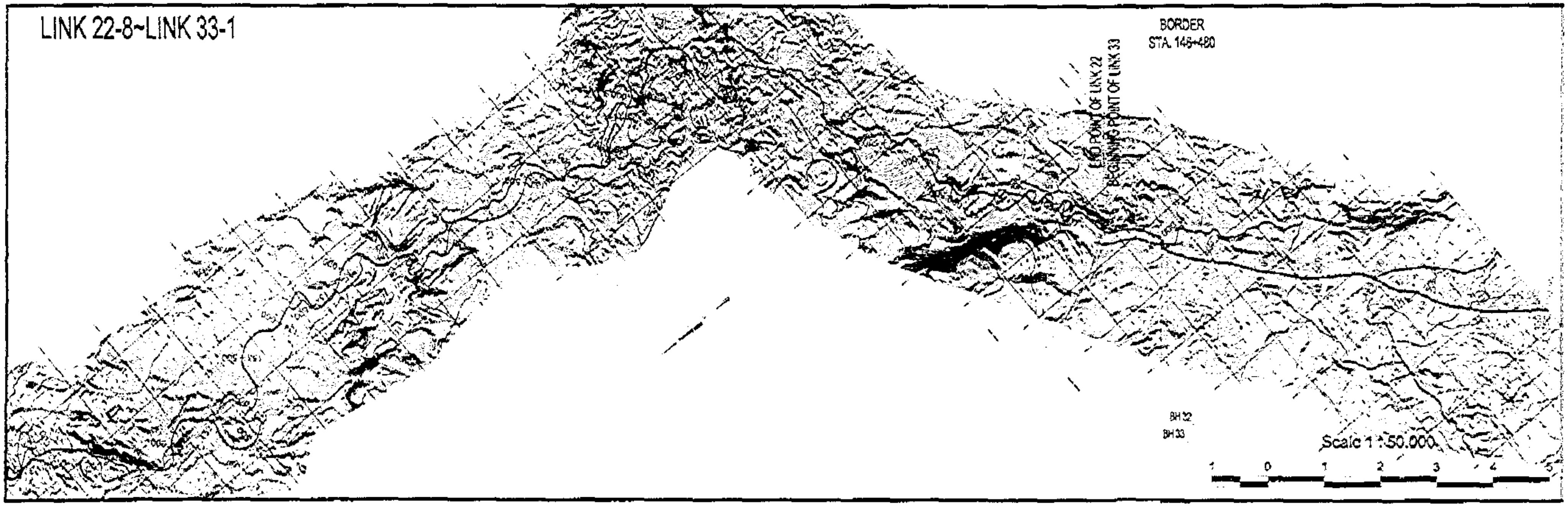


Figure A6-1-5 Road Alignment of Umpanga to Sandangpangan (5 of 11)

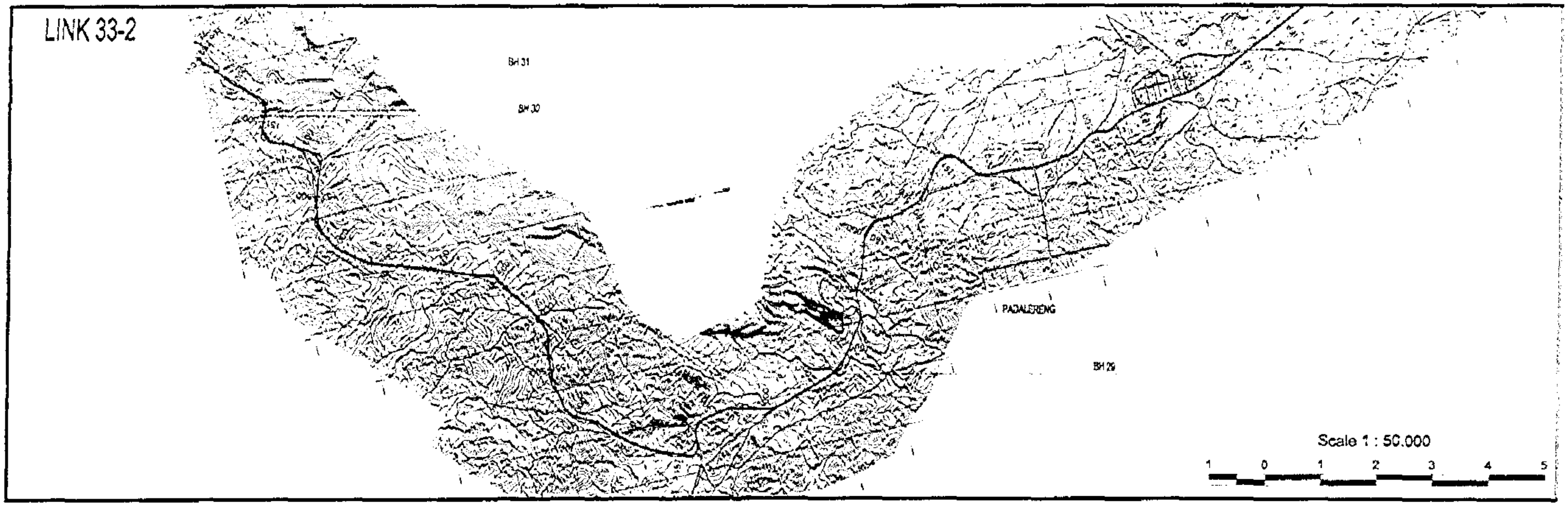
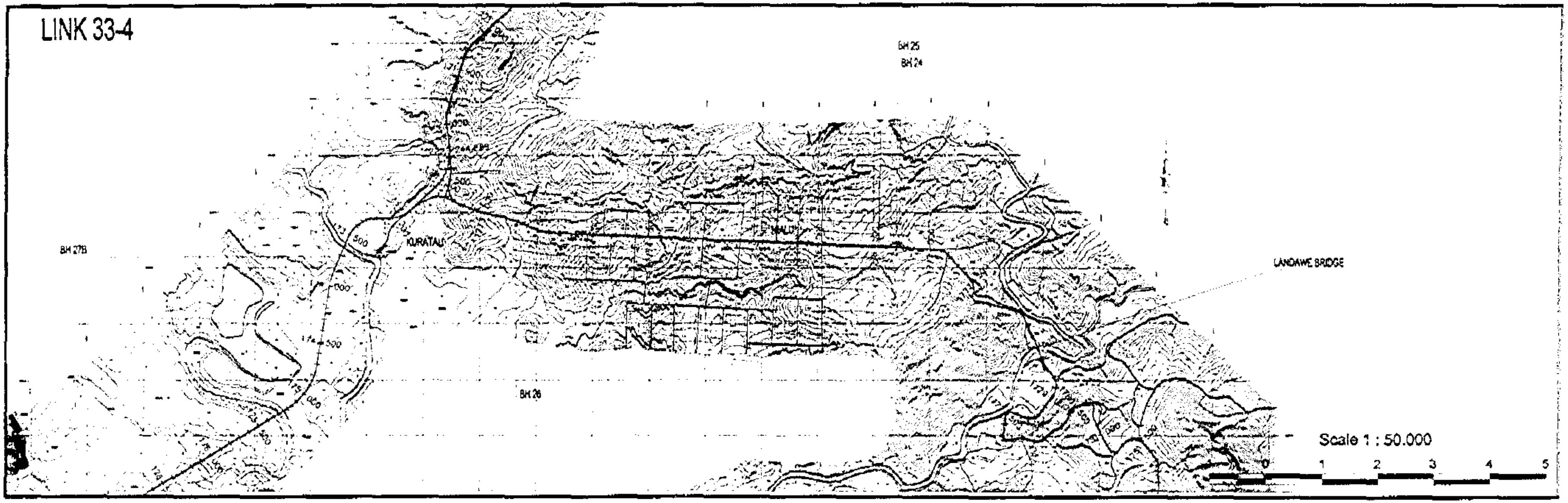


Figure A6-1-6 Road Alignment of Umpanga to Sandangpangan (6 of 11)



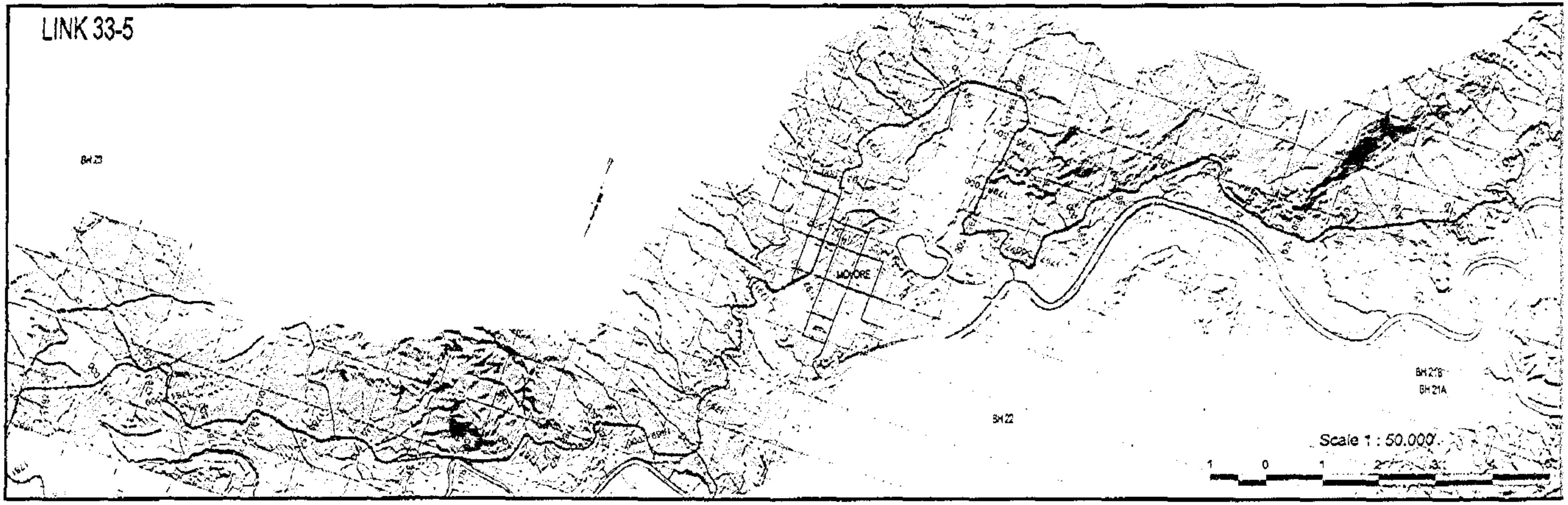
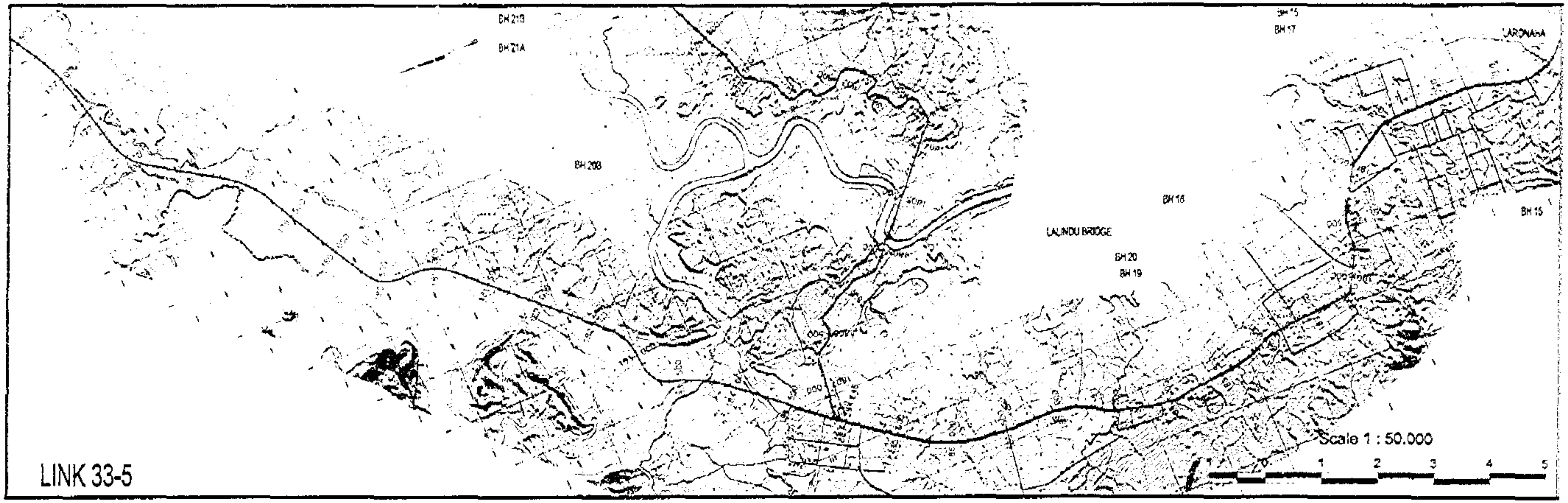


Figure A6-1-7 Road Alignment of Umpanga to Sandangpangan (7 of 11)



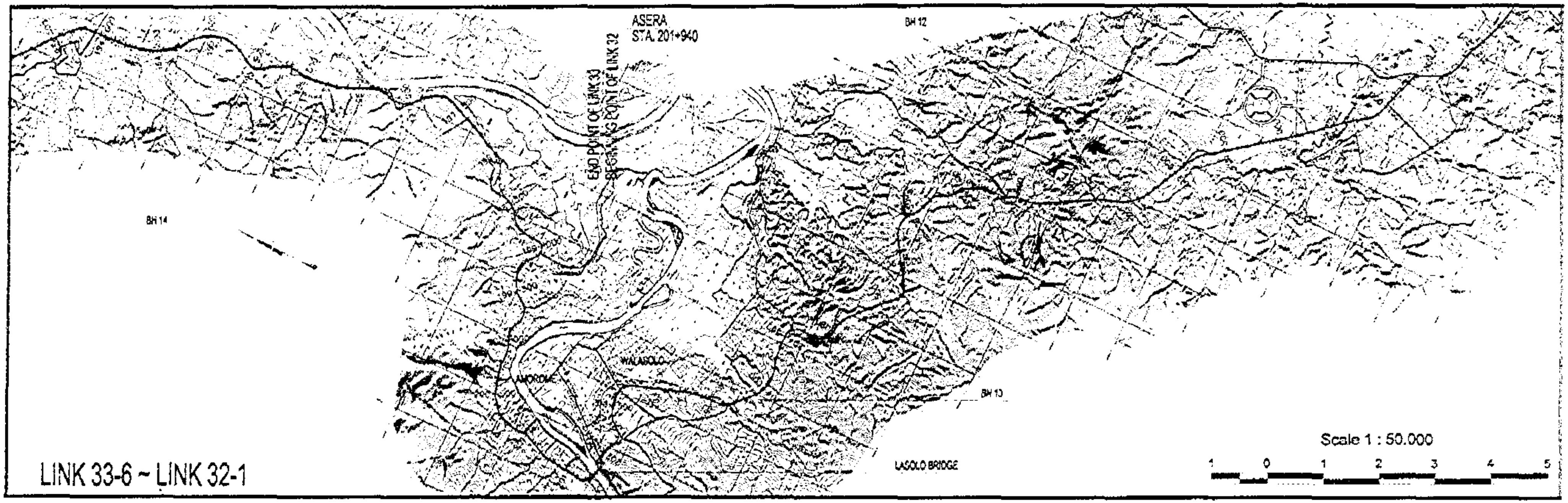
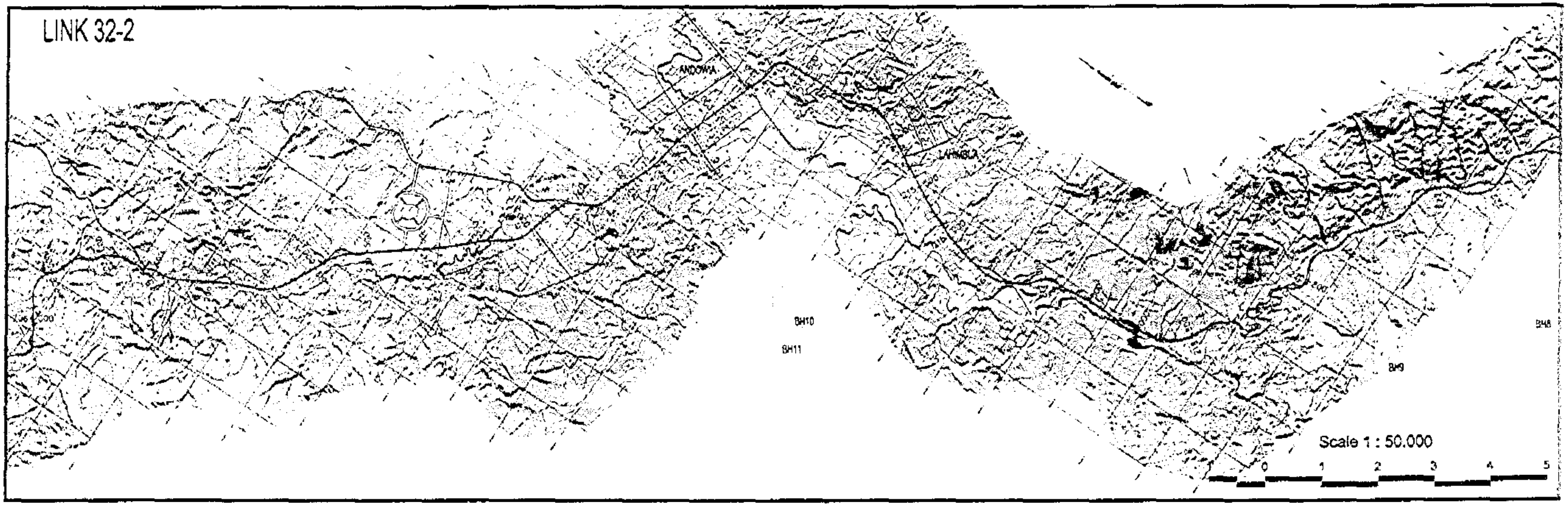


Figure A6-1-8 Road Alignment of Umpanga to Sandangpangan (8 of 11)



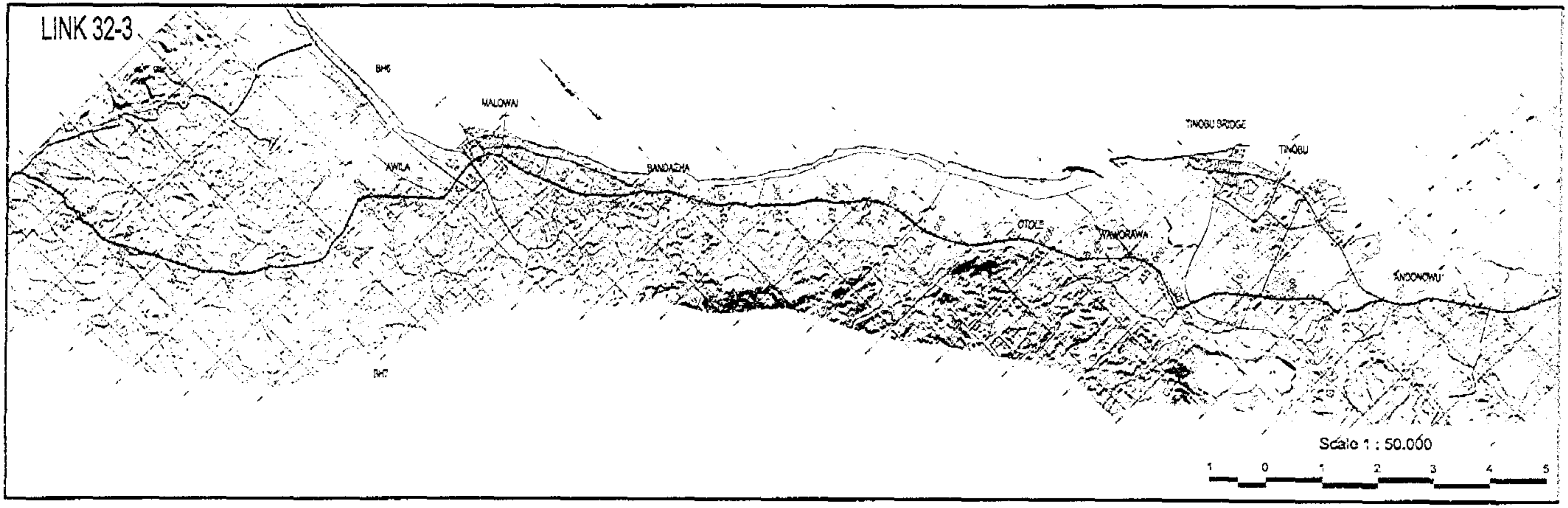
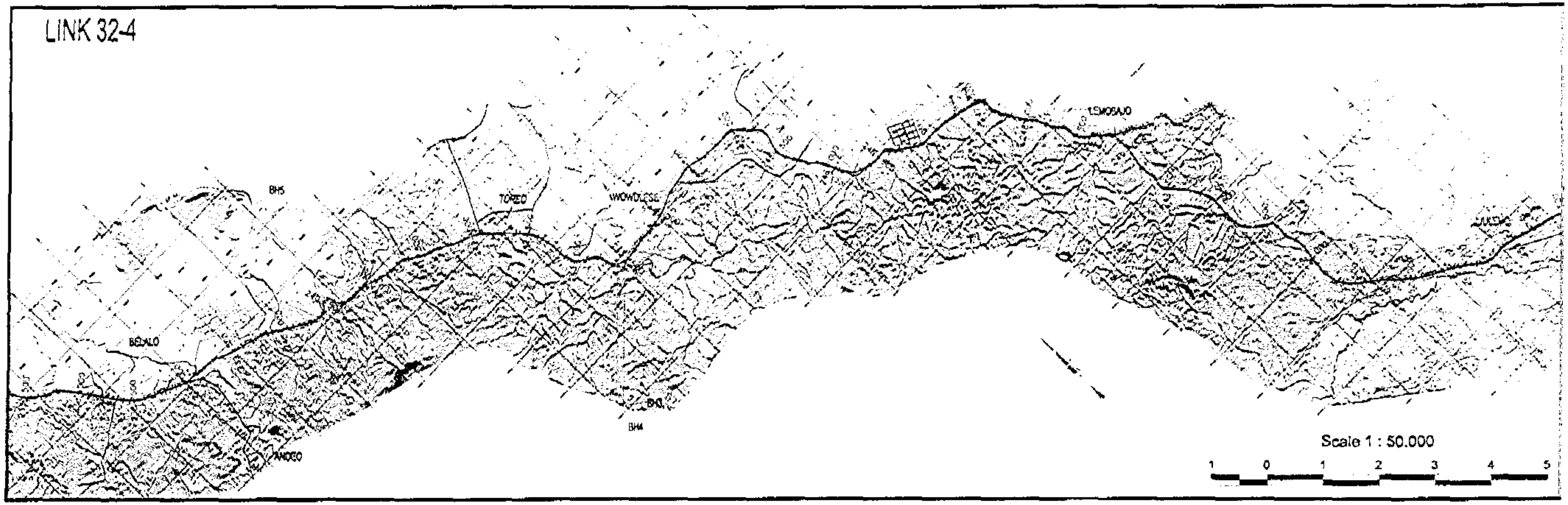


Figure A6-1-9 Road Alignment of Umpanga to Sandangpangan (9 of 11)



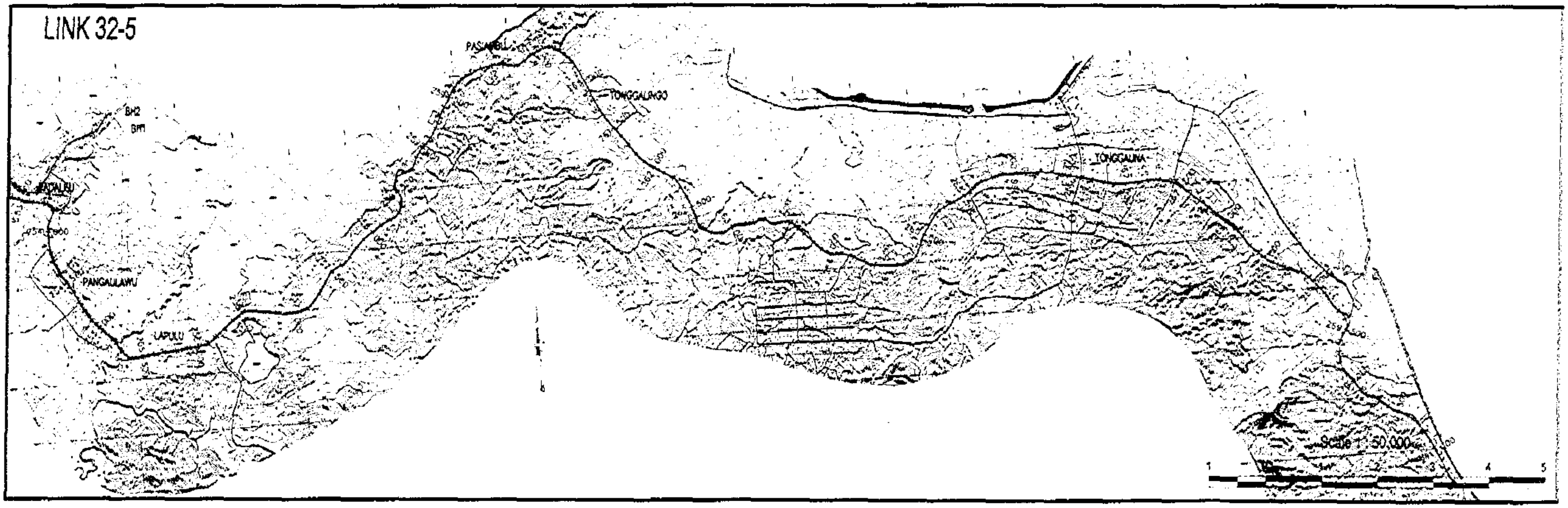


Figure A6-1-10 Road Alignment of Umpanga to Sandangpangan (10 of 11)

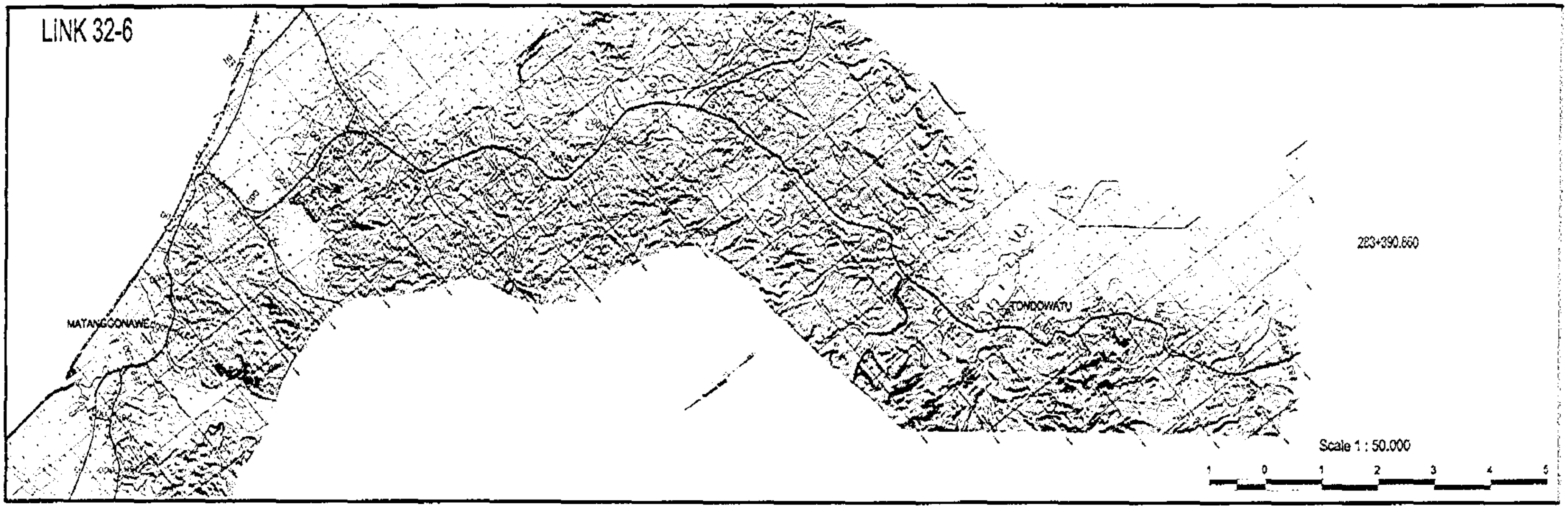


Figure A6-1-11 Road Alignment of Umpanga to Sandangpangan (11 of 11)

Appendix A-6.2 Uekuli -- Tompira (114.1km): Link No.15

A-6.2.1 Selection and Description of Route (Link No.15)

This is important as a Trans-Sulawesi Est route. The existing route between Kolonadale and Poso via Tentena is 183 km. The proposed route will reduce the distance by 50 km or more. The new route, which will connect Poso, Klolonadale, and Bungku ports, is expected to be a road for regional development. The Tonodoyondo district along the route has rivers with affluent river water and wide land appropriate for cultivation. It also serves as an access point to Morowari National Park. Due to its access to the rich natural tourist resources, tourism development in this district is expected. At present, transport of everyday goods to the Tondoyondo district is made by sea from Kolonadale.

(1) Uekli – Malino (30 km)

1) Location of existing road

The route climbs from the coast of Uekuli over the main ridge pass at 1200 m above sea level, reaching a karst plateau. The road runs along ridges branching from the main ridge, connecting the coast with the pass linearly with a steep slope of 18% or more. From the pass, the road runs down to the plateau at 600 m above sea level through a valley.

2) Condition of existing road

The existing paved road is a 4.5 m wide. It connects the coast to the pass, and its grade is as steep as 18% or more. The section from the pass to the plateau is a gravel road.

3) Land use

The roadside area has already been cultivated to a great extent by settlers. The roadside land with a relatively gentle slope is cultivated for cassava through slash and burn farming. Cocoa, etc. are grown on the hilly land. Malino is located on a plateau where paddy fields are developed. A great deal of land has been left uncultivated. The karst topography in the neighborhood is a relatively wide plateau which is most appropriate for livestock farming.

4) Possibility of development

The Malino district at 600 m above sea level has a relatively mild climate, and agricultural development of the flat uncultivated area on the south side is expected.

5) Construction work

Correction of the road vertical alignment, widening, paving, and installation of drainage facilities on shoulders are required.

(2) Malino - Tondoyond (30 km)

1) Location of existing road

This route extends from the Malino plateau at 600 m above sea level down to Momo along the valley. It is a steep dirt road. It is difficult for vehicles to pass this road even for a 4WD vehicle. The section from Momo to Tondoyondo runs through flat land along the Sumara River.

2) Condition of existing road

The Malino - Momo section runs from the plateau to the Momo flat land along the valley. The existing road is a dirt road leveled by a bulldozer. The grade is steep. A 4WD vehicle can travel on the road during the dry season. The section from Momo to Tondoyondo runs through flat land. It is mostly a dirt road without any bridge to cross the river.

3) Land use

The roadside of the mountainous section from Malino to Mono is covered with forest. Migration is under way for the flat land, from Momo to Tondoyondo.

4) Possibility of development

In the flat land extending from Momo to Tondoyondo, there is ample river water and the land is appropriate for paddy fields. The foothill is appropriate for livestock farming. Development is expected in the future in these fields. The estuary where a river flows into the sea includes a wide mangrove area. The coast is appropriate for fishery. Increased fishery production is expected. Tondoyondo is expected to prosper as an access base to natural tourist resources, such as Morowari National Park.

5) Construction work

Correction of the road vertical alignment, construction of an 8 km new road, construction of bridges across rivers, widening, paving roads and installation of drainage facilities on shoulders are required

(3) Tondoyondo - Kolonadale (40 km)

1) Location of existing road

A 10 km section to the south of Tondoyondo runs though precipitous limestone topography. The existing dirt road, a foothill route with the sea on one side, extends from Kolonadale up to a point 4 km before Tondoyondo. In other sections, the topography along the existing road crosses hilly ridges projecting to points near the coast line. Though the road connects narrow inlets along the coast, the road alignment crossing the hilly area is based on the low road standard level both vertically and horizontally.

2) Condition of existing road

About 10 km section to the south of Tondoyondo crosses the foothills of precipitous mountains of limestone. The grade is 20% or more. Even 4WD vehicles can not pass the road in rainy days. Other sections also include precipitous topography. Passage of vehicles on the dirt road is often impossible during the rainy season.

3) Land use

Small villages dot the flat areas along small inlets, in which lumbering and small agricultural areas are distributed. The slope facing the coast is covered with natural forest without cultivated land.

4) Possibility of development

There are almost no artificial structures along the coast in this district. Rivers flowing into the sea bring clean and transparent spring water from the limestone district. The coastal landscape includes many peninsulas and islands with rich natural tourist resources.

Tourism development is expected in the future.

5) Construction work

Correction of the road vertical alignment, construction of a 10 km new road, construction of bridges crossing small rivers, widening, paving, and installation of drainage facilities on shoulders are required.

(4) Kolonadale - Tompira (14 km)

1) Location of existing road

Kolonadale is a port town at an inlet surrounded by mountains. The route reaching Kolonadale crosses a peninsula at Tompira. To cross the peninsula, the road climbs over a pass of 120 meters above sea level. The route from the pass to Tompira runs through the diluvial stratum along Laa River.

2) Condition of existing road

The section crossing the pass and the Kolonadale side is based on the low road standard level vertically and horizontally. The road width is 4.5 meters (pavement width), and the shoulder is as narrow as 1 meter on one side.

3) Land use

The pass and the Kolonadale side are precipitous mountainous areas. The roadside is covered with natural forest. The Tompira side is a flat land with cultivated agricultural land (paddy fields, etc.).

5) Possibility of development

Promotion of industries in the surrounding areas is expected through improvement of access to the Kolonadale port.

6) Construction work

Correction of the road vertical alignment, widening and paving, and installation of drainage facilities on shoulders

A-6.2.2 Preliminary Engineering Design (Link No.15)

(1) Preliminary Engineering of Bridges

Application of types of bridge superstructures of Link No.15 is the same as description in section 6.2.2 (1).

Quantities of bridge improvement on Link No.15 are summarized shown in Table A6-2-1. And proposed bridge list of Link No.15 is shown in Table A6-2-2

Table A6-2-1 Summary of Bridge Improvement Quantities of Link No.15

Classification		The Number of Bridges	Area of Bridges (m^2)
New Construction	Bridge length ≦50m	25	4,504
	Bridge length >50m	10	5,640
	Total	35	10,144
Retain Existing		1	720

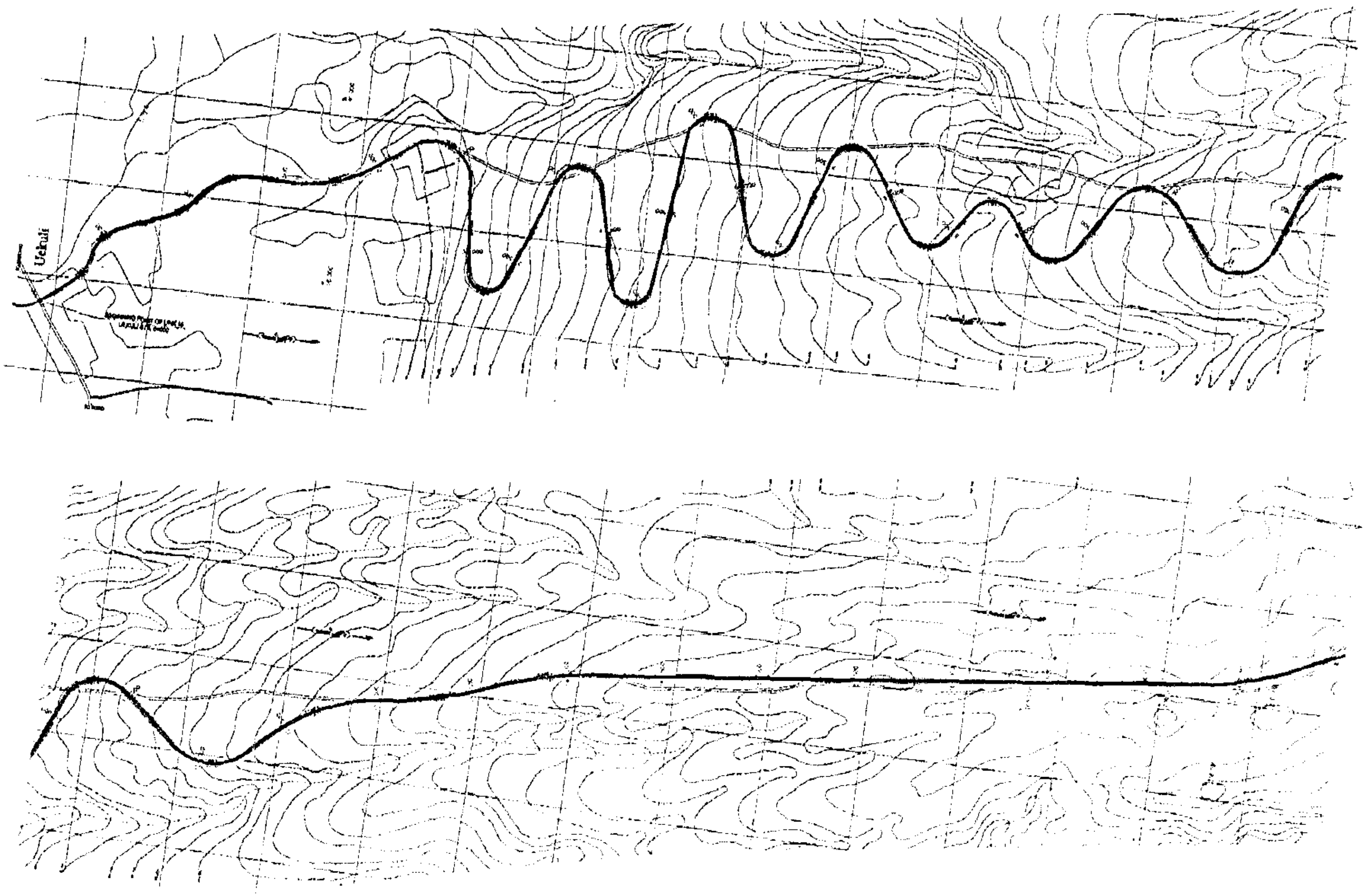


Figure A6-2-1 Route Alignment of Link 15 (1 of 7): (S=1:30,000)

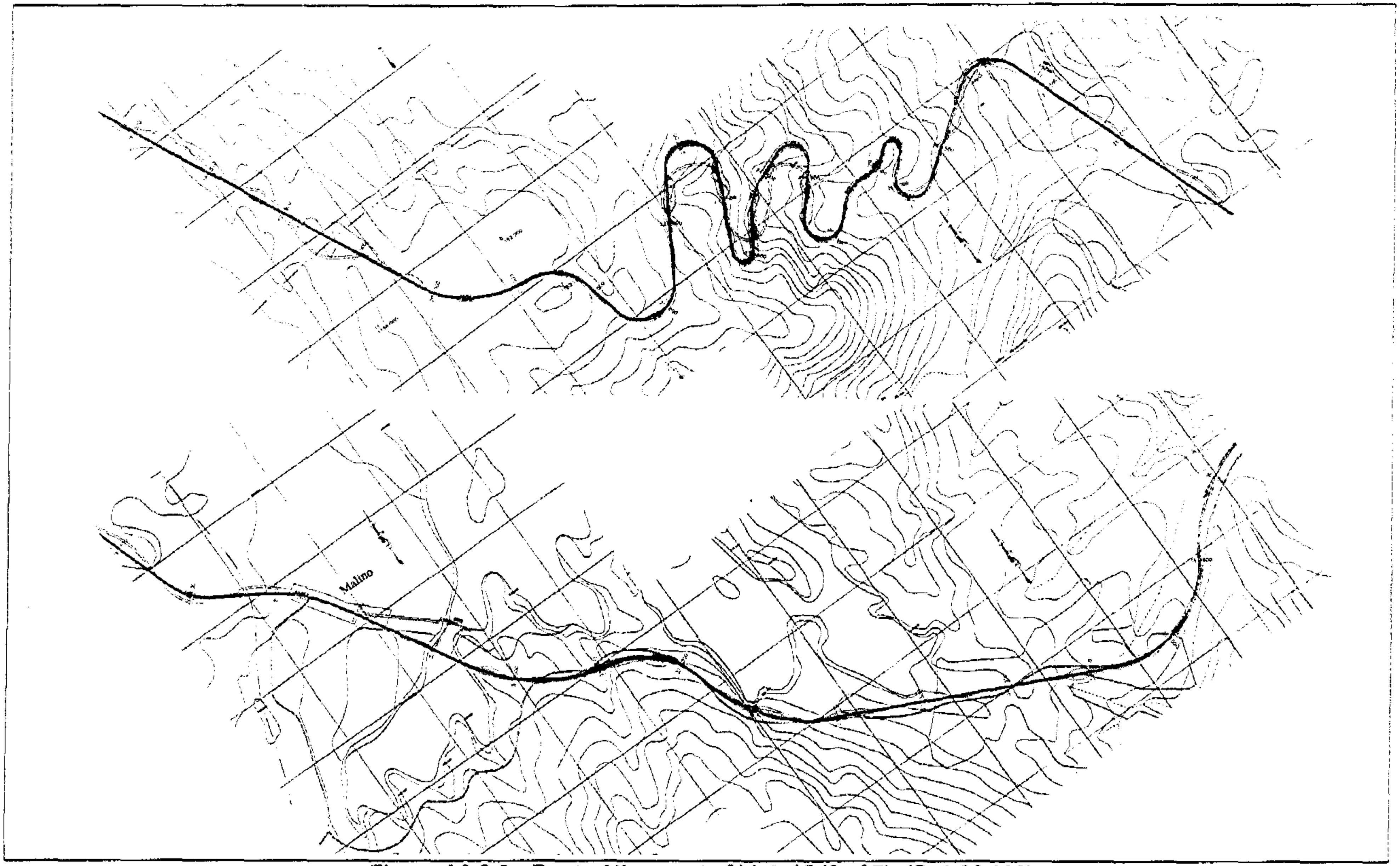


Figure A6-2-2 Route Alignment of Link 15 (2 of 7): (S=1:30,000)

Figure A6-2-3 Route Alignment of Link 15 (3 of 7): (S=1:30,000)

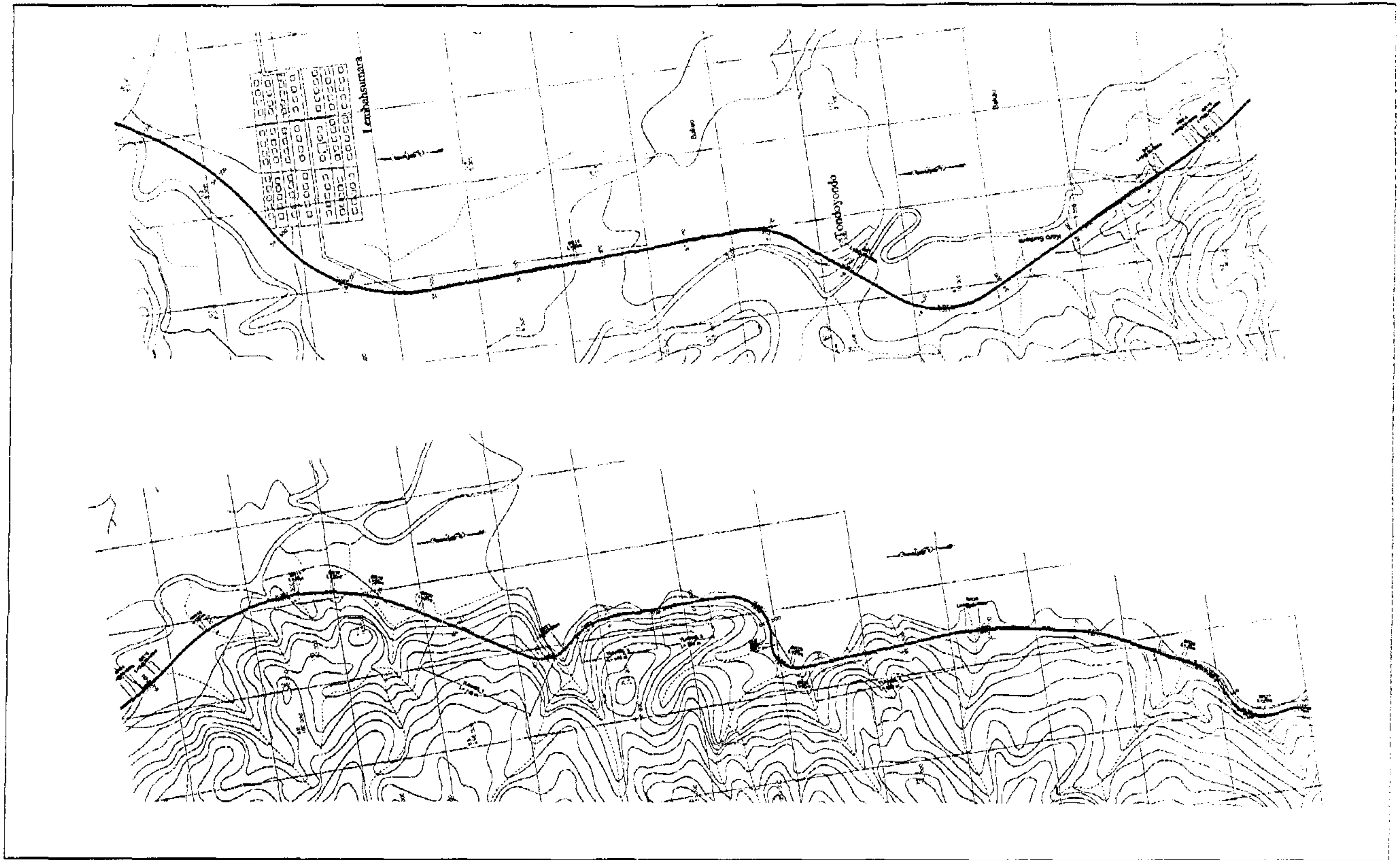


Figure A6-2-4 Route Alignment of Link 15 (4 of 7): (S=1:30,000)

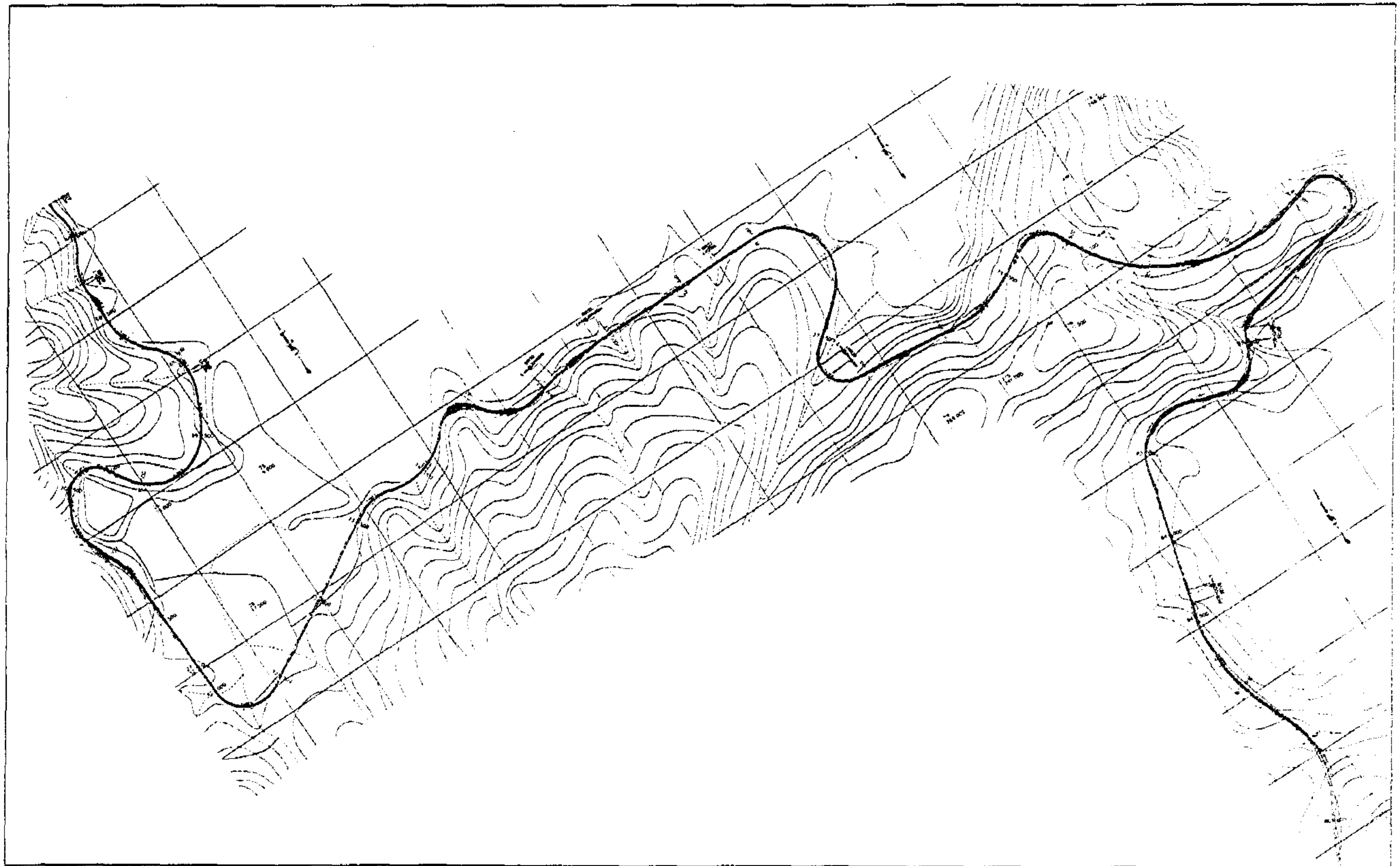


Figure A6-2-5 Route Alignment of Link 15 (5 of 7): (S=1:30,000)

Figure A6-2-6 Route Alignment of Link 15 (6 of 7): (S=1:30,000)

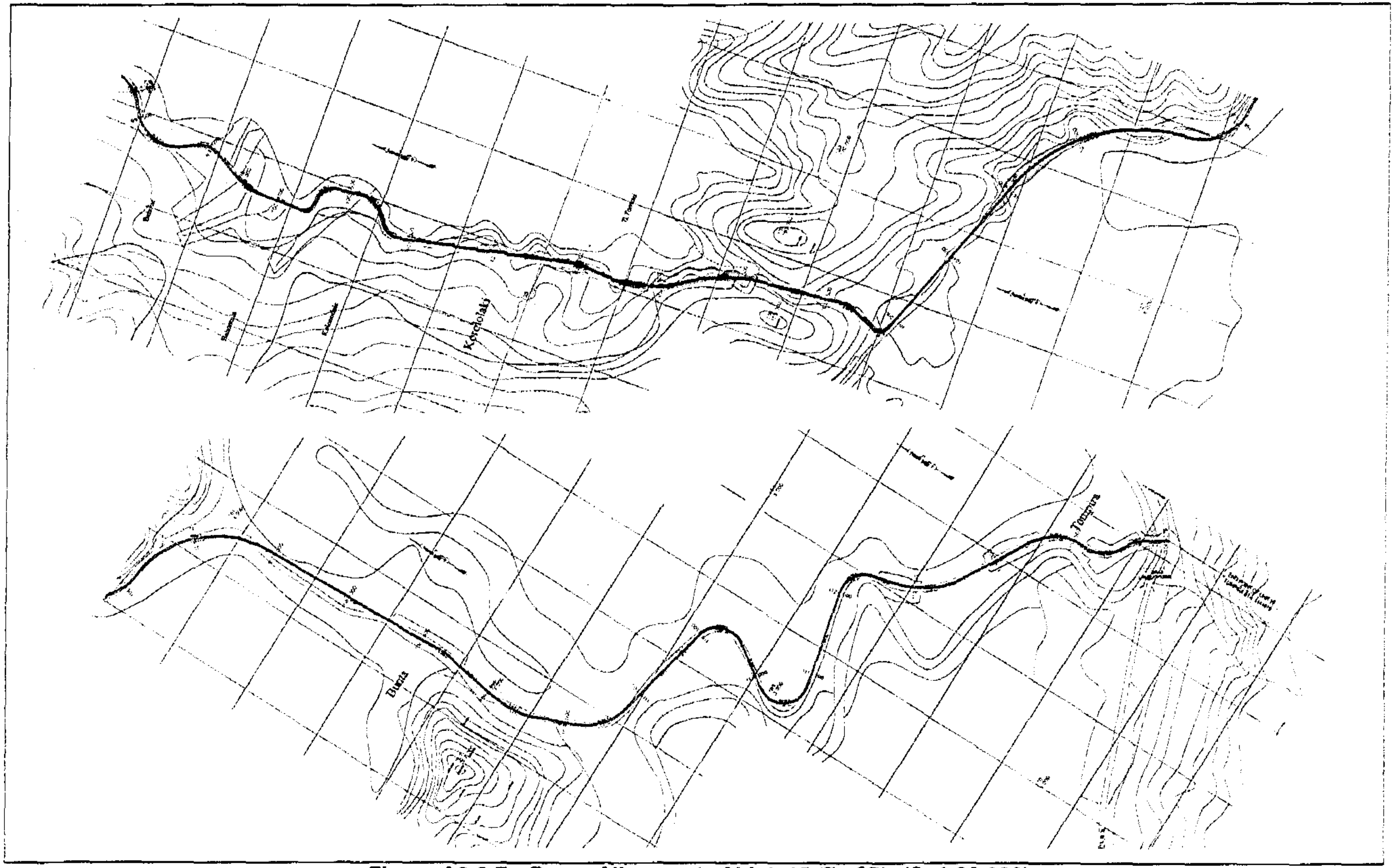


Figure A6-2-7 Route Alignment of Link 15 (7 of 7): (S=1:30,000)

Table A6-2-2 Proposed Bridge List of Link No.15

Bridge No.	Location Km	Length (m)	Nos. of Span	Span Arrangement	Bridge Width (m)	Types of Super-structures	Types of Foundations	Sub-structures: Abutments FIX Nos.	Abutments FIX ha(m)	Abutments FIX Pile La(m)	Abutments FIX Pile Nos.	Abutments MOVE Nos.	Abutments MOVE ha(m)	Abutments MOVE Pile La(m)	Abutments MOVE Pile Nos.	Piers FIX+FIX Nos.	Piers FIX+FIX hp(m)	Piers FIX+FIX Pile/ 1 pier Lp(m)	Piers FIX+FIX Pile/ 1 pier Nos.	Piers MOVE+FIX Nos.	Piers MOVE+FIX hp(m)	Piers MOVE+FIX Pile/ 1 pier Lp(m)	Piers MOVE+FIX Pile/ 1 pier Nos.
BR 15 - 1	27+400	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 2	36+680	20.0	1	1@20.0	7.6	RC-T	Pile	1	8	15	18	1	8	15	18	-	-	-	-	-	-	-	-
BR 15 - 3	39+740	60.0	3	3@20.0	7.6	RC-T	Pile	-	-	-	-	2	6	15	18	1	8	15	22	1	8	15	18
BR 15 - 4	42+400	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 5	43+890	80.0	4	4@20.0	9.6	RC-T	Pile	-	-	-	-	2	8	15	18	1	8	15	22	2	8	15	18
BR 15 - 6	44+580	80.0	4	4@20.0	9.6	RC-T	Pile	-	-	-	-	2	8	15	18	1	8	15	22	2	8	15	18
BR 15 - 7	45+750	20.0	1	1@20.0	9.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 8	47+310	20.0	1	1@20.0	9.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 9	56+340	20.0	1	1@20.0	9.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 10	58+050	40.0	2	2@20.0	9.6	RC-T	Pile	-	-	-	-	2	8	15	18	1	8	15	22	-	-	-	-
BR 15 - 11	60+570	40.0	2	2@20.0	9.6	RC-T	Pile	-	-	-	-	2	8	15	18	1	8	15	22	-	-	-	-
BR 15 - 12	60+950	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 13	61+530	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 14	62+250	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 15	63+150	60.0	3	3@20.0	7.6	RC-T	Pile	-	-	-	-	2	6	15	18	1	12	15	22	1	12	15	18
BR 15 - 16	64+640	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 17	64+820	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 18	64+870	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 19	65+910	80.0	4	4@20.0	7.6	RC-T	Pile	-	-	-	-	2	8	15	18	1	8	15	22	2	8	15	18
BR 15 - 20	67+140	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 21	67+750	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 22	69+120	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 23	75+050	80.0	4	4@20.0	7.6	RC-T	Pile	-	-	-	-	2	6	15	18	1	12	15	22	2	12	15	18
BR 15 - 24	75+450	80.0	4	4@20.0	7.6	RC-T	Pile	-	-	-	-	2	6	15	18	1	12	15	22	2	12	15	18
BR 15 - 25	76+250	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 26	77+720	60.0	3	3@20.0	7.6	RC-T	Pile	-	-	-	-	2	6	15	18	1	8	15	22	1	8	15	18
BR 15 - 27	82+450	60.0	3	3@20.0	7.6	RC-T	Pile	-	-	-	-	2	6	15	18	1	12	15	22	1	12	15	18
BR 15 - 28	84+370	60.0	3	3@20.0	7.6	RC-T	Pile	-	-	-	-	2	6	15	18	1	8	15	22	1	8	15	18
BR 15 - 29	88+050	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 30	88+230	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 31	90+210	20.0	1	1@20.0	9.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 32	91+210	20.0	1	1@20.0	9.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 33	92+690	20.0	1	1@20.0	9.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 34	95+760	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 35	98+850	20.0	1	1@20.0	7.6	RC-T	Pile	1	6	15	18	1	6	15	18	-	-	-	-	-	-	-	-
BR 15 - 36	114+000	120.0	2	2@60.0	6.0	Steel Truss	Pile	-	RETAIN EXISTING														

(2) Preliminary Engineering of Slope Protection Works

Slope protection works are constructed to protect the slopes from erosion or weathering by covering them with vegetation or structures and also to stabilize the slopes by means of drainage works or retaining structures. The following types of slope protection works are adopted for the feasibility route considering the terrain and geology, as shown in Table A6-2-3 and Table A6-2-4.
Necessary height of slope protection works for each links is Figure A6-2-1.

Table A6-2-3 Adopted Slope Protection Type (Cutting Slope)

Station(km)	Geology	Slope Protection Type
0-28	Ultra Basic Rock	Shotcrete
28-37	Bungku Formation	Shotcrete
37-46	Ultra Basic Rock	Shotcrete
46-69	Alluvium	Sprayed Concrete Cribwork
69-81	Tetambahu Formation	Shotcrete
81-98	Ultra Basic Rock	Shotcrete
98-106	Matano Formation	Shotcrete
106-114	Allvium	Sprayed Concrete Cribwork
114-120	Ultra Basic Rock	Shotcrete
120-126	Matano Formation	Shotcrete
126-175	Tomata Formation	Shotcrete

Table A6-2-4 Quantities of Slope Protection

	Cut		Fill
	Sprayed Concrete Cribwork(m^2)	Shotcrete (m^2)	Mat Gabion (m^2)
Quantity	15,261	126,042	52,699

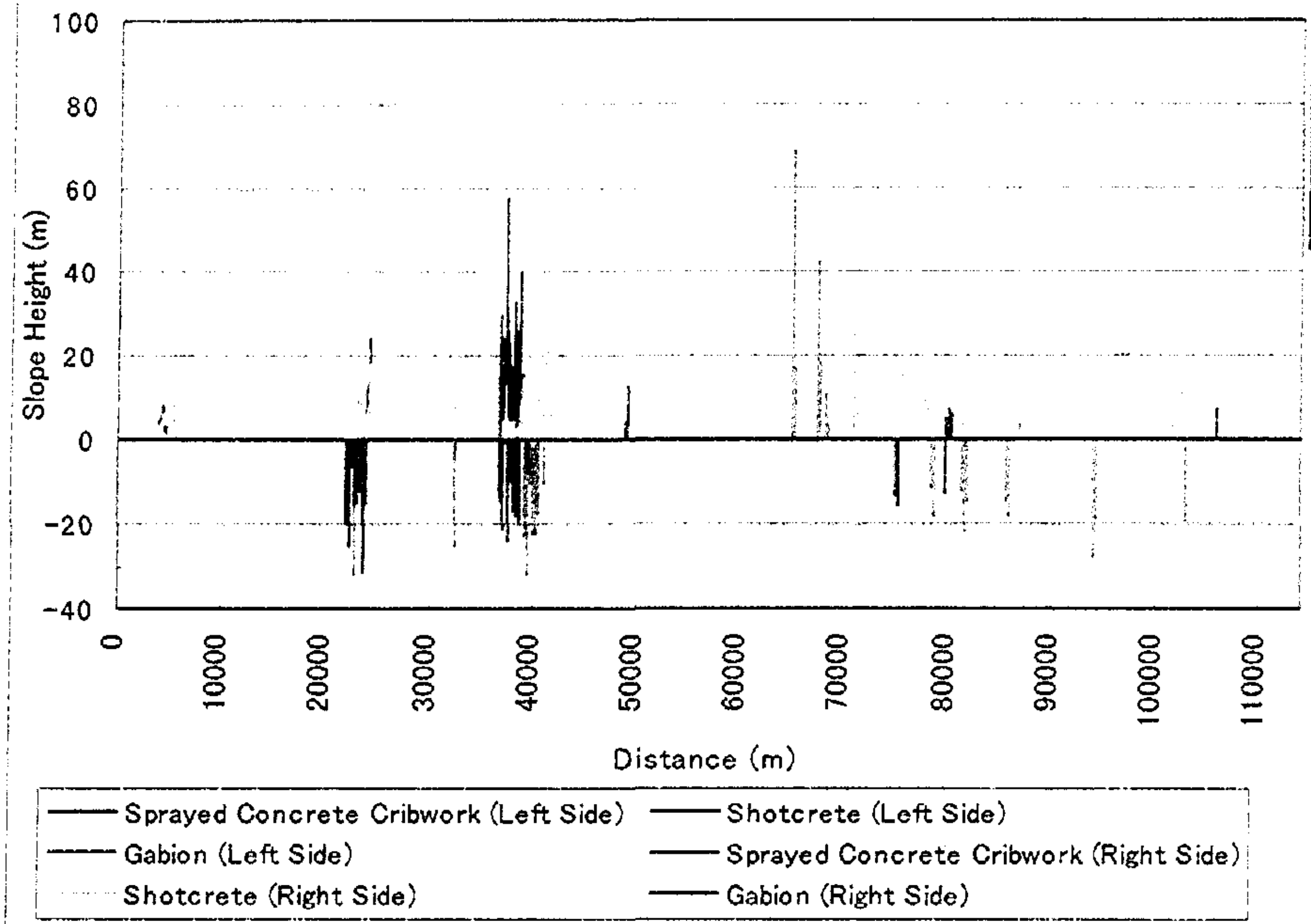
(3) Preliminary Engineering of Tunnel

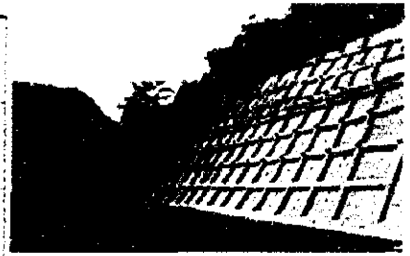
Four tunnels were required on the steep lime stone terrain between station 62km to 66km of link 15 as shown table A6-2-5.

Table A6-2-5 List of Tunnels

Tunnel No.	Location of Tunnel	Tunnel Length
No1 Tunnel	62k380～63k120	740m
No2 Tunnel	63k270～63k730	460m
No3 Tunnel	63k800～64k090	290m
No4 Tunnel	65k240～65k740	500m

Tunnel lighting powered by solar energy will be provided at present. After the distribution of electricity, lighting facilities could be connected.





Sprayed Concrete Cribwork Type

Shotcrete Type

Figure A6-2-8 Location and Height of Slope Protection for Link No.15

(a) No.1 Tunnel
This tunnel has a length of 740m and overburden 150m, and is longest tunnel on this route. The cutting slope of an tunnel entrance (62k380m) will become huge because tunnel center and contour cross at an acute angle. Considering the stability of the tunnel entrance slope, the cutting should be minimized. Therefore, a counterweight fill shall be placed before setting of the tunnel portal for the purpose of stabilizing the cutting slope. Centerline of the other entrance at 63k120 is at right angles to the contours; therefore it is advantageous for slope stabilization.
Construction work will be carried out from the north side entrance to secure use of temporally yards and access road.

(b) No.2 Tunnel
The 460m tunnel lies along base of a mountain slope. The tunnel centers for both tunnel entrances are at an acute angle to the contour of mountain. Therefore, both entrances will be constructed in same manner as the northern entrance of No.1 tunnel. The oblique load will occur because of inclination of the slope surface. Therefore, it is necessary to provide support to avoid a collapse of the rock mass of the tunnel interior. Considering to location of this tunnel, construction of No.2 tunnel will be carried out after completion of No.1 or No.3 tunnel.

(c) No.3 Tunnel
This tunnel is shortest of the four. The length of this tunnel is only 290m and overburden is also shallow at 30m.
There is also necessity to provide highly rigid supports as well as No.2 tunnel portal because of the oblique load. Both tunnel entrances will cross the mountain contours at an acute angle, and a counterweight fill will be placed before excavation of tunnel portals start.
Tunnel construction will commence from the southern end because of the location of temporary yards and easy access.

(d) No.4 Tunnel
This tunnel length is 600m and the overburden is a maximum of 100m. Both tunnel portals are at an angle of 40 to 50 degree between tunnel center line and mountain contours. Therefore, counterweight fill will also be placed before construction of the tunnel entrance starts.
Tunnel construction will be started from the southern entrance because of the location of temporary yards and easy access.

(4) Cost Estimates

1) Estimated Project Cost

Cost items consist of preparation works, pavement, earth work, drainage, bridge, slope protection, tunnel and safety facilities works. The engineering service cost is estimated at 20% of the total cost of direct and indirect cost. A contingency has been included in 10 % of total construction and engineering cost. The construction cost ratio of major items is shown in Figure A6-2-2 and Table A6-2-6 shows the result of estimated project cost.

2) Implementation Plan

As shown in Figure A6-2-3, the construction period will be 5 years consisting of one year for preparation of project for fund raising plan, 1.5 years for detailed design of the roads and 2.5 years for construction. Also, the investment plan will be set in accordance with the construction plan.

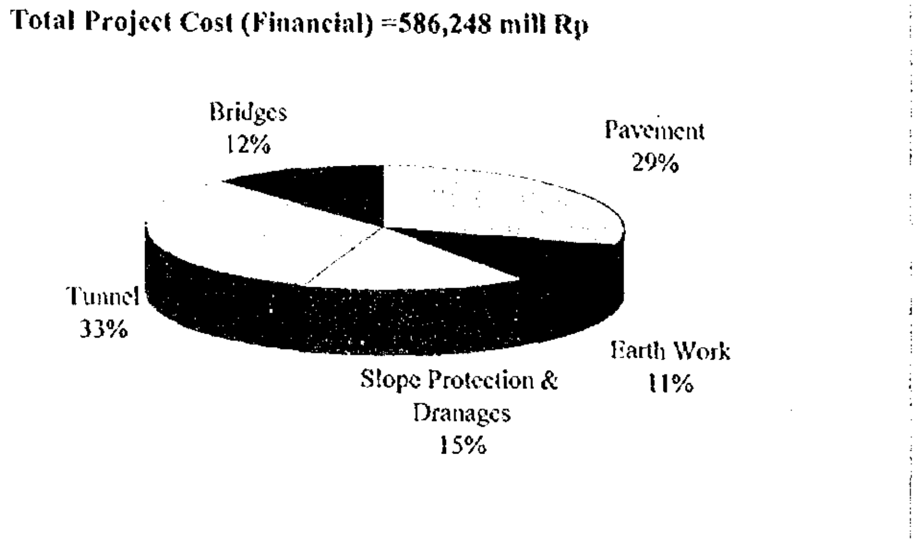


Figure A6-2-2 Construction Cost Ratio for Link 15

(5) Economic Analysis

1) Economic Project Costs

The economic investment costs are estimated in constant 1998 prices. The financial investment costs in terms of market price include the component of taxes. The economic costs for economic analysis are obtained by subtracting the portion of transfer payment such as taxes from financial costs. Implementation is scheduled over four years from 2000 to 2003. The phased financial and economic investment costs (initial investment) are summarized in Table A6-2-7.

Table A6-2-6 Total Construction Cost For Uekuuli - Tompira Road (Link No.15)

Rate : 1US$ = 10600Rp = 140Yen

Item	Unit	Quantity	Unit Price: Foreign (US$)	Unit Price: Financial (Rp)	Unit Price: Economic (Rp)	Total Price: Foreign (US$)	Total Price: Local Financial (Rp)	Total Price: Local Economic (Rp)	Total Price: Financial Total (Mill Rp)
1.Preparation Works									
Clearing and Grubbing	m2	1,641,748	0.23	1,867	2,099	377,602	3,065,142,769	3,446,028,212	7,068
2.Pavement									
New Road Asphalt Concrete + Sub base (Type A)	m	81,400	39.50	436,896	392,152	3,215,300	35,563,334,400	31,921,172,800	69,646
Widnning Road Asphalt Concrete + Sub base (Type A)	m	32,694	20.99	234,564	211,846	686,247	7,668,835,416	6,926,093,124	14,943
Transport for Pavement Material (L=29km)	m3	154,360	3.59	26,801	31,267	554,765	4,136,958,418	4,826,451,487	10,017
Sub-2						4,456,312	47,369,128,234	43,673,717,411	94,606
3.Earth Work									
Excavation (Common)	m3	1,258,807	0.92	7,407	8,213	1,158,102	9,323,983,449	10,338,581,891	21,600
Excavation (Sound Rock)	m3	23,607	4.12	33,605	36,492	97,261	793,313,235	861,466,644	1,824
Disposal soil (L=5km)	m3	441,374	1.20	8,610	10,050	529,649	3,800,230,226	4,435,808,801	9,415
Sub-3						1,785,012	13,917,526,910	15,635,857,336	32,839
4.Drainage									
Pipe Culvert (D=100cm)	m	120	44.35	634,758	554,426	5,322	76,170,960	66,531,120	133
Pipe Culvert (D=60cm)	m	2,282	15.28	202,787	184,640	34,867	462,735,600	421,326,323	832
Box Culvert (B=2.0m, H=2.0m)	m	920	325.89	3,064,762	2,510,606	299,819	2,819,581,040	2,309,757,520	5,998
U-ditch (U=50cm)	m	52,900	2.85	69,850	61,200	150,765	3,695,065,000	3,237,480,000	5,293
Sub-4						490,773	7,053,552,600	6,035,094,963	12,256
5.Slope Protection									
Sprayed Concrete Cribwork	m2	15,261	14.68	127,197	88,984	224,031	1,941,153,417	1,357,984,824	4,316
Shotcrete Work	m2	126,042	11.82	101,390	67,157	1,489,816	12,779,398,380	8,464,602,594	28,571
Stone Masonry	m2	0	6.91	116,286	109,711	0	0	0	0
Mat Gabion	m2	52,699	9.20	72,584	61,374	484,831	3,825,104,216	3,234,348,426	8,964
Sodding	m2	0	0.08	3,238	2,851	0	0	0	0
Sub-5						2,198,679	18,545,656,013	13,056,935,844	41,852
6.Tunnel	m	1,990	3,500.00	22,400,000	17,920,000	6,965,000	44,576,000,000	35,660,800,000	118,405
7.Bridges	No	34				2,193,901	19,723,916,899	15,774,251,115	42,979
8.Sefty Facilities Works									
Guard Railing	m	32,500	11.30	168,012	143,025	367,250	5,460,390,000	4,648,312,500	9,353
Traffic Sign	each	380	27.98	426,548	373,259	10,641	162,221,892	141,955,374	275
Line Marking	m	114,094	0.42	4,231	3,518	47,919	482,731,714	401,382,692	991
Sub-8						425,811	6,105,343,606	5,191,650,566	10,619
9.Mobilization & Temporally Works (20% of Total Cost)						3,402,104	36,062,301,344	31,374,202,170	72,125
10.Sub -Total						**22,295,193**	**196,418,568,375**	**169,848,537,618**	**432,748**
11.Land Acquisition	m2	554,000	0.00	20,000	20,000	0	11,080,000,000	11,080,000,000	11,080
12.Compensation	houses	20	0.00	15,000,000	15,000,000	0	300,000,000	300,000,000	300
13.Engineering Cost (20% of 10+11+12)						**5,027,860**	**35,530,209,291**	**28,424,167,432**	**88,826**
14.Contingency (10% of 10+11+12+13)						**2,732,305**	**24,332,877,767**	**20,965,270,505**	**53,295**
Ground Total Cost (10+11+12+13+14)						**30,055,358**	**267,661,655,432**	**230,617,975,555**	**586,248**

Item	Unit	Quantity	1999	2000	2001	2002	2003	Total
1. Preparation of Project								
2. Survey and Design	km	114.09						
3. Construction								
Earth Work	m3	1,282,414						
Slope Protection	m2	-						
Tunnel	m	1,990.0						
Bridges	No	34						
Pavement	km	114.09						
Foreign (US$)				1,382,661	6,212,518	10,933,757	11,526,422	30,055,358
Local Financial Cost (Rp)				16,029,807,555	56,416,802,158	87,108,898,581	108,106,147,139	267,661,655,432
Local Economic Cost (Rp)				14,075,646,044	51,095,894,971	71,995,854,374	93,450,580,166	230,617,975,555
Total Financial Cost (Mill. Rp)				30,686	122,269	203,007	230,286	586,248
Total Ecomomic Cost (Mill. Rp)				28,732	116,949	187,894	215,631	549,205

Figure A6-2-10 Implementation Schedule For Uekuuli - Tompira Road (Link No.15)

Table A6-2-7 Phased Initial Investment Costs in 1998 Prices (F/S - Link No. 15)

(Million Rp.)

Year	Financial Prices	Economic Prices
2000	30,686	28,732
2001	122,269	116,949
2002	203,007	187,894
2003	230,286	215,631
Total	586,248	549,205

Source : Estimated by the Study Team.

The maintenance cost of the proposed road follows the engineering study results of the cost estimates. Besides, the maintenance cost of the proposed road in the case of "without the improvement of the proposed road" is treated as a negative cost.

2) Economic Benefits

Benefits are classified into two types, one is the direct benefit and the other is the indirect benefit or intangible benefit.

The direct benefits which would be realized from the implementation of the Project are defined as the savings in travel costs, composed of the vehicle operating cost and vehicle time cost when comparing the "with" and "without" project conditions.

The benefit of vehicle operating costs is estimated as a difference of vehicle operating costs between "with" Project" case and "without" Project" case. The vehicle operating cost is derived from the obtained daily vehicle-kilometers and the unit vehicle operating cost by vehicle type. In addition, a promotion of traffic safety and a saving in accident costs are anticipated.

In this economic analysis, the above-mentioned direct benefits, e.g. the saving in vehicle operating cost is computed as a quantified benefit. The calculation of direct benefits are made for the planning year of 2003 and 2018.

As a result, the saving in vehicle operating cost is summarized as shown in Table A6-2-8.

Table A6-2-8 Estimated Economic Benefits (F/S - Link No. 15)

(Million Rp. at 1998 price)

Year	Benefit of Saving in VOC
2004	78,586
2018	258,092

Source : Estimated by the Study Team.

3) Economic Cost-Benefit Analysis

The analysis follows the conventional discounted cash flow method in determining the economic internal rate of return (EIRR), the net present value (NPV) and the benefit cost ratio (B/C). (NPV and B/C are calculated at a discount rate of 15 percent.) The project life is assumed to be 20 years after the completion of the construction.

The benefits in the intermediate years were interpolated and those beyond 2018 were assumed to be fixed. The total economic project costs and benefits streams are presented in Table A6-2-9. The efficiency measures were calculated and the results are as follows:

Efficiency Measures	F/S - Link No. 15
EIRR	20.5%
NPV (Million Rp.)	152,563
B/C	1.51

Source : Estimated by the Study Team.

These results indicate that implementation of the Project (road improvement of Link No.15) is economically feasible.

Table A6-2-9 Economic Analysis for F/S of Link No. 15

(Million Rp.)

	Year	Benefits VOC Saving	Total	Costs Invest. Costs	Maint. Cost (With)	Total	Maint. Cost (Without)	Net Cash Flow
1	1999			0	0	0	0	0
2	2000			28,732	207	28,939	207	-28,732
3	2001			116,949	207	117,156	14,348	-102,808
4	2002			187,894	207	188,101	207	-187,894
5	2003	0	0	215,631	207	215,838	207	-215,631
6	2004	78,586	78,586	0	207	207	207	78,586
7	2005	91,407	91,407	0	207	207	207	91,407
8	2006	104,229	104,229	0	207	207	14,348	118,370
9	2007	117,051	117,051	0	207	207	207	117,051
10	2008	129,873	129,873	0	207	207	207	129,873
11	2009	142,695	142,695	0	207	207	207	142,695
12	2010	155,517	155,517	0	21,484	21,484	207	134,240
13	2011	168,339	168,339	0	207	207	14,348	182,480
14	2012	181,161	181,161	0	207	207	207	181,161
15	2013	193,982	193,982	0	207	207	207	193,982
16	2014	206,804	206,804	0	207	207	14,348	220,945
17	2015	219,626	219,626	0	207	207	207	219,626
18	2016	232,448	232,448	0	207	207	207	232,448
19	2017	245,270	245,270	0	21,484	21,484	14,348	238,134
20	2018	258,092	258,092	0	207	207	207	258,092
21	2019	258,092	258,092	0	207	207	207	258,092
22	2020	258,092	258,092	0	207	207	14,348	272,233
23	2021	258,092	258,092	0	207	207	207	258,092
24	2022	258,092	258,092	0	207	207	207	258,092
25	2023	258,092	258,092	0	207	207	14,348	272,233
				549,206	47,522	596,728	103,955	

Assuming that the benefits and cost stream might alter ±10%, ±20%, the effect on the EIRR was tested and the results are summarized in Table A6-2-10. In the most severe case of - 20% benefit and + 20% cost, the value of EIRR is 15.1%.

Table A6-2-10 EIRR by Altered Benefit and Cost (F/S - Link No. 15)

Cost	Benefit		
	Base	-10%	-20%
Base	20.5%	19.0%	17.4%
+10%	19.2%	17.7%	16.2%
+20%	18.0%	16.6%	15.1%

Source: Estimated by the Study Team.

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